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Prevalence of musculoskeletal disorders among immigrant Latino farmworkers and non-farmworkers in North Carolina

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Abstract

Background—This manuscript evaluates the variability in the prevalence of epicondylitis, rotator cuff syndrome, low back pain, and lower extremity pathology among immigrant Latino farmworkers and non-farmworkers.

Methods—Data were collected from a study among 272 farmworkers and non-farmworkers. Participants were recruited in eastern and central North Carolina. A physical exam was conducted by trained physicians.

Results—Prevalence of MSDs among Latino manual workers is high compared other workers in similar occupations. Non-farmworkers (49%) had a higher prevalence of MSDs than farmworkers (35%). Epicondylitis (20.2%) and rotator cuff syndrome (19.1%) were most prevalent. Age was

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found to be significant among those who had epicondylitis (AOR = 1.04) and lower extremity pathology (AOR = 1.07).

Conclusions—Latino immigrant manual workers have high prevalence of MSDs. Further studies are needed to identify possible factors that make these populations more vulnerable to MSDs.

Keywords

Musculoskeletal disorders; Latino; immigrant; manual workers; farmworkers

BACKGROUND

In 2012, musculoskeletal disorders (MSDs) accounted for 34% of all workplace injuries and illness.¹ In 2007, the median number of days away from work for MSDs by selected worker occupation and ownership was 9, while in 2012 that number increased to 12. MSDs are cited as the most frequent cause of severe pain and disability.² MSDs account for injuries occurring to the muscles, bones, nerves, tendons, ligaments, joints, cartilage, and spinal discs; they include pain, fractures, soreness, sprains, strains, carpal tunnel syndrome, hernia, and musculoskeletal system and connective diseases. MSDs often occur when the body reacts to strenuous or sudden movement, such as bending, climbing, crawling, reaching, and twisting, or to overexertion or repetitive motion.³

Industrialized countries around the world have a shortage of labor in occupations that require low skill, are poorly remunerated, and are often dangerous, such as agriculture, manufacturing, and construction.⁴ In the United States such occupations are disproportionately occupied by immigrant workers, especially those from Latin America.^{5, 6} Latino immigrant workers are especially vulnerable workers because they face many barriers to obtaining proper safety training; these include limited education, limited English proficiency, and limited or no knowledge of worker safety laws and rights.^{7, 8} As a result of their participation in such jobs and lack of proper communication and safety training, Latino immigrants experience higher rates of occupational injury and fatality^{6,8} than other workers in the US.

Agriculture is among the most dangerous occupations in the US. The fatal injury rate among farmworkers is six times greater than that of the all-industry rate.⁹ Farm work is a physically demanding occupation that requires repeated bending, stooping, kneeling, lifting, and carrying. Such repetitive motions put workers at a high risk of developing MSDs. Previous studies have shown that MSDs are the most common occupational non-fatal injury or illness among farmworkers.^{2,4,10–12} Farm work is not only one of the most dangerous occupations, but it is also an occupation that is disproportionately held by immigrant Latino workers. In North Carolina, for example, Latinos account for 35% of the crop production workforce; however, they account for only 9% the total state workforce.¹³

Non-farm work occupations such as construction and production are among other jobs where the Latino workforce is disproportionately distributed compared to the overall percent of Latino workforce in the US.¹³ Such occupations also present high rates of fatal and non-

fatal injury and illness rates among foreign-born Latino workers. Prior studies conducted among non-farmworker immigrant Latinos have shown high musculoskeletal injury rates.^{14–18} Non-farm work occupations also require workers to engage in dangerous tasks (i.e., use of dangerous equipment, maintain awkward postures, conduct repetitive movements throughout their work shift, work in small spaces hindering movement, carry excessive weight, and work in extreme environments, among other potentially hazardous tasks).

Although studies have shown the prevalence of MSDs among immigrant farmworkers and non-farmworkers, the literature of MSDs comparing Latino immigrants working in industries with high injury and fatality rates is limited. Studies have shown that prevalence of MSDs is higher among farmworkers when compared to non-farmworkers, but those were conducted among workers of non-comparable populations, among non-immigrant populations, and outside the US.^{2,19–21} Immigrant Latinos, regardless of the industry in which they work, have a higher prevalence of work-related injuries, and therefore it is important to identify the prevalence of these injuries and possible factors that increase their risk of MSDs, particularly in industries with high injury and fatality rates. In an attempt to extend the limited literature of MSDs among immigrant Latinos in dangerous occupations, this manuscript seeks to compare the prevalence of epicondylitis, rotator cuff syndrome, low back pain, and lower extremity pathology among immigrant Latino farmworkers with manual non-farmworkers.

METHODS

Study design and sampling

Data analyzed in this study are a subset of data obtained from two larger simultaneous longitudinal studies conducted in four different counties in eastern and west-central North Carolina. The studies are PACE4 (Pesticide exposure and neurological outcomes for Latinos) and PEARL (Pesticide exposure and age-related changes in cognitive function). The aim of PACE4 is to assess subclinical effects of pesticides among Latino workers. The purpose of PEARL is to document the effects of pesticides on cognitive function in older Latino farmworkers. Data were collected from May through October 2013 in four counties (Harnett, Johnson, Sampson, and Forsyth) of eastern and west-central North Carolina.

The issues that many Latino immigrants face in the United States (i.e., language barriers, lack of proper documentation to work, discrimination) make them a complex population with whom to conduct research. Community-based sampling was used to assure that a representative sample would be selected.²² Two community organizations collaborated with the research team: 1) the North Carolina Farmworkers Project and 2) El Buen Pastor Latino Community Services. Staff at the community organizations helped the research group identify and recruit potential participants at farmworker camps and in the community. Farmworkers were recruited by going to the camps served by the North Carolina Farmworkers Project, explaining the project, and asking for those who were interested to volunteer to participate in the study. Non-farmworkers were recruited with the help of community organizations who identified potential participants. Further details of recruitment and methods are described by Arcury et al.²³ To be eligible participants had to be between

18 and 70 years of age, self-identify as being Latino or Hispanic, work in agriculture (farmworkers), or be a non-farmworkers. Work in agriculture was defined as work as a farmworker for at least three years. Non-farmworkers could not have been employed for the past three years in jobs involve pesticide exposure (e.g. farm work, forestry, landscaping, grounds keeping, lawn maintenance, and pest control). The project had a longitudinal design in which participants completed a baseline interview in May and June 2012; up to four follow-up contacts from June to October, 2012 (contacts 1–4), and up to four follow-ups from June to October 2013 (contacts 5–8). Baseline data for this analysis were collected at the baseline interview in 2012, contact 5, and contact 8 (n=157 farmworkers and 119 non-farmworkers), and follow-up data for those that attended contact 5 data were collected at contact 8 (n= 95 farmworkers and 62 non-farmworkers) in 2013.

Among the non-farmworkers, 101 individuals were contacted who did not meet the inclusion criteria. Eighty-seven individuals qualified, but refused to participate. A total of 212 non-farmworkers participated in the longitudinal portion of the study, for a participation rate of 70.9% ($212/(87+212)$). Since farmworkers were asked to volunteer, only the number of those who agreed to volunteer is available. The musculoskeletal component used for this manuscript was added at the request of the community partners to assess musculoskeletal injuries among workers. A final sample size of 272 workers was analyzed for this manuscript. Of the total sample size, 157 participants were farmworkers, and 119 were non-farmworkers.

Data collection

Data collection for the musculoskeletal component of the study involved three distinct encounters with all participants. The first encounter was an interviewer-administered survey that took place in the participant's place of residence. During the baseline interview (completed in 2012) participants were asked basic demographic information (e.g., age, preferred language), as well as detailed questions about the types of work performed for pay, specific physical occupational exposures (e.g., heat exposure, chemicals-pesticides), and general health (e.g., previous injuries, smoking status). Participants received an incentive of \$30 for completion of the questionnaire. The second encounter (contact 5 – June-July 2013), a data collection clinic, took place on a Sunday at two different locations within the study area. A board-certified family physician with fellowship training in sports medicine supervised the musculoskeletal examinations. The physical exams were conducted by a physician. Participants received an incentive of \$30 for their participation. Some participants were followed throughout the summer of 2013, and attended a second data collection clinic at the end of the summer (contact 8 September – October 2013) at which they were again assessed by a physician and received an incentive of \$30. All procedures were approved by the XXXX School of Medicine Institutional Review Board. Signed informed consent was obtained from each participant. Study data were collected and managed using Research Electronic Data Capture (REDCap) electronic data capture tools hosted at XXXX School of Medicine.²⁴ REDCap is a secure, web-based application designed to support data capture for research studies.

Measures

Outcome measures were diagnoses of epicondylitis, rotator cuff syndrome, low back pain, and lower extremity pathology. Case definitions were similar to criteria outlined by Sluiter et al.²⁵ Rather than requiring multiple exam findings in addition to self-reported pain, this study required only one positive exam finding. Epicondylitis was defined as 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 or lateral epicondyle regions. Rotator cuff syndrome was defined as one of the following on exam: presence of pain with resisted abduction, internal rotation, external rotation, forward flexion of the shoulder; active elevation of the upper arm, or tenderness to palpation over the bicipital tendon or supraspinatus tendon. Low back pain was defined as one of the following on exam: presence of pain with active flexion, extension, side-bending to right or left, twisting to right or left; or tenderness to palpation anywhere in the lumbar region. Lower extremity pathology was defined as one of the following on exam: pain on the hips, knees, or ankles while taking a total of 4 steps (2 each leg) in the squatted position (the duck walk), or the inability to complete the task due to mechanical limitations.

Farmworkers' work with different crops was recorded by asking "what crop did you worked with in the past three days." Non-farmworkers' occupations were classified according to the Standard Occupational Classification (SOC) groups. 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.²⁶ All participants were asked if, for their current job, they came to the U.S. under a work visa such as an H-2A or an H-2B visa.

Gender and age were asked during the baseline interview. 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 to 6 years (Primaria), 7 to 9 years (Secundaria), or >10 years (Preparatoria or Universidad).

Statistical methods

We obtained baseline musculoskeletal conditions for 272 participants (157 farmworkers and 119 non-farmworkers) through one of the two data collection clinics. A total of 157 participants (95 farmworkers and 62 non-farmworkers) who attended the first clinic also attended the second clinic and provided us with follow-up musculoskeletal conditions. Descriptive statistics (frequencies and percentages) were used to describe the overall baseline sample and to describe the baseline sample by farmworker status. The prevalence of each individual musculoskeletal condition at baseline was compared using chi-square tests or Fisher's exact test between farmworkers and non-farmworkers. Further, we used a generalized estimating equation (GEE) approach to examine the effect of various predictors (age, gender, farmworker status, and time) have on the overall likelihood of MSDs over time while adjusting for the correlation between two repeated measures on the same participant. Adjusted odds ratios (OR) and corresponding 95% confidence intervals (CI) were reported. All analyses were performed using SAS 9.3 (Cary, NC). A p-value less than 0.05 was considered statistically significant.

RESULTS

The mean age for all workers was 37 years old. Farmworkers were slightly older (38 years) than non-farmworkers (36 years). The majority of the sample was male (85%) (Table 1). Most of the participants in the sample had 7–11 years of education (80%). Most farmworkers had less than 11 years of education (80%). Non-farmworkers had a slightly higher percentage of workers with 12 or more years of education (35%). Most of the farmworkers interviewed had H-2A visas (91%). At baseline, farmworkers most frequently worked in sweet potatoes (71%) and tobacco (31%). The most common occupations among non-farmworkers were production (30%), construction (25%), food preparation (14%), and building/grounds cleaning (10%).

For the overall sample epicondylitis (20%) and rotator cuff syndrome (19%) were the most prevalent of MSDs at baseline (Table 2). For farmworkers the most common MSDs were epicondylitis (19%), rotator cuff syndrome (15.7%), and lower back pain (14%). Among non-farmworkers rotator cuff syndrome was most common (24%), followed by epicondylitis (22%), and lower back pain (21%). Significantly more non-farmworkers compared to farmworkers had lower extremity pathology at the time of the baseline exam (9.2% vs. 1.3; p -value <0.05).

Table 3 presents multivariable models for the presence of various MSDs over time using baseline and follow-up data together. Age was significantly associated with a slight risk of epicondylitis (Adjusted odds ratio (AOR) = 1.04, 95% CI = 1.01–1.07) and lower extremity pathology (AOR = 1.07, 95% CI = 1.03–1.11) (Table 3). Farmworkers had lower odds of all MSDs: epicondylitis (AOR = 0.54, 95% CI = 0.32–0.92), rotator cuff syndrome (AOR = 0.36, 95% CI = 0.20–0.64), low back pain (OR = 0.38, 95% CI = 0.21–0.69), and lower extremity pathology (AOR = 0.08, 95% CI = 0.02–0.37). There was a significant time effect for the presence of each MSD. At follow-up visits, workers had a lower odds of having epicondylitis (AOR = 0.40, 95% CI = 0.22–0.73), rotator cuff syndrome (AOR = 0.42, 95% CI = 0.26–0.69), and low back pain (AOR = 0.35, 95% CI = 0.18–0.66).

DISCUSSION

Immigrant workers many from Latin America often perform manual occupations. Farmworkers have an occupation that is physically demanding, dangerous, and is performed in extreme environments.^{10,27, 28} Those work characteristics are often also endured by workers in other manual occupations such as construction and production.^{10,28} Constant stooping, bending, carrying, heavy lifting, and high speed production lines can lead these workers to develop MSDs. Results of our study show that Latino immigrant farmworkers and non-farmworkers have a higher prevalence of MSDs when compared to similar studies. Difference in prevalence of MSDs was slightly higher but not significant among non-farmworkers with the exception of lower extremity pathology. The study also showed that age increases the risk of developing MSDs, and that farmworkers, when compared to non-farmworkers, have a lower risk of developing an MSD. Lastly, workers at a follow-up visit were less likely to have an MSD present compared to baseline.

Our results are consistent with other studies that report that MSDs rates among immigrant Latinos who work in dangerous manual occupations are the most common of all occupational non-fatal injuries and illnesses.^{4, 14, 18, 29–32} Our study showed that 19.1% of the workers had rotator cuff syndrome (farmworkers 15.7%, non-farmworkers 23.5%). A study conducted among manufacturing workers by Silverstein and colleagues 2008 found a 7.5% prevalence of rotator cuff syndrome; similarly among Latino immigrant poultry processing workers the prevalence was 14.7%.¹⁸ Among those working in farming, prevalence of shoulder pain has been reported between 7–14%.^{33, 34} Our study found that epicondylitis was the most prevalent MSD among our participants (Total = 20% farmworkers 19%, non-farmworkers 21.9%). In previous studies among fish processing workers, meat cutters, poultry processing workers, and manufacturing workers, the prevalence rates were 14.5%, 8.9%, 5.8%, and 5.2%, respectively.^{18, 35–37} Among agricultural workers Bovenzi et al.³⁸ found that foresters had higher odds of epicondylitis (OR = 4.9) than other agricultural workers. Compared to previous studies,^{20,34, 39} the prevalence of lower back pain reported in our study is lower (total 16.9%, farmworkers 13.7%, non-farmworkers 21%). Among farmworkers in previous studies, prevalence of lower back pain range from about 20–50%.^{19, 34,39} A study conducted among tobacco workers showed a prevalence rate of 9%,³⁴ a similar rate to that reported in our study; about 31% of the farmworkers in our study reported working with tobacco at baseline. Among non-farmworkers the prevalence rate of low back pain is closer to those reported among construction workers (15.4%), carpenters (19%), and poultry processing workers (17.2%).^{18, 40,41} Lower extremity pathology prevalence was lower than that reported by previous studies (total 4.8%, farmworkers 1.3%, non-farmworkers 9.2%). Previous studies of farmworkers have reported prevalence rates between 8% and 32% among farmworkers.^{34, 39, 42} In a study by Holmstrom and Engholm among construction workers, the prevalence rate ranged from 7.5% to 21.4%.⁴² One possible reason prevalence of low back and lower extremity pathology is lower than for other studies is that data collection was conducted on Sunday, and some of the workers had the chance to rest and recover from the work of the previous week.

Latino foreign workers in the US are at greater risk of developing MSDs than other workers. High risk among this population can be attributed to several physical and social factors. Many of the factors related to MSDs are related to work organization and work safety climate.^{11, 43–45} These workers often carry excessive loads, make rapid repetitive movements, and sustain awkward postures, often without breaks.⁴⁶ Farmworkers are often paid by the piece, a practice that discourages them from taking breaks, and many of the non-farmworkers feel pressured from their supervisor to perform the work fast.^{46, 47} These workers have language barriers that keep them from receiving proper training.^{12, 48} Workers might also tolerate situations or tasks that they know are dangerous because they do not want to lose their jobs. Many of the farmworkers interviewed for this study have H-2A visas and can only work for the employer who contracted with them in Mexico. These workers do not want to complain or seem weak because they want to maintain employment through the season and increase their chances of getting hired the following harvesting season.⁴⁹ Most non-farmworkers in this study are likely undocumented workers; they often are afraid to

report injuries because they do not want to lose their job or be reported to immigration authorities.

Multivariate analysis showed a significant association between age and having increased odds of developing epicondylitis and lower extremity pathology. The results from our study agree with prior studies that show increased odds of developing MSDs among manual workers.^{37, 50–52} Higher odds of developing epicondylitis and lower extremity pathology with increasing age could be due to greater exposure to repetitive movements and awkward postures.^{18, 52} Results showed that farmworkers when compared to non-farmworkers were less likely to develop an MSD. Although there are no studies conducted among similar populations, the reason for this is most likely that non-farmworkers in our study are mostly construction and production workers. Although agriculture is one of the most dangerous occupations among immigrant Latino workers, production is also among the most dangerous occupations, and construction ranks higher than agriculture among dangerous occupation.⁸ Therefore, our results are in accord with the statistics that rank these occupations as dangerous, especially among immigrant Latino workers. Another factor that decreased the risk of developing a MSDs was whether the participant was examined at the first clinic visit or at the follow-up clinic visit. Participants examined at follow-up clinics were less likely to report pain at the time of exam on the elbow, shoulder, and lower back. Among athletes, studies have shown that injury at the beginning of the season or prior to the season could either develop or resolve.⁵³ It is possible that early-season injuries had resolved by the time of the second visit. The lack of reporting of pain at the second visit could also be a consequence of the normalization of pain where workers view pain as part of the job.⁵⁴ Among Latino men there is a culture in which men are expected to act as if there is no harm as a consequence of hard work to show others around them their “health capital” by proving they are strong enough to endure the job,⁵⁵ and to fulfill their cultural masculine roles.^{44, 56}

One of the limitations of the study is that the participants were not randomly selected, limiting the generalizability of the results. The findings are also the result of pain upon examination, but do not take into account reports of self-reported pain prior to the day of the exam. Although the crop and occupation of the workers was collected, no further questions were asked to assess potential causes related to the different MSDs. Despite these limitations, this study is unique because it was conducted within a hard to reach population. Comparisons of pain prevalence in different parts of the body were done among workers of the Latino population who have jobs in industries with high injury rates, and exams were conducted by trained physicians.

In conclusion, this manuscript shows that MSD are prevalent among immigrant Latino manual workers, possibly as a consequence of the barriers they face and their immigrant status which lead them to take jobs that are dangerous and hazardous to their health. Compared to other workers, Latino immigrant workers have higher prevalence rates of MSDs as a consequence of their participation in dangerous occupations.⁴⁶ High rates of MSDs reflect the occupational health disparities these workers face. Unfortunately as a consequence of the barriers they face (e.g. language, fear of losing their job or being deported, etc.) the ability these workers have to control workplace hazards to prevents MSDs is limited. Ergonomic standards were proposed by the Occupational Safety and Health

Administration,³⁹ but were not made mandatory; hence they are not likely to be enforced. It is necessary for future research to further study work factors that might be leading to high injury rates in order to develop appropriate interventions that could potentially improve the safety and health of these workers as well as to serve as a tool to encourage the enation of policies that make ergonomic standards mandatory. Future interventions should also focus on enlisting employers to help improve the safety of their workers and encourage workers to be proactive about their safety at work.

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Table 1

Descriptive characteristics of farmworkers and non-farmworkers

	Total n=272 n (%)	Farmworkers n=157 n (%)	Non- farmworkers n=119 n (%)	p-value
Gender				0.0002
Female	41 (15.07)	12 (7.84)	29 (24.37)	
Male	231 (84.93)	141 (92.16)	90 (75.63)	
Education				<0.0001
0–6 years	102 (37.5)	57 (37.25)	45 (37.82)	
7–11 years	113 (41.54)	80 (52.29)	33 (27.73)	
12 years or more	57 (20.96)	16 (10.46)	41 (34.45)	
H-2A workers				<0.0001
Yes	148 (54.41)	139 (90.85)	0 (0)	
No	124 (45.59)	14 (9.15)	110 (100)	
Crop				
Tobacco	-----	46 (31.29)	-----	-----
Sweet potato	-----	104(70.75)	-----	
Cucumber	-----	11 (7.48)	-----	
Bell pepper	-----	1 (0.68)	-----	
Tomato	-----	1 (0.68)	-----	
Other	-----	16 (10.96)	-----	
SOC major ^a				-----
Arts, design, entertainment, sports, media	1 (0.37)	-----	1 (0.84)	
Food preparation and serving related	14 (5.15)	-----	14 (11.76)	
Building/grounds cleaning, maintenance	10 (3.68)	-----	10 (8.40)	
Personal care and service	1 (0.37)	-----	1 (0.84)	
Sales and related	9 (3.31)	-----	9 (7.56)	
Farming, fishing, forestry	153 (56.25)	153 (100)	-----	
Construction and extraction	25 (9.9)	-----	25 (21.01)	
Installation, maintenance, and repair	6 (2.2)	-----	6 (5.04)	
Production	30 (11.03)	-----	30 (25.21)	
Transportation and material moving	3 (1.10)	-----	3 (2.52)	
Other	20 (6.73)		20 (16.81)	

^aStandard Occupational Classification system major categories.

Table 2

Pain on exam at baseline

	Total Workers (n=272) n (%)	Farmworkers (n=153) n (%)	Non- farmworkers (n=119) n (%)	Chi- square	P-value
Site of pain on exam					
Rotator cuff syndrome	52 (19.1)	24 (15.7)	28 (23.5)	2.66	0.10
Epicondylitis	55 (20.2)	29 (19.0)	26 (21.9)	0.35	0.56
Lower back	46 (16.9)	21 (13.7)	25 (21.0)	2.53	0.11
Lower extremity pathology	13 (4.78)	2 (1.3)	11 (9.2)	9.26	0.002

Table 3

Predictors of musculoskeletal disorders over time *

	Epicondylitis AOR (95% CI)	Rot. cuff syndrome AOR (95% CI)	Low back pain AOR (95% CI)	Lower extremity pathology AOR (95% CI)
Age	1.04 (1.01–1.07) [†]	1.03 (1.00 – 1.07)	1.03 (0.99–1.06)	1.07 (1.03–1.11) [†]
Gender				
Female	1.26 (0.59–2.69)	0.55 (0.22–1.38)	0.66 (0.26–1.66)	0.38 (0.05–3.13)
Male	Ref	Ref	Ref	Ref
Work Type				
Farmworkers	0.54 (0.32–0.92) [†]	0.36 (0.20–0.64) [†]	0.38 (0.21–0.69) [†]	0.08 (0.02–0.37) [†]
Non-farmworker	Ref	Ref	Ref	Ref
Visit				
Baseline	Ref	Ref	Ref	Ref
Follow-up	0.40 (0.22–0.73) [†]	0.42 (0.26–0.69) [†]	0.35 (0.18–0.66) [†]	0.69 (0.30–1.59)

* Adjusted for age, gender, work type, baseline of follow-up visit.

[†]P-value < 0.05

AOR- Adjusted odds ratio