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## Job activities and respiratory symptoms among farmworkers in North Carolina

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### Abstract

Respiratory health is an important component of the ability to perform physically demanding work. We assessed the prevalence of self-reported respiratory symptoms among Latino farmworkers primarily engaged in crop production and investigated work activities as risk factors for respiratory symptoms. During June-September 2008, 122 farmworkers completed up to three interviewer-administered questionnaires. We estimated the associations between work activities and wheezing symptoms using alternating logistic regression, controlling for age and smoking. At the first data collection, 24% (n=29) of farmworkers reported ever wheezing and 8% reported wheezing within the past month. Though not statistically significant, the odds of wheezing were elevated for individuals who reported performing tobacco-related work in the last three days. The odds were decreased among individuals who reported harvesting activities (odds ratio: 0.3, 95% confidence interval: 0.1, 1.0). Among Latino farmworkers, respiratory symptoms may be associated with work activities.

### Keywords

agriculture; asthma; epidemiology; occupational lung disease; respiratory diseases

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## INTRODUCTION

Migrant and seasonal farmworkers experience a number of potential inhalation exposures including aerosolized pesticides,<sup>1</sup> organic and inorganic dusts,<sup>2–5</sup> pollens,<sup>6</sup> and other gases, fumes, and particulates in the ambient air. Occupational exposures such as these may increase agricultural workers' risks of asthma,<sup>7</sup> chronic bronchitis,<sup>8;9</sup> and wheezing.<sup>10;11</sup> Despite the extent to which migrant and seasonal farmworkers may encounter inhalation hazards on the job, little is known about respiratory health in this population.

In 2008, a population of farmworkers was recruited for participation in a study to assess respiratory health symptoms. The prospective design of the study and the high rate of continued participation provide a unique opportunity to assess the prevalence of and occupational risk factors for self-reported respiratory symptoms in this population.

## METHODS

The Community Participatory Approach to Measuring Farmworker Pesticide Exposure (PACE3) study is a prospective, workforce-based research study designed to assess the health of Latino farmworkers and their families in eastern North Carolina.<sup>12</sup> The study design and methods have been described previously.<sup>12;13</sup> Briefly, PACE3 was a longitudinal study of a fixed cohort; the initial survey of the population began in June 2007 when 287 farmworkers were recruited from 44 farmworker camps in 11 eastern North Carolina counties. In June 2008, follow-up of the cohort began with a target of recruiting 120 members of the original population to participate in additional data collection. The follow-up was proposed a pilot study to assess the feasibility of collecting additional data, including a questionnaire designed to assess respiratory health. The recruitment goal was to have at least 100 participants complete all three rounds of data collection, therefore 120 participants were recruited in order to account for expected loss to follow-up. Farmworker camps were visited by study personnel in random order and the target sample size was reached after 29 camps were recruited.<sup>13</sup> Wake Forest University School of Medicine Institutional Review Board approved the study protocol and instruments, and each participant provided written informed consent.

A total of 122 participants were enrolled and completed respiratory health questionnaires administered during three rounds of data collection during the summer of 2008. Dates of data collection were categorized into three approximately month-long time intervals: (1) June 13-July 11 (n=122), (2) July 12-August 10 (n=117), and (3) August 11-September 9 (n=114). Three participants were lost to follow-up before July 12<sup>th</sup> and five others were lost before August 11<sup>th</sup>. The final study population in this analysis is the 122 farmworkers who participated in the first round of data collection in 2008.

Questionnaires were administered by Spanish-speaking study personnel who traveled to the farmworkers' residences for each round of data collection. Demographic and other characteristics of the population were collected in the first questionnaire administered. In the occupational exposure assessment portion of all three questionnaires, participants responded to questions about whether they worked on each of the last three days, including today, and then indicated how many hours they spent performing selected activities (e.g., planting, applying pesticide, harvesting) on each of the last three days. Respondents who indicated that they performed the activities one or more hours on any of the last three days were classified as having performed the specific activity.

Respiratory and allergic symptoms were identified using symptom-related questions based on items from the European Community Respiratory Health Survey questionnaire.<sup>14</sup> In all three rounds of data collection, respondents were also asked whether they had wheezing or

difficulty breathing, itchy eyes, nasal allergies, or runny nose in the last three days. In the initial questionnaire, respondents were asked whether they ever experienced wheezing symptoms and whether they had wheezing, been awoken by shortness of breath, or had nasal allergies in the last 12 months. In the next two questionnaires, these items referred to the last month, referencing the month since the previous data collection.

There are two levels of clustering in these data: repeated measures of the same individual and clustering of farmworkers within farmworker camps. To account for this data structure, we estimated associations between occupational activities and respiratory symptoms using alternating logistic regression to compare the odds of symptoms among farmworkers with each work activity exposure to those of farmworkers without the exposure.<sup>15;16</sup> Models were adjusted for age, included as a continuous variable, and smoking status (current smoker, former smoker, lifetime non-smoker). We performed all analyses using SAS version 9.2 (SAS Institute Inc., Cary, NC).

## RESULTS

The 122 Latino farmworker participants were predominantly male, lifetime non-smokers, with low levels of educational attainment, and living in grower-provided housing. At the time of the first questionnaire, 20 (16%) of the farmworkers reported wheezing in the last 12 months, with the highest percentages reported among older workers, current and former smokers, and individuals with 8+ years of experience in the agricultural industry. Also at that time, 29 (24%) farmworkers reported ever experiencing wheezing or whistling in the chest, and 8% (n=10) reported the symptoms within the last month (Table I). Across the agricultural growing season, the prevalence of wheezing in the last month declined monotonically to 4%, though at each time point the number of individuals who reported wheezing was low.

Table I also presents the prevalence of eye and nasal symptoms in this population. Across the agricultural season, the prevalences of nasal allergies and runny or stuffy nose symptoms both notably declined after the first data collection of the season. When wheezing, waking due to cough, and waking due to shortness of breath were combined, the prevalence of any of these self-reported respiratory symptoms declined from 21% (n=25) to 10% (n=11).

Throughout the agricultural season, the most frequently reported work activities were harvesting and tobacco-related activities (Table II). Planting and cultivating were more common early in the season, whereas packing, loading, or transporting activities occurred more frequently at the end of the season. Despite the low number of individuals in this population who reported wheezing, these analyses generated lower odds of wheezing in the population that reported performing harvesting activities in the last three days (odds ratio (OR): 0.3, 95% confidence interval (95% CI): 0.1, 1.0). Increased odds were associated with two tobacco-related activities: topping tobacco (OR=2.4, 95% CI: 0.9, 6.3) and baling or baling tobacco (OR: 1.7, 95%: 0.6, 5.4), though these elevated risks are not statistically significant.

## DISCUSSION

Farmworkers are a large and important workforce in the United States; they routinely perform demanding physical work and are exposed to inhalation hazards throughout the agricultural season.<sup>17</sup> In this analysis, we present the prevalence of respiratory symptoms in a population of Latino farmworkers. Despite the small number of workers who reported individual symptoms, we observed decreasing prevalences of nearly all respiratory symptoms across the 2008 agricultural season.

In the first of the three questionnaires, nearly 24% of the participants reported ever wheezing, 16% reported wheezing in the last year, 8% in the last month, and 3% in the last three days. Little data exist with which to compare our results. Among a population of adult Hispanic migrant farmworkers in Indiana, 6.2% reported chronic wheeze;<sup>18</sup> in a sample of Hispanic farmworkers in California, 2.8% reported persistent wheeze.<sup>19</sup> In our sample, the prevalence of wheeze in the last year was similar to that of adults in the US (16.5%), using data from the National Health and Nutrition Examination Survey (NHANES) 2005–2006.<sup>20</sup> The decreasing prevalence of wheezing in the past month could be due to changes in allergens or other exposures that trigger wheezing or to changes in work- or non work-related behaviors, including occupational activities, the use of personal protective equipment, smoking habits, exercise or other aspects of one's behavior that affect respiratory health.

We conducted these analyses to describe the respiratory health status of a population of Latino farmworkers and to investigate the associations between farmworking activities and symptoms. We are unable to draw conclusions about the prevalence of diagnosed respiratory disease and instead provide estimates of the prevalence of several hallmark symptoms. Clinical assessment of respiratory disease or additional information about access to diagnostic healthcare services would improve our ability to attribute the reported symptoms to asthma, assess asthma severity, and investigate associations between the specific farmworking activities and mild to severe asthma. We were also unable to assess the roles of ambient air quality, pre-existing health status, co-morbid conditions, and other factors with important contributions to respiratory health; accounting for these as well as for multiple farmworking exposures would strengthen future research about respiratory health of farmworkers. In particular, detailed information about the frequency and safety precautions with which farmworkers apply, handle, transport, or otherwise come into direct contact with pesticides and how much time passes between the application of pesticides onto the crops and farmworkers' re-entry into the fields would provide valuable information about the frequency and intensity of the pesticide exposures and the onset of new respiratory symptoms or exacerbation of existing symptoms. Using these data, we were not able to estimate the extent to which the healthy worker effect affected our study population and our results. Workers must be physically fit to be hired into farm labor jobs, and they must continue to be strong and healthy to continue without injuries or illnesses that would prevent them from continuing to work throughout the agricultural season. In this study, 8 of the 122 participants were lost to follow-up between the first and final interviews and each of the 8 responded negatively to the respiratory and allergy symptom questions included in the initial questionnaire. We are unable to determine whether pre-existing respiratory health status affected individuals' decisions to enroll or continue to participate in our study. We also have no information about whether farmworkers who reported respiratory symptoms made any changes to their routines or work activities to reduce their inhalation exposures; such information would be a useful addition to future research about inhalation exposures and respiratory health in a larger cohort of farmworkers.

Despite these limitations, our findings suggest that even in a healthy working population, some agricultural exposures may affect the risk of wheezing. Latino farmworkers are a unique working population because of the isolated areas in which they work, the language barriers that limit the extent to which they are able to engage with their host communities, and for migrant farmworkers in particular, the mobility of the workers and their families.<sup>21</sup> These findings suggest a gap in the knowledge about respiratory health and farm work, especially harvesting and tobacco crop activities, among farmworkers in the US agricultural industry.

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**Table 1**

Respiratory and allergy symptoms among Latino farmworkers in eastern North Carolina

Symptoms	June 13 – July 11	July 12 – August 10	August 11 – September 9	June 13 – September 9
	N=122 No. (%)	N=117 No. (%)	N=114 No. (%)	N=122 No. (%)
<b>Respiratory</b>				
Wheezing or difficulty breathing in the last 3 days	4 (3)	4 (3)	3 (3)	7 (6)
Wheezing or whistling in the chest	20 (16) <sup>a</sup>	8 (7)	5 (4)	26 (21)
Woken by coughing	8 (7)	4 (3)	7 (6)	18 (15)
Woken by shortness of breath	7 (6)	3 (3)	4 (4)	10 (8)
<b>Allergy</b>				
Itchy eyes	13 (11)	14 (12)	18 (16)	36 (30)
Nasal allergies, including hay fever	23 (19)	7 (6)	9 (8)	28 (23)
Runny or stuffy nose	10 (8)	3 (3)	4 (4)	14 (12)
<b>Respiratory and Allergy</b>				
Any respiratory symptom	25 (21) <sup>b</sup>	12 (10) <sup>c</sup>	11 (10)	36 (29)
Any allergy symptom	35 (29) <sup>d</sup>	20 (17) <sup>e</sup>	26 (23)	55 (45)
Any respiratory symptom + any allergy symptom	13 (11)	4 (3)	6 (5)	18 (15)

<sup>a</sup> n=10 (8%) reported wheeze in the last month in the baseline questionnaire

<sup>b</sup> Respiratory symptoms at baseline: wheeze in the last 3 days, 1 month, or 12 months, or woken by cough in the last 12 months, or woken by shortness of breath in the last 12 months

<sup>c</sup> Respiratory symptoms at follow-ups 1 and 2: wheeze in the last 3 days or 1 month, or woken by cough in the last 1 month, or woken by shortness of breath in the last 1 month

<sup>d</sup> Allergy symptoms at baseline: runny or stuffy nose in the last 3 days or itchy eyes in the last 3 days or nasal allergies, including hay fever in the last 12 months

<sup>e</sup> Allergy symptoms at follow-ups 1 and 2: runny or stuffy nose in the last 3 days or itchy eyes in the last 3 days or nasal allergies, including hay fever in the last 1 month

**Table II**  
Self-reported job activities and wheezing in the last month among 122 Latino farmworkers in eastern North Carolina

	June 13 – July 11		July 12 – August 10		August 11–September 9		OR (95% CI) <sup>a,b</sup>
	No. (%)	Wheeze No. (row %)	No. (%)	Wheeze No. (row %)	No. (%)	Wheeze No. (row %)	
Study population	122 (100)	10 (8)	117 (100)	8 (7)	114 (100)	5 (4)	
Job activity							
Planting	22 (18)	1 (5)	1 (1)	0 (0)	0 (0)	0 (0)	0.5 (0.1, 3.6)
Cultivating	16 (13)	1 (6)	7 (6)	0 (0)	5 (4)	0 (0)	0.6 (0.1, 2.5)
Mixing, loading, applying pesticide	4 (3)	1 (25)	4 (3)	0 (0)	2 (2)	0 (0)	2.5 (0.3, 18)
Harvesting	38 (31)	1 (3)	42 (36)	2 (5)	38 (33)	1 (3)	0.3 (0.1, 1.0)
Packing, loading, transporting	11 (9)	1 (9)	10 (9)	0 (0)	19 (17)	0 (0)	0.3 (0.03, 3.5)
Topping tobacco	44 (36)	6 (14)	48 (41)	5 (10)	8 (7)	1 (13)	2.4 (0.9, 6.3)
Barring, baling tobacco	0 (0.0)	0 (0.0)	10 (9)	2 (20)	39 (34)	2 (5)	1.7 (0.6, 5.4)

<sup>a</sup> Adjusted for age and smoking status

<sup>b</sup> Referent category: population that did not perform the activity