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Prevalence of Epicondylitis, Rotator Cuff Syndrome, and Low Back Pain in Latino Poultry Workers and Manual Laborers

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Background *The goal of this study is to improve understanding of immigrant Latino manual workers' occupational health, focusing on upper body musculoskeletal injury.*
Methods *Physical exams were conducted with a representative sample of 516 Latino poultry workers and manual laborers in western North Carolina; outcome measures were prevalence of epicondylitis, rotator cuff syndrome, and low back pain.*
Results *Low back pain (n = 89; 17.2%) and rotator cuff syndrome (n = 76; 14.7%) indicated by physical exam was common. Epicondylitis was less common, but still frequent (n = 30; 5.8%). Prevalence of each outcome did not differ between poultry processing workers and other manual workers. Workers >40 years old had greater incidence of rotator cuff syndrome and epicondylitis.*
Conclusions *Epicondylitis, rotator cuff syndrome, and low back pain are common in immigrant Latino workers, and may negatively impact long-term health and contribute to occupational health disparities.* Am. J. Ind. Med. 56:226–234, 2013.

KEY WORDS: poultry workers; musculoskeletal illness; epicondylitis; low back pain; rotator cuff syndrome

INTRODUCTION

Immigrant Latino workers experience elevated rates of occupational fatality and injury. The occupational fatality rate of foreign-born Latinos between 2003 and 2006 was 5.9/100,000 workers compared to 3.5/100,000 for Latinos born in the US [Forst et al., 2010]. The occupational injury rate for non-agricultural immigrant Latino workers was 12.2/100 workers compared to an expected 7.1 injuries/100 workers in the general population [Pransky et al., 2002]. Excessive occupational fatality among foreign-born Latinos relative to US-born Latinos and elevated injury among Latino workers suggest that immigrant status and Latino ethnicity each pose independent risk for poor occupational health outcomes.

Immigrant workers frequently find themselves in the most dangerous occupations. For example, agriculture is frequently among the most dangerous occupations in terms of non-fatal occupational injury and illness

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[NIOSH, 2004], and over 70% of agricultural crop workers are Latinos from Mexico [Carroll et al., 2005]. Similarly, occupational injuries are consistently elevated in construction, particularly among roofers [CPWR, 2008], and this industry and occupational group is increasing comprised of Latino workers [Dong et al., 2009]. Poultry processing is another high-risk occupational group with a large percentage of immigrants [Government Accountability Office, 2005]. The most recent estimates from the [Bureau of Labor Statistics, 2011a] suggest that 4.4% of poultry processing workers experience some type of injury or illness, frequently caused by exposure to slippery floors, small work spaces with hindered movement, manual movement of objects, and repetitive motions [Government Accountability Office, 2005]. Since 1975 the observed injury and illness rate in poultry processing has been twice the national all-industry average [OSHA, 2005].

The organization of the modern poultry processing enterprise creates distinct occupational exposures [Government Accountability Office, 2005]. Poultry processing work applies high-speed assembly line technology to the killing and butchering of animals. Large trucks carrying hundreds of cages, each containing 10–12 birds/cage, arrive at the processing plant throughout the day. Birds are taken from their cages, stunned, and hung by their feet on hooks on an overhead moving belt, and they are subsequently killed, plucked, eviscerated, butchered, often deboned, and packaged—all at a speed of more than 1 bird/worker/s. This efficiency requires employees to work at high rates of speed for long periods, frequently without breaks. Workers' experiences in the poultry processing plants have been documented [Lipscomb et al., 2007; Marín et al., 2009], and associated with self-reported occupational health outcomes [Lipscomb et al., 2005; Quandt et al., 2006; Grzywacz et al., 2007]. In contrast to other, less automated types of occupations that employ immigrant Latinos, the exposures resulting from modern poultry processing may contribute to elevated upper-body musculoskeletal problems [Government Accountability Office, 2005].

A significant limitation of previous occupational health research with immigrant Latino workers is the general absence of studies using clinical outcomes. The paucity of clinical data from immigrant workers is driven by several factors. Employers may be reticent to allow occupational health researchers to screen their workforce [Lipscomb et al., 2005; Quandt et al., 2006]. Immigrant workers are frequently characterized as ''hard to reach'' because many may not have documents allowing legal residence in the US, thereby encouraging workers to remain invisible [Quandt et al., 2006]. The combination of poor access to immigrant worker groups provided by employers and the desire of individual workers to remain invisible poses substantial challenges to the systematic collection of clinical occupational health data.

Challenges to obtaining high quality and objective clinical indicators of occupational health from immigrant Latinos has resulted in heavy reliance on self-reported measures [Lipscomb et al., 2005; Quandt et al., 2006; Grzywacz et al., 2007]. Unfortunately, self-reported symptom inventories are subject to a wide variety of potential biases and shortcomings. Some suggest that language barriers and fear of reprisal may contribute to systematic under-reporting of illness or injury, thereby underestimating the burden of poor occupational health among immigrant workers [Premji et al., 2010]. By contrast, others suggest that immigrant Latinos tend to use extreme responses to questions about symptoms and illness, which may contribute to over-estimation of poor occupational health outcomes [Escobar et al., 1987]. The ability to advance occupational health research with immigrant Latinos requires clarifying the extent to which self-reported musculoskeletal symptoms correspond with objective clinical findings.

The goal of this study is to improve understanding of the burden of poor occupational health among immigrant Latino manual workers. To accomplish this goal we use self-reported musculoskeletal symptoms and clinical exam findings from a large cohort of immigrant Latino poultry processing workers and other manual workers in western North Carolina to achieve three primary aims. Specifically this analysis seeks to (1) determine the prevalence of selected upper-body musculoskeletal impairments (i.e., rotator cuff syndrome, epicondylitis, and low back pain) (2) delineate variation in selected upper-body musculoskeletal impairments by age, sex, and job type (poultry vs. other manual labor, differences among occupational groups, and differences among distinct poultry processing tasks), and (3) document the sensitivity and specificity of self-reported symptoms suggestive of musculoskeletal impairment relative to physical exam findings.

METHODS

Study Design

The data for this study are from a larger study focused on occupational illness and injury among manual immigrant workers. The larger project involved a structured interviewer-administered survey questionnaire, followed by a physical exam conducted at a community-based data collection clinic held within 1 month of the interview. Previous papers from this project have described the prevalence of carpal tunnel syndrome [Cartwright et al., 2012] and respiratory outcomes [Mirabelli et al., 2012; Schulz et al., 2012].

Study Site

Data were collected in Burke, Surry, Wilkes, and Yadkin Counties in western North Carolina. These counties are rural and considered ''new settlement'' areas for Hispanic/Latino residents [Fry, 2008]. The total population of the four counties was 272,331, with 19,310 (7%) of that Hispanic [US Census, 2010].

Sampling

The issues that Latino immigrants face in the United States make them a complex population with whom to conduct research because they are often ''hidden'' and difficult to reach. The research team did not have access to workplaces, and no census existed of Latino manual workers in the area. Therefore, community-based sampling was used to assure that a representative sample would be selected [Arcury and 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 enclaves 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

Members of the Latino community were hired as recruiters; two to four recruiters worked in each study county. Recruiters visited randomly selected dwellings in order. If no one was home, recruiters returned at different times and on different days. Residents were screened for inclusion criteria: self-identified as being Latino or Hispanic, worked 35 hr or more per week in a manual labor job, and 18 years or older. Manual labor jobs were defined as employment in non-managerial jobs in industries such as landscaping, construction, hospitality (e.g., restaurants, hotel), personal services (e.g., child care), or manufacturing. Non-poultry manual workers with previous work in poultry only qualified if lifetime employment in poultry production or processing was 6 months or less, and not within the past 2 years. Work 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%. A total of 1,526 residents were screened. Of the 957 eligible residents, 742 (77.5%) were interviewed, and 518 (69.8%) of those interviewed attended the data collection clinic. Two individuals left the clinic prior to completing the physical exam, resulting in a final sample of 516.

Data Collection

Data collection involved two distinct encounters with participants. The first encounter was an interviewer-administered survey questionnaire that took place in participants' homes. During the in-home interview participants were asked basic demographic information (e.g., age, preferred language), as well as detailed questions about the types of work performed for pay and specific physical and psychosocial occupational exposures (e.g., chemicals, biological fluids, opportunities to control type of work). The second encounter, a ''data collection clinic,'' took place on Sundays at seven different locations within the study area during the data collection period. Participants were scheduled for a clinic that occurred within 30 days of the in-home interview. On the day of the clinic, a short questionnaire was administered to assess any changes in occupation or health since the in-home interview and if any self-reported pain at the elbows, shoulders, or low back on 2 or more days in the last month. Two board-certified physicians with fellowship training in sports medicine conducted all of the musculoskeletal examinations. Examiner 1 examined 92.6% of the subjects. Rates of positive findings were comparable between the two examiners suggesting no evidence of examiner effects. Those who attended the clinic were given $30. All procedures were approved by the Wake Forest School of Medicine Institutional Review Board. Signed informed consent was obtained from each participant.

Measurement

Case definitions were similar to criteria outlined by Sluiter et al. [2001] but rather than requiring multiple exam findings in addition to self-reported pain this study required only one positive exam finding. Epicondylitis was defined as self-reported pain at either epicondyle area on 2 or more days in the previous month and one of the following on exam: presence of pain at the lateral epicondyle with resisted active wrist extension, pain at the medial epicondyle with resisted active wrist flexion, or tenderness to palpation over the medial and lateral epicondyle regions physical exam [Werner et al., 2005]. Rotator cuff syndrome was defined as self-reported pain at the

shoulder on 2 or more days in the previous month and one of the following on exam: presence of pain with resisted abduction, internal rotation, external rotation, or forward flexion of the shoulder, or tenderness to palpation over the bicipital groove or lateral shoulder. Low back pain was defined as self-reported low back pain on 2 or more days in the previous month and one of the following on exam: presence of pain with active flexion, extension, side-bending to right or left, or twisting to right or left, or tenderness to palpation anywhere in the lumbar region [Strender et al., 1997].

Participants were categorized into Standard Occupational Classification (SOC) groups using data obtained from self-reported descriptions of jobs and job title. The SOC is a coding structure used by the U.S. Bureau of Labor Statistics to encompass all occupations in the U.S. economy. Occupations are identified and defined so that each occupation includes workers who perform similar job tasks [Bureau of Labor Statistics, 2010]. Because some poultry worker participants reported multiple poultry processing activities, specific poultry jobs were combined into three categories corresponding to main production areas [OSHA, 2005]: those jobs likely to emphasize fine movements of hands and wrists (cutting, evisceration, wash-up, trimming, deboning), jobs requiring lifting of whole birds (receiving, hanging, killing, plucking), and other tasks with more varied physical demands (packing, sanitation, chilling). Subjects who reported performing job tasks in more than one category were placed in a fourth classification labeled ''multiple.''

Gender and *age* were asked during the in-home interview with age classified into one of three groups ($<$30, 30–39, $\geq$40). *Indigenous language* (e.g., Quiche, Aguacateco) was assessed by asking individuals the language spoken by adults in the household when the participant was a child. *Educational attainment* was assessed based upon the grading system used in Latin American countries (i.e., Primaria, Secundaria, Preparatoria, Universidad) and responses were classified as either 0–6 years (Primaria), 7–9 years (Secundaria), or $>$10 years (Preparatoria or Universidad). *Years in the US* was asked and responses were classified as 0–4, 5–9, 10–14, or 15 or more years.

Statistical Methods

Descriptive statistics (frequencies and percentages) were used to describe the study sample. Bivariate associations between injury prevalence and risk factors (such as age, sex, and work type) were examined using chi-squared tests while adjusting for the clustering of multiple participants from the same dwelling units and recruitment sites. Statistical significance was not assessed where there were small or empty cells in a two-way contingency table. Otherwise, a P-value of <0.05 was considered statistically significant. The agreement between self-reported pain symptoms and the diagnosis of a condition based on physical exam was examined using Kappa values. In addition, we used McNemar's tests to evaluate whether or not the estimated prevalence based on self-reported symptoms is different from that based on any positive finding from exams. Finally, sensitivity and specificity for self-reported symptoms were calculated using any positive finding from exam as the criterion. All analyses were performed using SAS 9.2 (Cary, NC).

RESULTS

Most participants were $<$40 years of age (Table I). There were more males (54.7%) than females. Spanish was the dominant spoken language for most participants; nevertheless, 21% reported an indigenous primary language. A majority of the participants reported $<$10 years of schooling (81.6%) and having lived in the United States for at least 5 years (81.6%).

There were 289 poultry workers and 227 non-poultry workers in the sample. The composition of the two groups was similar in terms of sex and primary language (Table I). The poultry worker group included a larger number of older participants with 15.4% more falling in the $\geq$40 years category and was less educated as 11.3% more participants reported 0–6 years of schooling compared to the non-poultry workers. A larger number of poultry workers had lived in the US $\geq$15 years (34.6% vs. 17.6%). As expected, all but two of the poultry workers were classified as having jobs in ''production,'' while all ten of the major Standard Occupational Categories were represented in the non-poultry worker group, with production being most common (24.7%), followed by personal care and service (18.1%), and construction and extraction (15.9%).

Low back pain was the most common injury (Table II). Physical exam identified 89 participants (17.2%) affected by low back pain, followed by 76 (14.7%) with rotator cuff syndrome and 30 (5.8%) with epicondylitis. Medial epicondylitis was more common than lateral epicondylitis (22 vs. 13). Of the 30 subjects with epicondylitis 11 had it bilaterally. Of the 76 subjects with rotator cuff syndrome 28 had it bilaterally. Multiple diagnoses were found in 8.7% of subjects with 1.7% having all three. There were no differences between poultry and non-poultry workers in any of the clinical outcomes, nor were there differences in the outcomes among poultry workers with different types of work. There was a significant association for rotator cuff syndrome ($P = 0.036$) and epicondylitis ($P = 0.001$) with age $\geq$40.

Looking specifically at poultry workers (Table III), rotator cuff syndrome was the most common injury (17.0%), followed closely by low back pain (15.6%) and then

TABLE I. Demographics of Study Sample (% Are for Column)

	Non-poultry N (%)	Poultry N (%)	Total N (%)
Age			
<30	91 (40.1)	90 (31.1)	181 (35.1)
30–39	90 (39.6)	96 (33.2)	186 (36.0)
40+	46 (20.3)	103 (35.7)	149 (28.9)
Gender			
Female	105 (46.3)	129 (44.6)	234 (45.4)
Male	122 (53.7)	160 (55.4)	282 (54.6)
Language			
Non-indigenous	183 (81.0)	220 (76.9)	403 (78.7)
Indigenous	43 (19.0)	66 (23.1)	109 (21.3)
Education			
0–6 years schooling	118 (52.0)	183 (63.3)	301 (58.3)
7–9 years schooling	60 (26.4)	60 (20.8)	120 (23.3)
10+ years schooling	49 (21.6)	46 (15.9)	95 (18.4)
Years in US			
0–4	34 (15.0)	61 (21.1)	95 (18.4)
5–9	74 (32.6)	68 (23.5)	142 (27.5)
10–14	79 (34.8)	60 (20.8)	139 (26.9)
15+	40 (17.6)	100 (34.6)	140 (27.1)
SOC major[a]			
Arts, design, entertainment, sports, media	1 (0.4)	0 (0.0)	1 (0.2)
Food preparation and serving related	25 (11.0)	0 (0.0)	25 (4.8)
Building/grounds cleaning, maintenance	19 (8.4)	0 (0.0)	19 (3.7)
Personal care and service	41 (18.1)	0 (0.0)	41 (8.0)
Sales and related	1 (0.4)	0 (0.0)	1 (0.2)
Farming, fishing, forestry	15 (6.6)	0 (0.0)	15 (2.9)
Construction and extraction	36 (15.9)	0 (0.0)	36 (7.0)
Installation, maintenance, and repair	12 (5.3)	0 (0.0)	12 (2.3)
Production	56 (24.7)	287 (99.3)	343 (66.5)
Transportation and material moving	21 (9.3)	2 (0.7)	23 (4.5)

[a]Standard Occupational Classification system major categories.

epicondylitis (6.6%). Rotator cuff syndrome was associated with female gender. Low back pain was elevated for workers performing receiving, hanging, killing, and plucking ($P = 0.038$).

Table IV compares self-report of elbow, shoulder, and low back pain for 2 consecutive days within the last 30 days prior to the exam to presence or absence of epicondylitis, rotator cuff syndrome, or lower back pain by physical exam. The estimated prevalence was significantly different between self-report and exam for elbow pain and shoulder pain but not for low back pain. Kappa values were similar between self-report and exam for low back pain but not for elbow pain/epicondylitis and shoulder pain/rotator cuff syndrome. Using exam as the gold standard, self-report of symptoms for 2 consecutive days within the last 30 days had specificity ranging from 86.7% for back pain to 92.3% for rotator cuff syndrome to 98.7% for epicondylitis. Sensitivity ranged from 25.9% for elbow pain to 47.6% for rotator cuff syndrome to 62.2% for back pain. The self-reported symptoms had positive predictive values ranging from 87.5% for epicondylitis to 66.9% for back pain.

DISCUSSION

Immigrants in developed countries frequently are employed in dangerous manual labor occupations [Guthrie and Quinlan, 2005; Toh and Quinlan, 2009]. In the US, Latino immigrants frequently find themselves in agriculture, construction, and other occupations like poultry processing that pose substantial risk for a variety of injuries, including musculoskeletal injury [NIOSH, 2004; Carroll et al., 2005; CPWR, 2008; Dong et al., 2009]. Research on immigrant Latino workers is expanding, but previous

TABLE II. Injury Prevalence for all Subjects by Age, Sex, Work Type, and Standard Occupational Classification (SOC) System Major Categories

	Total N	Epicondylitis N (%)	Rot. cuff syndrome N (%)	Low back pain N (%)
Age				
<30	181	5 (2.8)	18 (9.9)	26 (14.4)
30–39	186	9 (4.8)	28 (15.1)	38 (20.4)
40+	149	16 (10.7)*	30 (20.1)*	25 (16.8)
Sex				
Female	234	13 (5.6)	38 (16.2)	48 (20.5)
Male	282	17 (6.0)	38 (13.5)	41 (14.5)
Work type				
Poultry	289	19 (6.6)	49 (17.0)	45 (15.6)
Non-poultry	227	11 (4.9)	27 (11.9)	44 (19.4)
SOC major				
Arts, design, entertainment, sports, media	1	0 (0.0)	1 (100.0)	0 (0.0)
Food preparation and serving related	25	1 (4.0)	1 (4.0)	3 (12.0)
Building/grounds cleaning and maintenance	19	0 (0.0)	1 (5.3)	3 (15.8)
Personal care and service	41	3 (7.3)	3 (7.3)	13 (31.7)
Sales and related	1	0 (0.0)	0 (0.0)	1 (100.0)
Farming, fishing, forestry	15	1 (6.7)	3 (20.0)	3 (20.0)
Construction and extraction	36	0 (0.0)	4 (11.1)	3 (8.3)
Installation, maintenance, and repair	12	0 (0.0)	1 (8.3)	2 (16.7)
Production	343	25 (7.3)	58 (16.9)	55 (16.0)
Transportation and moving materials	23	0 (0.0)	4 (17.4)	6 (26.1)

*$P < 0.05$.

research has relied almost exclusively on self-reported musculoskeletal symptoms [Lipscomb et al., 2005; Quandt et al., 2006; Grzywacz et al., 2007]. This study used data obtained from clinical exam to measure prevalence of upper body musculoskeletal injuries in Latino manual laborers in North Carolina. The results make several contributions to the literature, particularly the occupational health disparities literature.

The prevalences of three upper body musculoskeletal injuries found in this study suggest that the 2010 non-fatal occupational injury rates of 3.4/100 full time workers for private industry and 5.0/100 full time workers for food manufacturing reported by the US Bureau of Labor and Statistics [Bureau of Labor Statistics, 2011b] underestimate the burden of injury experienced by immigrant Latino workers. We found that 5.8% of workers in this

TABLE III. Poultry-Only Injury Prevalence by Age, Sex, and Job Task

	Total N (%)	Epicondylitis N (%)	Rot. cuff syndrome N (%)	Low back pain N (%)
Age				
<30	90	3 (3.3)	11 (12.2)	11 (12.2)
30–39	96	5 (5.2)	16 (16.7)	18 (18.8)
40+	103	11 (10.7)	22 (21.4)	16 (15.5)
Sex				
Female	129	9 (7.0)	31 (24.03)*	24 (18.6)
Male	160	10 (6.3)	18 (11.3)	21 (13.1)
Job task				
Pack/sanitation/chill/other	107	8 (7.5)	19 (17.8)	12 (11.2)
Cut/evisceration/wash/trim/debone	128	6 (4.7)	17 (13.3)	18 (14.1)
Receive/hang/kill/pluck	22	2 (9.1)	4 (18.2)	7 (31.8)*
Multiple jobs	32	3 (9.4)	9 (28.1)	8 (25.0)

*$P < 0.05$.

TABLE IV. Self-Report of any Pain for 2 Days in Last 30 Days Versus any Positive Exam Finding

		Exam				
	Yes (%)	**No**	***P*-value**	**Sensitivity**	**Specificity**	**Kappa values**
Self-Report						
Elbow[a]						
Yes	35 (6.8)	5 (1.0)	<0.0001	25.9%	98.7%	0.44
No	100 (19.4)	375 (72.8)				
Shoulder[a]						
Yes	79 (15.3)	27 (5.2)	<0.0001	47.6%	92.3%	0.44
No	87 (16.9)	322 (62.5)				
Back						
Yes	97 (18.8)	48 (9.3)	0.29	62.2%	86.7%	0.50
No	59 (11.4)	312 (60.5)				

[a]One response was missing.

group had evidence of epicondylitis, with 2.5% having lateral involvement and 4.3% medial. By contrast, reported prevalence of lateral epicondylitis in the general working age population of the United Kingdom is 0.7–1.9% [Walker-Bone et al., 2004, 2012] and 0.6% for medial epicondylitis [Walker-Bone et al., 2012]. Rotator cuff syndrome was identified in 14.7% of our sample compared to 4.5–6.1% in the general population of the United Kingdom [Walker-Bone et al., 2004]. Prevalence rates for upper extremity disorders in our sample were lower than those reported in other clinical exam studies of manual laborers. Epicondylitis was found in 14.5% of Taiwanese fish processing workers [Chiang et al., 1993] and 8.9% of Finnish meat cutters [Roto and Kivi, 1984] while 30.9% of fish processing workers [Chiang et al., 1993] and 24.7% of Danish slaughterhouse workers [Frost and Andersen, 1999] had shoulder problems. These studies are over a decade old and are based on non-US and non-immigrant samples which makes direct comparison difficult. Low back pain was identified in 17.2% of our participants, which is similar to the 1-year prevalence self-reported by construction workers in Germany [Latza et al., 2002].

Expected sources of variation in upper-body musculoskeletal impairment were found by age for rotator cuff syndrome and epicondylitis. The association between epicondylitis and rotator cuff syndrome with older age is consistent with other studies [Lipscomb et al., 2007; Nordander et al., 2009]. Speculative explanations for the increased risk in older workers include greater accumulated exposure volume and greater mismatch between task force requirement and physical strength. These results extend the literature by documenting similar effects in an exclusively immigrant cohort and suggest that the processes contributing to sex differences in impairment are not ethnic specific.

We found no differences between poultry workers and non-poultry workers for upper-body musculoskeletal impairment by major occupational group. This is consistent with recent government reports that overall injury rates for poultry processing are similar to those in other manual labor categories [Bureau of Labor Statistics, 2011b]. Lipscomb et al. [2007], however, found that female Black poultry workers had more than twice the prevalence of upper extremity and neck symptoms than was reported by a community comparison group. The similarity of injury rates found in our study for poultry and non-poultry workers may be explained in part by the wide range of physically challenging tasks performed by both groups. Nearly half (104/227) of the non-poultry workers were in the manual labor job categories of production, construction, or installation/maintenance/repair. Activities outside of the workplace in this culturally and socioeconomically uniform group could be similar and possibly account for the lack of differences in injury rates. The sample size may not have been large enough to detect a difference for these injury types. Additional research is needed to determine if poultry workers are at greater risk for upper-body musculoskeletal injuries than other manual laborers.

A final contribution of this study is results from the comparison of self-reported symptoms in the last 30 days with one positive finding on clinical exam as the reference. Results indicated that self-reported symptoms had excellent specificity (ranging from 86.7% to 98.7%), suggesting that the use of self-reported symptoms is an effective tool for identifying apparently healthy or impairment-free individuals. However, questions about self-reported symptoms lasting 2 or more days had poor sensitivity: in the best case scenario, only 62% of individuals with observed impairment self-reported having experienced symptoms for 2 consecutive days. In some cases, sensitivity was as low as 25.9%, and previous research has

found that 25% of poultry workers had abnormal objective signs of disorder yet denied having symptoms [Young et al., 1995]. The low sensitivity of self-reported symptoms to impairment observed via physical exam is noteworthy because it is in stark contrast to concerns that have been expressed that Latino workers may over-report symptoms or health concerns [Escobar et al., 1987], and it further reinforces arguments that occupational illness and injury rates obtained from self-reported symptoms may substantially underestimate the actual burden of disease [Quandt et al., 2006].

Additional limitations of this study must be acknowledged. While physical exam represents increased measurement precision compared to self-report, imaging studies or pathology specimens would provide more definitive confirmation of tendinopathy of the elbow or shoulder. Performing the exams on Sundays when participants were off-duty for the day means that injuries that flared only while or very shortly after working would not have been detected. This study did not address injury severity so impact on worker health and productivity cannot be determined. Comparing exam findings to self-report within this study is difficult because the self-report time window of the previous 30 days was fairly broad. Also, the injuries diagnosed may be due to recreational or household activities and not related to a participant's occupation. Sample sizes were too small to allow for analysis of injury by specific job duties.

CONCLUSION

Epicondylitis, rotator cuff syndrome, and low back pain are prevalent injuries among Latino poultry workers and manual laborers in western North Carolina. Further study of factors related to immigrant status such as language, education, documentation, and financial vulnerability could identify interventions aimed at improving work related health in this group.

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