Individual and Occupational Characteristics Associated With Respiratory Symptoms Among Latino Horse Farm Workers

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Background *Latino workers are likely exposed to a variety of respiratory hazards in the horse barn, yet the potential impact of these exposures on respiratory health has not been investigated.*

Methods *Using a community-based sample of 225 Latino horse farmworkers we investigated the prevalence of upper and lower respiratory symptoms and occupational characteristics associated with them. Multivariable logistic regression was used to identify factors associated with respiratory symptomology.*

Results *Upper respiratory symptoms prevalence ranged from 24% to 45%. Half of workers reported lower respiratory symptoms. Workers with symptoms were more likely to be female and have lower levels of English understanding. Workers who never/rarely used dust masks while working in the barn experienced over two times the odds of reporting upper respiratory symptoms.*

Conclusions *Many Latino horse workers experienced upper and lower respiratory symptoms. Dust mask use may protect workers in this and other enclosed livestock operations from respiratory symptoms. Am. J. Ind. Med.* © *2015 Wiley Periodicals, Inc.*

KEY WORDS: respiratory health; respiratory symptoms; occupational health; Latino farm workers; equine workers; personal protective equipment

INTRODUCTION

The United States' agricultural industry is heavily reliant upon the Latino workforce. Seventy percent of the approximately 750,000 agriculture jobs are held by Latinos [Carroll et al., 2011; BLS, 2014]. The agriculture industry is known to be dangerous, especially for Latinos, with the risk of injury or death for Latino farmworkers the greatest among all ethnic groups [BLS, 2006; Byler 2013]. In response to this increased risk, the National Institute of Occupational Safety and Health, NIOSH has prioritized the identification of evidence-based strategies to reduce the risks associated with farm work among Latinos [NORA AgFF Sector Council, 2008].

Within agriculture, the animal production sector is particularly hazardous, with illness and injury rates greater than all other agricultural jobs [Meyers and Chapman, 2001]. One segment of the animal production sector that remains under investigated is the horse breeding industry. Over two-thirds of the 460,000 full-time workers in the horse industry are either Latino or foreign-born [AHC, 2005]. Echoing these trends, a recent study of thoroughbred farms in the Southeast indicates that half of the year-round farmworker workforce was Latino [Swanberg et al., 2013].

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Workers on horse farms are exposed to several occupational hazards, including the horse, with the potential for kicks, bites, and falls [Iba et al., 2001; Douphrate et al., 2009; Langley and Morris, 2009; Löfqvist et al., 2009; Clouser et al., 2014]; strenuous labor duties and repetitive motion that could result in musculoskeletal injury [Löfqvist et al., 2009; Swanberg et al., 2013]; and dusts containing various respiratory hazards [Curtis et al., 1996; Mackiewitcz et al., 1996; Elfman et al., 2009; Samadi et al., 2009; Cho et al., 2010]. Swanberg et al. [2013] investigated Latino worker injuries on 22 southeastern farms and found that Latino workers may work in closer proximity to horses than non-Latino workers and may be subject to respiratory hazards in the stable environment. Although the link between respiratory illness in horses and humans due to barn exposures has long been known [Gregory and Lacey, 1968; McPherson and Thomson, 1983; Pickrell, 1990], no studies to date have investigated occupational hazards encountered by Latino horse workers and related respiratory symptoms.

Occupational respiratory hazards for horse workers are derived from a number of potential sources, although the horse barn may be a primary location for most exposure [Curtis et al., 1996; Elfman et al., 2009; Samadi et al., 2009]. The chief mechanism of exposure appears to be job tasks, such as mucking, that disrupt settled dusts [Samadi et al., 2009]. Barn ventilation levels, season, and horse bedding materials may also affect exposure, with higher ventilation, more common in warmer months, lowering airborne respirable particles [Curtis et al., 1996; Elfman et al., 2009; Wålinder at al., 2011], and paper bedding decreasing exposures relative to straw bedding [Curtis et al., 1996]. Work procedures conducted close to livestock may also increase exposure to respiratory hazards [O'Shaughnessy et al., 2010]. Outside of the barn, horse worker exposure to respiratory hazards may be high as well. For example, Cho et al. [2010] found Ohio and Kentucky horse farms had outdoor air samples with 11 times greater dust concentrations than grain handling sites and pig farms.

Particles in horse barn air contain a variety of respiratory irritants and toxins that may compromise human respiratory function following exposure. For example, air sampling in horse barns and stables have yielded high levels of general dust [Elfman et al., 2009], endotoxins and mold [Mackiewicz et al., 1996; Samadi et al., 2009], β(1,3)-glucans [Elfman et al., 2009; Samadi et al., 2009], horse hair and dander [Tutluoglu et al., 2002], ammonia [Curtis et al., 1996], hydrogen sulfide [Elfman et al., 2009], various toxic chemicals [Swanberg et al., 2012], and sawdust, metal, and silica particles [Mazan and Hoffman, 2006]. Exposure to these hazards may be responsible for horse workers experiencing high rates of asthma [Kimball-Dunn et al., 1999], bronchial obstruction [Elfman et al., 2009], dyspnea [Kimball-Dunn et al., 1999], chronic bronchitis [Melbostad et al., 1997; Gallagher et al., 2007], and allergic reactions to horse dander and hair [Tutluoglu et al., 2002]. Furthermore, in a New England study of equine workers, individuals exposed to horse barns reported significantly higher prevalence of self-reported respiratory symptoms than a non-exposed group [Mazan et al., 2009].

Personal protective equipment (PPE), such as respiratory masks rated N95 and higher, is likely to be effective against exposure to horse barn dusts. Cho et al. [2010] found that on horse, pig, and grain farms, respirators and the elastomeric and filtering face piece N95 provided protection against dust exposure, and that protection increased with increasing airborne particle size. However, the actual use of PPE may be influenced by various social and work organization factors. For example, a study of Louisiana farmers with livestock contact found less than 11% used respiratory protection [Carruth et al., 2008]. Furthermore, level of training, availability of PPE, and knowledge of safety risks associated with exposure affect the use of PPE among Latino farmworkers working with pesticides [Elmore and Arcury, 2001]. No known research has assessed the extent to which PPE is offered or used on horse breeding farms, particularly among Latino workers.

The Occupational Safety and Health Administration (OSHA) does not regulate air quality on horse farms, thus actual worker exposure to dust and respirable toxins in horse barns is not well documented. Evidence extrapolated from research in New Zealand, Poland, and Holland suggest the levels of dust, endotoxins, β(1,3)-glucans, and ammonia are likely above acceptable levels on U.S. horse farms [Curtis et al., 1996; Mackiewicz et al., 1996; Samadi et al., 2009]. Thus, it is probable that Latino horse workers may be exposed to high levels of respiratory hazards and experience subsequent adverse respiratory effects. However, in the general U.S. population, the prevalence of respiratory conditions is relatively low in those of Mexican descent. For example, Mexican–Americans exhibit a lower prevalence of obstructive lung disease than Whites [Diaz et al., 2014] and those born in Mexico exhibit a lower prevalence of asthma than those of Mexican descent born in the United States [Holguin et al., 2005]. Yet to the authors' knowledge, there is little known about the respiratory health of Latino horse workers.

To address this gap in knowledge about respiratory health among horse workers, and more specifically among Latino horse workers, our study examined the prevalence of respiratory symptoms among Latino horse workers and the individual and occupational characteristics associated with them.

METHODS

Sampling and Recruitment

This study was conducted within the central region of a southeastern state between October 2013 and April 2014.

The inclusion criteria included the following: (i) self-identify as Latino; (ii) over 18 years of age; and (iii) worked at a thoroughbred farm for at least 9 months in the past year. Horse farmworkers were recruited and interviewed via a purposive sampling strategy in the community at stores, churches, or social events; through flyers; and word-of-mouth. In addition, an interview about the study, conducted in Spanish with the study's research coordinator, was aired on a popular Spanish language radio station. A randomized sampling approach was not possible because there was no list of workers in the industry that could be used, nor were labor camps common in this industry or region. A site-based sampling approach by residence was not feasible because workers live in dispersed areas. Site-based sampling by work site was also not feasible because the survey contained some sensitive questions about horse farm jobs, and workers might feel that their jobs would be in jeopardy. Prior to administering the survey, workers were informed of the purpose, procedures, risks, and benefits of participating; were offered an opportunity to ask questions; were given a participation fact sheet; and were asked for verbal consent. A waiver of documentation of informed consent and all other research procedures were approved by the University of Kentucky's Non-Medical Institutional Review Board (IRB). Participants were given a $15 gift card to Wal-Mart for their participation in the interview, which lasted between 1 and 1.5 hr.

Training of Interviewers

Four lay health promoters (*Promotoras*) performed in-person interview-administered questionnaires. They were trained in the overall purpose of the study, human subjects' protection, and survey administration—including question-by-question details of the survey. At the end of the training, each interviewer successfully administered five observed pilot interviews. Halfway through the completion of the field investigation, as part of our quality control, study personnel observed each lay health promoter administer one questionnaire in order to ensure the continued fidelity to the survey protocol. In addition, all questionnaires were reviewed by the project manager with whom interviewers met weekly to discuss any questions or complications. Questionnaire content was adapted from translated standardized measures where available. Other content was translated into Spanish by a native Spanish-speaker, reviewed by a second native Spanish-speaker, and further reviewed by the four native Spanish-speaking interviewers, all of whom had previous experience working with the target population. A cultural consultant with the IRB reviewed and approved of the final questionnaire.

Respiratory Symptoms

The current study focused on respiratory symptoms of horse farmworkers. Respiratory symptoms included upper and lower respiratory symptoms. Upper respiratory symptoms include nasal irritation, throat irritation, and sinus trouble; whereas lower respiratory symptoms include cough, wheezing, chest tightness, shortness of breath, and difficulty breathing. If a worker reported having any upper respiratory symptoms, the worker was regarded as having upper respiratory symptoms. Similarly, if a worker reported having any lower respiratory symptoms, the worker was regarded as having lower respiratory symptoms. Finally, if a worker reported having any of these upper or lower respiratory symptoms, the worker was regarded as having respiratory symptoms. Questions probing for respiratory symptomology were adapted from a list of 11 respiratory symptoms developed by Rylander et al. [1990] which had previously been used with equine stable hands [Mazan et al., 2009]. Three dependent variables were generated: "lower respiratory symptoms" included cough, wheezing, chest tightness, shortness of breath, or difficulty breathing; "upper respiratory symptoms" included nasal irritation, throat irritation, and sinus trouble; and "all respiratory symptoms" included all upper and lower respiratory symptoms.

Potential Exposure Factors

Time spent working in barns ("How many hours per week, on average, do you spend in a barn") was adapted from Rylander et al. [1990] and ultimately collapsed into two categories: short (includes quartiles 1 and 2) and long (includes quartiles 3 and 4). If a worker never worked in a barn, the number of hours was counted as 0.

Availability of dust mask was measured using a yes/no question. Those who answered "yes" were asked about the frequency for the use of dust masks ("How often do you wear the dust masks provided by your employer?"). This question was created by the team with a five-point Likert scale, which was ultimately collapsed into two categories: less (never, seldom, sometimes) and more (often or always/almost always). If a worker did not have access to dust masks through their employers, their response was coded as "never." Length of time working for the current horse farm and Length of time working on horse farms in general were both captured as continuous variables in years.

Other Factors Related to Respiratory Symptoms

Most demographic questions, including educational attainment and language acquisition, were taken from the Spanish translation of the National Agricultural Workers

Survey (NAWS). Age was collected as a continuous variable in years and gender was recorded as a dichotomous variable (female and male). We also collected data on the following factors that might potentially be associated with the presence of respiratory symptoms.

Educational attainment ("What is the highest level of education you have completed") was collapsed into two categories: low (<high school education), and high (≥high school education). *Marital status* was coded dichotomously as single and married or living as married. *Birth country* ("What country were you born in?") was measured using four categories (Mexico, Guatemala, United States, and other).

Language acquisition ("How well can you understand English") was collapsed into two categories: low (not at all or a little), and high (somewhat or well). *Length of time in the U.S.* was collected as a continuous variable in years. Finally, information on *smoking status* ("Do you smoke cigarettes" and "Have you ever smoked cigarettes") were collected and were classified into never smoker, current smoker, or former smoker.

Statistical Analyses

We first compared the characteristics between workers with and without any respiratory symptoms. A χ^2 test was used for categorical variables, and a two-sample *t*-test was used for continuous variables. To identify variables associated with the existence of respiratory symptoms, we first performed intensive exploratory data analyses to examine the influence of each single variable on the existence of respiratory symptoms. Because of the small sample size of the current study, we finally restricted 9 variables to be included in the multivariable logistic regression model, including age, sex, education, years of living in US, English understanding, smoking status, time working in barns each week, dust mask utilization, and years of work at the farm. We chose these variables because they were either important demographic factors (e.g., age, sex, education, smoking status) or major occupational factors (e.g., time working in barns each week, dust mask utilization, and years of work at the farm) that might be potentially associated with the existence of respiratory symptoms. In the multivariable logistic regression analyses for each type of respiratory symptoms, we calculated odds ratio (OR) and 95% confidence interval (CI) of having the type of respiratory symptoms for a specific group compared with corresponding reference group after adjustment for all other selected factors.

All statistical tests were two-sided, and were performed using SAS 9.3 (36). A *P*-value ≤ 0.05 was considered statistically significant.

RESULTS

A total of 225 Latino workers were recruited to the study; 86% were male, the average age was 35 years (SD = 10, Range = 18–65). Most participants were born in Mexico (84%), had less than high school education (76%), and were married or living as married (68%). Approximately one-third did not understand English; half were current or former smokers. On average, participants had lived in U.S. for 15 years and worked on horse farms for 10 years. The average tenure at their current farm was 5 years and the vast majority (92%) of workers currently worked in barns (about 23 hr each week) with 63% never seldom or sometimes using dust masks while doing so (Table I).

Overall, 62% of Latino workers reported having various respiratory symptoms (Table II). For upper respiratory symptoms including nasal irritation, throat irritation, and sinus trouble, the overall prevalence was 53%; the prevalence of each single upper respiratory symptom ranged from 24% to 45%. There were no significant differences between male and female workers in having these symptoms (Table II). About half (52%) of the workers reported having lower respiratory symptoms, and cough was the most common respiratory symptom (44%); for other lower respiratory symptoms, the prevalence was similar and ranged from 6% to 9%. Compared with male workers, female workers were more likely to report having lower respiratory symptoms (Table II).

Compared with those without any respiratory symptoms, the workers with respiratory symptoms were more likely to be female, have lower levels of English understanding, were less likely to have access to dust masks, and, on average, they had shorter period of time living in U.S. Notably, the workers with the respiratory symptoms were less likely to be current smokers and more likely to be former smokers compared with those without the respiratory symptoms (Table I).

Table III summarized the results of multivariable logistic regression analyses. For upper respiratory symptoms, infrequent use of dust mask (OR, 2.34; 95%CI, 1.21–4.53) and former smokers (OR, 2.95; 95%CI, 1.36–6.43) were two factors significantly associated with existence of the respiratory symptoms. For lower respiratory symptoms, being female (OR, 4.33; 95%CI, 1.60–11.70) was significantly associated with having the respiratory symptoms. When upper and lower respiratory symptoms were combined together, females (OR, 4.28; 95%CI, 1.45–12.63) and former smokers (OR, 3.07; 95%CI, 1.30–7.26) were significantly associated with having any respiratory symptoms. We did not find significant influences of sex on the associations between occupational factors and the existence of respiratory symptoms.

TABLE I. Characteristics of Study Participants by Existence of any Respiratory Symptoms[a]

Selected factors	Total (n = 225)	Respiratory symptoms		*P* value[b]
		Presence (n = 139)	Absence (n = 86)	
Age (years)	35.4 ± 9.6	34.7 ± 9.4	36.5 ± 9.9	0.181
Sex (female, %)	14.2	19.4	5.8	0.006
Mexico as birth country (%)	84.4	83.5	86.1	0.901
Less than high school education (%)	75.6	73.4	79.1	0.335
Married or living as married (%)	67.6	68.4	66.3	0.748
Length of time living in US (years)	14.5 ± 8.4	13.2 ± 7.5	16.5 ± 9.4	0.003
Poor english understanding (%) (little or not at all)	26.2	30.9	18.6	0.041
Cigarette smoking (%)				0.009
Current smokers	16.5	12.3	23.3	
Former smokers	26.3	32.6	16.3	
Never smoker	57.1	55.1	60.5	
Length of time working for the current horse farm (years)	5.4 ± 4.6	5.3 ± 4.0	5.5 ± 5.6	0.792
Length of time working in the area of horse farms (years)	10.5 ± 7.3	10.1 ± 6.3	11.2 ± 8.6	0.297
Work in barns (yes, %)	92.4	94.2	89.5	0.194
Hours working in barns per week[c]	22.9 ± 13.7	22.2 ± 11.7	23.9 ± 16.5	0.401
Availability of dust mask (yes, %)	37.9	31.9	49.3	0.014
Dust mask utilization (%)[d] (never, seldom, or sometimes)	63.1	68.9	52.1	0.018

[a]Data are present as prevalence (%) for categorical variables and mean ± SD for continuous variables. Respiratory symptoms include cough, wheezing, chest tightness, shortness of breath, difficult breathing, nasal irritation, throat irritation, or sinus trouble. If a worker reported having any of these respiratory symptoms, the worker was regarded as having respiratory symptoms.
[b]Comparison between presence and absence groups.
[c]If a worker never worked in a barn, the hour was counted as 0.
[d]For those who did not have dust masks, the use of dust mask was regarded as never.

TABLE II. Prevalence (%) of Respiratory Symptoms by Sex

Symptom	Total (n = 225)	Sex		*P* value[a]
		Women (n = 32)	Men (n = 193)	
Upper respiratory symptoms[b]				
Nasal irritation	41.3	40.6	41.5	0.930
Throat irritation	44.9	53.1	43.5	0.312
Sinus trouble	24.3	31.3	23.3	0.333
Any of the above	52.9	62.5	51.3	0.240
Lower respiratory symptoms[c]				
Cough	44.4	56.3	42.5	0.147
Wheezing	6.2	15.6	4.7	0.017
Chest tightness	9.3	18.8	7.8	0.048
Shortness of breath	8.0	25.8	5.2	<0.001
Difficulty breathing	7.6	21.9	5.2	<0.001
Any of the above	52.0	78.1	47.7	0.001
Any upper or lower symptoms	61.8	84.4	58.0	0.005

[a]Comparison between women and men.
[b]Upper respiratory symptoms include nasal irritation, throat irritation, and sinus trouble.
[c]Lower respiratory symptoms include cough, wheezing, chest tightness, shortness of breath, and difficult breathing.

TABLE III. ORs (95% CIs) of Having Respiratory Symptoms in Relation to Selected Variables[a]

	Any upper symptoms[b]	Any lower symptoms[c]	Any symptoms[d]
Age (1 year increase)	1.00 (0.96–1.03)	1.00 (0.96–1.04)	1.00 (0.96–1.05)
Sex (female vs male)	2.13 (0.88–5.13)	4.33 (1.60–11.70)	4.28 (1.45–12.63)
Education (low vs high)	1.06 (0.51–2.23)	0.80 (0.38–1.70)	0.65 (0.29–1.46)
Years of living in US (1 year increase)	0.96 (0.92–1.01)	0.96 (0.92–1.01)	0.95 (0.90–1.00)
English understanding (poor vs good)	1.41 (0.67–2.98)	1.93 (0.90–4.11)	1.43 (0.63–3.24)
Smoking status			
Former versus never	2.95 (1.36–6.43)	1.48 (0.71–3.08)	3.07 (1.30–7.26)
Current versus never	0.83 (0.36–1.92)	0.41 (0.17–1.01)	0.59 (0.25–1.39)
Time working in barns per week (long vs short)[e]	0.93 (0.49–1.74)	1.09 (0.58–2.05)	0.99 (0.51–1.93)
Dust mask utilization (less vs more)[f]	2.34 (1.21–4.53)	1.71 (0.87–3.36)	1.79 (0.89–3.62)
Years of work at the farm	1.02 (0.94–1.10)	0.97 (0.89–1.05)	1.01 (0.93–1.09)

[a]For each type of respiratory symptoms, a multivariate logistic regression model was used to calculate OR and 95% CI for a specific group compared with corresponding reference group after adjustment for all other factors in the table (see Statistical Analyses).
[b]Upper respiratory symptoms include nasal irritation, throat irritation, and sinus trouble. If a worker reported having any upper respiratory symptom, the worker was regarded as having upper respiratory symptoms.
[c]Lower respiratory symptoms include cough, wheezing, chest tightness, shortness of breath, and difficult breathing. If a worker reported having any lower respiratory symptom, the worker was regarded as having lower respiratory symptoms.
[d]If a worker reported having any upper or lower respiratory symptoms, the worker was regarded as having respiratory symptoms.
[e]If a worker never worked in a barn, the hour was counted as 0. Short means quartiles 1 and 2, long means quartiles 3 and 4, of hours working in barns.
[f]For those who did not have dust masks (n = 128), the use of dust mask was regarded as never. Less means never, seldom, or sometime used dust masks; more means often or almost always used dust masks.

DISCUSSION

The Latino horse worker participants in this study reported high levels of respiratory symptoms. Over half of workers reported experiencing respiratory symptoms, with cough as the most common lower respiratory symptom. In the general population, respiratory symptom reporting is much lower. The prevalence of cough was about 11% in adults of NHANES 2007–2012 in contrast to 44% in the current study [CDC, 2012]. Although this difference is extreme, it is consistent with other studies that have found strong and significant differences in the prevalence of respiratory symptoms between equine workers and workers in other areas of agriculture and the general population. In a recent study of equine stable hands in the northeastern U.S., exposed equine workers experienced four times the prevalence of dry cough than a control group [Mazan et al., 2009]. A New Zealand study found that horse breeders experienced 6.5 times the odds of stage three dyspnea [OR = 6.5 (2.2–19.0)] compared to other farm operators [Kimbell-Dunn et al., 1999].

A chief difference between our study and other studies of equine workers is that our study focused specifically on Latino farmworkers, most of whom were born in Mexico. Other studies of the general population, such as NHANES III, have found that Latinos, and Mexican–Americans specifically, experienced reduced odds for obstructive lung disease (OLD) compared to whites [Diaz et al., 2014]. The fact that our sample, which was entirely comprised of Latino and chiefly of Mexican-born workers, experienced even greater odds of respiratory symptoms, such as cough, than was reported by the general population or even Latinos in the NHANES 2007–2012 [CDC, 2012], suggests that this worker group may experience environmental exposures which differ from the general population.

Females experienced over four times the odds of any lower respiratory symptoms and any symptoms overall. When looking at individual symptoms, significant differences were found between male and female reporting of wheezing, chest tightness, shortness of breath, and difficulty breathing—findings which have been observed in other studies as well [Kimbell-Dunn et al., 1999; Watson et al., 2004; Lamprecht et al., 2013]. Kimbell-Dunn et al. [1999] found that women were two times more likely to report current asthma symptoms than men. Such discrepancies in the prevalence of self-reported lower respiratory symptoms between genders may be due in part to biological differences —including a reduced inspiratory and expiratory pressure in females and a generally smaller inherent lung capacity—and may in part be due to social differences—whereby men, who may be less inclined to report symptoms which may characterize them as weak, may be prone to under-reporting [Lamprecht et al., 2013].

As was expected, former smokers experienced approximately three times the odds of reporting upper respiratory symptoms or any respiratory symptoms compared to never

smokers, although this difference was not observed for lower respiratory symptoms. Interestingly, our study shows that current smokers experienced a mild protective effect for respiratory symptoms, though these findings were not statistically significant. This unusual observation might be explained by our small sample size in which workers with respiratory symptoms were less likely to be current smokers compared with those without respiratory symptoms (12% vs. 23%). As a cross-sectional study, there was no information on the development of these respiratory symptoms. However, one possibility is that smoking workers with respiratory symptoms were motivated to stop smoking, resulting in a less symptomatic group of "healthy smokers." Another possibility is that current smokers may be more tolerant or accustomed to respiratory symptoms and therefore less likely to report them. Finally, it may be possible that smoking suppresses allergic responses in a subgroup of smokers [Spiess et al., 2013].

Finally, those who used a dust mask "never, seldom, or sometimes" while working in the barn— including those who did not have access to dust masks—experienced over two times the odds of reporting upper respiratory symptoms. This observation is plausible because workers who do not have access to dust masks—or choose not to wear them—likely breathe in more respiratory irritants such as hay, dander, endotoxins, and fine particles while working in the barn that could cause these symptoms.

Findings did not show, however, any significant difference in workers' general exposure to the barn environment and an increase in respiratory symptomology, nor a relationship between dust mask use and lower respiratory symptoms, which signal more long-term lung impairment than upper respiratory symptoms. It is possible that this is due in part to the relatively young age of the sample. With a mean age of 35, long-term respiratory problems may not have had time to develop, despite the elevated exposure to irritants experienced by these workers. Because a relationship was found between mask use and upper respiratory symptoms—which may be indicative of the body's attempt to expel respirable dust—it is important to educate workers and owners/managers at horse farms or other livestock operations with enclosed spaces that wearing a dust mask may help to prevent long-term damage. Another possibility is that the vast majority of the workers (92%) in our study worked in the barns, which might potentially limit our ability to detect the adverse respiratory effects associated with exposure to the barn environment. Although our study is one of the first to examine the relationships between work-related exposure and respiratory symptoms among a group of Latino horse farmworkers, our study has several limitations. Data were collected via a purposive, community-based sampling methodology and thus may not be generalizable to the general population, nor to all Latino equine farmworkers. Moreover, this study relies on self-reported measures of exposures and respiratory symptoms that might introduce observational bias. Future research should incorporate objective measures of air quality within the barns to determine exposures to respiratory irritants instead of relying on self-reported data.

In an effort to control for asthma and allergies, workers were asked about asthma and various allergies, although neither was prevalent enough to include in the final analysis. However, because this is a population that may not regularly access medical care, it is possible that each of these conditions was more prevalent than was understood by the worker. Furthermore, the survey was conducted during the winter months—a time when barns were less ventilated and therefore dust and endotoxins in the work environment might be more extreme [Elfman et al., 2009]. It was also a time when workers were more vulnerable to catching colds or other illnesses that might affect their respiratory health. Finally, there was a drastic difference between those who reported coughing and those who reported other lower respiratory symptoms, a difference which is not frequently observed in the literature. It is possible that lower respiratory symptoms aside from cough (e.g., wheezing) were not as well understood and that coughing was over-reported compared to other respiratory symptoms. Future research conducted with this study population should perform cognitive testing to ensure that all measures are fully comprehended.

CONCLUSIONS

This is one of the first studies to examine respiratory health among a medically underserved population that works in a high risk industry. Results from this research indicate that a significant proportion of Latinos employed on horse farms experienced upper respiratory and cough symptoms and that upper respiratory symptoms were associated with dust mask utilization—a relatively easy and potentially low-cost approach for preventing adverse respiratory health among workers on horse farms. Further research is warranted in several areas. First, objective measures of lung function (e.g., using spirometers) and the types and duration of relevant environmental factors (e.g., air quality) are necessary to more accurately assess the association on respiratory health with occupational exposures. Second, we need to better understand the determinants of cough and other respiratory symptoms among Latino farmworkers, including whether the standardized measures used to assess respiratory symptoms are able to accurately assess symptomology in this population due to low-levels of education and other cultural factors. Lastly, further investigation is needed to better understand why Latina, or female, workers had a higher risk of reporting symptoms. Is it because their job tasks differ from those of their male counterparts or are there other biological or environmental factors influencing the presence of symptoms?

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