

Physician Recognition of Work-related Asthma Among US Farm Operators

Jacek M. Mazurek, MD, MS, PhD; Patricia L. Schleiff, MS

Background and Objectives: *The occupational history of every adult patient with asthma provides information critical to the proper diagnosis and effective prevention of work-related asthma. This study determined the proportion of farm operators that reported an asthma attack while doing farm work that required the use of an inhaler or other medical treatment but who had not been told by a doctor, nurse, or other health professional that their asthma was related to work on the farm.* **Methods:** *Asthma and asthma attack prevalences were estimated using data on a nationally representative sample of 12,278 active farm operators who participated in the 2006 Farm and Ranch Safety Survey.* **Results:** *An estimated 4.9% of operators reported current asthma. Of these, an estimated 24.8% had been told that their asthma was related to work on the farm. Of those not so informed, 21.6% reported an asthma attack at work in the 12 months prior to the interview.* **Conclusions:** *A large proportion of farm operators who had not been told that their asthma was related to work on the farm experienced an asthma attack that occurred while doing farm work. These results suggest the need for improving clinicians' occupational health practices and clinician-patient communication.*

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Asthma is one of the most prevalent chronic medical conditions in the United States. An estimated 7.3% (16.0 million) of US adults aged ≥ 18 years had asthma in 2006.¹ For 2001–2003, asthma in adults resulted in an annual average of 7.6 million physician office visits, 1.1 million emergency department visits, and more than 4,000 deaths.² The National Heart, Lung, and Blood Institute estimated the economic cost of asthma to be \$19.7 billion in 2007.³ Between 4% and 58% (median 15%) of all adult asthma cases are attributable to occupational factors.⁴ A 1996 study estimated the cost of work-related asthma (WRA) to be approximately \$1.6 billion.⁵ In addition, WRA has been associated with acute morbidity, long-term disability, and adverse socioeconomic outcomes.^{6,7}

WRA encompasses occupational asthma (OA), defined as new-onset asthma induced by sensitizers or irritants at work and work-exacerbated asthma (WEA),

which is defined as preexisting or concurrent asthma worsened by work factors. WRA is and remains under-recognized and underdiagnosed in both developed and developing countries.⁸ Approximately 3.7% of all U.S. workers identified in the 1988–1994 National Health and Nutrition Examination Survey (NHANES) were considered to have WRA.⁹ Agricultural workers are exposed to organic and inorganic dusts, infectious agents, toxic chemicals, fertilizers, and feed additives that can cause or aggravate respiratory symptoms and diseases including asthma.¹⁰ Exposures to these agents may occur at concentrations substantially higher than in most other workplaces.^{10,11} A 2005 study conducted on the basis of data collected in 1993 from California farm operators documented that 7.8% of operators reported doctor-diagnosed asthma.¹¹ The 1988–1994 NHANES study results indicated that 3.6% of workers in farm-related occupations, including farm operators, managers, supervisors, and farm and nursery workers had WRA.¹²

A substantial proportion of asthma patients continue to have symptoms and to require visits to physicians' offices, emergency departments, or hospitalizations.² One explanation for this is the missed opportunity to diagnose and prevent WRA.^{6,13,14}

From the Division of Respiratory Disease Studies, National Institute for Occupational Safety and Health, Centers for Disease Control and Prevention, Morgantown, WV.

Asthma episodes or attacks can be controlled by following a medical management plan and eliminating or controlling exposures. When complete elimination of exposures to the agent is not feasible, patients should avoid exposure whenever possible and limit exposure, perhaps by use of personal protective equipment, whenever exposure is unavoidable. Early recognition of occupational causes and triggers of asthma and control of exposures or removal of affected individuals from these exposures is particularly important in management of occupational asthma because continued exposure to the causative agent can lead to increased severity of asthma and, rarely, death due to status asthmaticus.^{6,15,16} Although there is limited information on the effectiveness of WEA treatment or preventive strategies, reduction of the exposure to relevant workplace triggers is important for the management of patients with WEA.⁶

The diagnosis and management of WRA can be challenging. Although employers are responsible for maintaining safe and healthful working conditions, patient education is an essential component of asthma care and patients are expected to take on responsibility for preventive behavior. The National Asthma Education and Prevention Program (NAEPP) describes components of asthma care, including teaching patients about environmental exposure control measures.¹⁷ The NAEPP Report emphasizes that patient self-management education should be integrated into all aspects of asthma care.¹⁸ The education should occur in all points of care: clinic settings, emergency departments and hospitals, pharmacies, schools and other community settings, and patients' homes. The Report underscores regular review of the status of the patient's asthma control and teaching patients about environmental exposure control measures.

In this paper we discuss the need for increased awareness of these recommendations among health care providers. We use data from the 2006 Farm and Ranch Safety Survey on the prevalence of potential WRA and asthma attacks while doing farm work among primary farm operators in the United States.

Methods

The National Agricultural Statistics Service (NASS) conducted a telephone survey of 25,000 farm operations for the National Institute for Occupational Safety and Health in 2006. The objective of this survey was to assess the prevalence of selected injury and health risks on farms. The survey collected information from 14,159 farm operations, representing 56.6% of all such operations; 6,137 (24.5%) could not be reached by phone during the survey period, and 4,704 (18.8%) were contacted but refused to participate in the survey. The adjusted survey response rate, excluding non-contacts, was 75.1%. Of the 14,159 respondents, 1,881 (13.3%) were no longer actively farming, and 12,278 (86.7%)

were from active farms and provided information for analysis. Data on the operator's health were self-reported from either the primary farm operator, defined as the individual who runs the farm, making day-to-day management decisions,¹⁹ or the operator's spouse. The data are owned and retained by the US Department of Agriculture.

Asthma prevalence was determined by an affirmative response to the question "Have/Has you/the farm operator ever been told by a doctor, nurse, or other health professional that you/she/he had asthma?" and current asthma prevalence was determined by a positive response to the question "Do you/Does the farm operator still have asthma?" Participants who reported that the operator had current asthma were asked "Have you/was the farm operator ever told by a doctor, nurse, or other health professional that your/her/his asthma was related to your/their work on the farm?" (potential WRA) and "Did you/the farm operator have one or more asthma attacks requiring the use of an inhaler or other medical treatment in the last 12 months?" (asthma attack).

Participants who reported that the operator had one or more asthma attacks in the last 12 months prior to the interview were further asked if the asthma attack occurred while doing farm work ("Did any such asthma attack occur while doing farm work?" [asthma attack at work]).

Prevalences were estimated using survey weights determined by stratifying farms into nine regions of the United States and post-stratifying by three groups of value of sales of agricultural products. The weighted analysis allowed for drawing conclusions generalizable to the entire US farm operator population. To account for sampling error, 95% confidence intervals were calculated for each estimate. Statistical significance between groups was determined by *t* tests. To account for sampling design, analyses were conducted using PROC SURVEYFREQ and PROC SURVEYREG in SAS[®] software version 9.2 (SAS Institute Inc, Cary, NC).

Results

In the United States, an estimated 2.1 million farm operations existed in 2006; 42.2% were located in the South, 37.5% in the Midwest, 14.1% in the West, and 6.3% in the North. Selected characteristics of primary farm operators are shown in Table 1. Approximately 62.1% of the primary farm operators were aged 40–64 years, and 88.1% were males.

An estimated 4.9% of primary farm operators reported having current asthma. Although current asthma prevalence increased with age, differences between age groups were not significant (Table 2). Significantly more female than male operators reported current asthma (8.1% versus 4.5%; *P*=.001). Among the four US census

Table 1

Estimated Number of Active Primary Farm Operators,
by Selected Characteristics

Characteristics	Survey Respondents	Estimated Population	
		Number	% (95% CI)
Total	12,278	2,089,790	100.0
Age group (years)			
16–39	759	132,462	6.3 (5.8–6.9)
40–64	7,608	1,296,944	62.1 (60.9–63.2)
65+	3,609	611,954	29.3 (28.2–30.3)
Unknown age	302	48,429	2.3 (2.0–2.7)
Gender			
Male	10,885	1,841,424	88.1 (87.3–88.9)
Female	1,381	246,351	11.8 (11.0–12.6)
Unknown gender *	12	2,016	0.1 (0.0–0.2)
Current asthma			
Yes	614	101,85	4.9 (4.4–5.4)
No	11,600	1,975,153	94.5 (94.0–95.0)
Unknown asthma status	64	12,786	0.6 (0.4–0.8)

* The estimate is unreliable because the relative standard error of the estimate is >30%. All other relative standard errors are <30%.

regions, significantly greater prevalence of current asthma was found in the West than in the South (6.0% versus 4.4%; $P=.014$).

Of the operators with current asthma, an estimated 24.8% reported ever being told by a doctor, nurse, or other health professional that their asthma was related to work on the farm; of these, 46.1% reported an asthma attack while doing farm work in the 12 months prior to the interview (Table 2). Of the 74.6% operators never told that their asthma was related to work on the farm, 21.6% reported an asthma attack at work in the past 12 months. Significantly more farm operators who were informed that their asthma was work-related reported an asthma attack at work than those who were not so informed (46.1% versus 21.6%; $P<.0001$).

Discussion

Health care providers can improve their management of adult asthma by maintaining an active awareness of the potential for work-related disease, developing skills in taking occupational histories, establishing routine access to occupational health resources, and providing comprehensive education to their patients.^{18,20} Control of exposure to allergens and irritants is critical for achieving well-managed asthma.¹⁶ Patients need to be educated about asthma causes, symptoms, and triggers to actively participate in their asthma self-management.¹⁸

Many physicians are aware of WRA and make appropriate diagnoses, as reflected by the number of farm operators who were told about having WRA. Also, there is evidence of improvement in occupational disease recognition. A 1995 study of health maintenance organization members conducted by Milton and colleagues found that, although physicians documented a positive association of asthma with work in about 5% of cases, none of these cases were diagnosed as occupational asthma by the treating physician.²¹ A 2001 study of a similar population by Sama and colleagues demonstrated that 23% of potential WRA cases were diagnosed as having occupational asthma.²²

The data presented in our study suggest that the farm operators who were told about WRA account for 61% of the estimated total WRA cases, assuming that all asthma attacks at work represent WRA, and that total WRA cases encompasses all asthma cases for which the affected operators were told about WRA and all asthma cases involving attacks at work.

Although progress in occupational disease identification has been made, there is a need for better recognition of work factors in adult asthma and improved patient education.

Our study showed that an estimated 21.6% of operators with asthma who had not been informed that their asthma was work-related experienced an asthma attack while doing farm work. While the nature of our data does not allow us to confirm work-relatedness of these attacks, they can be considered as potentially work-related. To the extent that they are, our findings suggest that some operators may not be aware of asthma triggers associated with farm work and/or may not be sufficiently educated to manage their asthma.

Also, an estimated 46.1% of farm operators who were informed that their asthma was related to their work experienced asthma attacks at work. These results suggest that even when physicians recognize that a patient's asthma is related to their work, they may not provide guidance adequate enough to prevent all work-related attacks, or their patient may not fully comply with any guidance that was provided.

Given the nature of the data collected, limited to a single time point, temporal association between operators having been informed that they had WRA and occurrence of asthma attack at work could not be established. In fact, it is possible that asthma attacks triggered physician office visits and proper management resulted in cessation of further attacks. Factors that may contribute to continued work-related attacks of asthma include inadequate health care provider knowledge of occupational causes and triggers for asthma and occupational health issues and practices. Studies indicate

Table 2

Primary Farm Operators With Current Asthma,
by Selected Characteristics

Characteristics	Survey Respondents (n=614)	Estimated Population (101,851)	Prevalence % (95% CI)
Age group (years)			
16–39	31	5,166	3.9 (2.1–5.7)
40–64	378	62,475	4.8 (4.2–5.5)
65+	202	33,888	5.5 (4.6–6.5)
Unknown age*	3	—	—
Gender			
Male	514	81,990	4.5 (4.0–5.0)
Female	100	19,861	8.1 (6.0–10.1)
Region**			
North	149	6,860	5.2 (4.3–6.2)
Midwest	145	38,095	4.9 (4.0–5.7)
South	134	39,241	4.4 (3.6–5.3)
West	186	17,654	6.0 (5.1–6.9)
Asthma attack	355	62,435	61.3 (56.2–66.4)
Asthma attack at work	159	28,269	27.8 (22.9–32.6)
Told that asthma is work-related	179	25,282	24.8 (20.5–29.2)
Asthma attack at work***	81	11,665	46.1 (36.3–56.0)
Not told that asthma is work-related	428	76,005	74.6 (70.3–79.0)
Asthma attack at work****	76	16,389	21.6 (16.2–27.0)

* The estimate was suppressed because the relative standard error of the estimate exceeded 50%. All other relative standard errors are <30%.

** **North:** Connecticut, Maine, Massachusetts, New Hampshire, New Jersey, New York, Pennsylvania, Rhode Island, and Vermont; **Midwest:** Illinois, Indiana, Iowa, Kansas, Michigan, Minnesota, Missouri, Nebraska, North Dakota, Ohio, South Dakota, and Wisconsin; **South:** Alabama, Texas, Arkansas, Delaware, District of Columbia, Florida, Georgia, Kentucky, Louisiana, Maryland, Mississippi, North Carolina, Oklahoma, South Carolina, Tennessee, Virginia, and West Virginia; **West:** Alaska, Arizona, California, Colorado, Hawaii, Idaho, Montana, Nevada, New Mexico, Oregon, Utah, Washington, and Wyoming.

*** Prevalence estimated for farm operators projected to have ever been told that their asthma is related to farm work.

**** Prevalence estimated for farm operators projected to have never been told that their asthma is related to farm work; two of 428 participants had incomplete information on asthma attack at work.

indicate that health care providers do not fully use the opportunity to educate patients about asthma.^{26–30}

Within these studies, the percentage of health care providers that provide some type of asthma education for their patients ranges from 21% to 71%. In addition, data suggest that, compared with specialists, generalists provide less effective medical care, including spending less time to educate patients on asthma self-management.^{31,32}

Because decreasing exposure to allergens may significantly reduce inflammation, symptoms, and the need for medication, and because asthma can result in potentially life-threatening attacks, our results underscore an apparent need for increased instruction in occupational medicine in medical school curricula and enhanced educational activities conducted by employers, health and safety personnel, and health care providers.^{16,23} Storey and colleagues reported on a successful teaching method to improve occupational data collection by medical students.³³ A number of occupational history-taking guidance techniques exist.^{13,34–36} Finally, studies demonstrate the positive impact of patient health education on frequency and cost of health care use.^{37,38}

Limitations

This cross-sectional survey provides the first national estimates of asthma for primary farm operators. Both current asthma and WRA prevalence estimates presented here relied on proxy- (ie, spouse) or self-reported survey data that required individual recall of the physician's diagnosis. Either the physician's

diagnosis or the patient's recall of that diagnosis might be inaccurate, and patient reports of the details of the communications with their physician may be unreliable.^{6,21,22} The nature of the available data did not allow us to determine the number of proxy respondents or to stratify the analysis by the status of the respondent (self versus proxy), to validate asthma status, or to determine whether an asthma attack at work was actually work-related.

In addition, no information was collected on work-related changes in symptoms, medication use, and/or lung function to allow for a more objective identification of operators with WEA.⁶ We considered asthma attacks in operators who reported an asthma attack while do-

that some physicians do not receive any training in occupational medicine. For example, approximately 32% of family medicine residency programs do not offer occupational medicine in their curriculum despite recommendations for such training established by accreditation bodies.²³ A study of third-year medical students' practices found that occupational exposure was documented in only 8% of medical charts.²⁴ Demers and colleagues reported that occupational history was present in only 2% of 624 reviewed patients' charts derived from visits to 39 family physicians.²⁵ Milton and colleagues showed that physicians documented asking about work-related asthma symptoms in only 15% of medical charts of adults with asthma.²¹ Studies further

ing farm work as potentially work-related. Although it is likely that some exacerbations were due to work, other causes of asthma exacerbations and non-work-related triggers could be responsible for at least some of these episodes.²² Moreover, although an exposure at work could potentially trigger a delayed asthma attack occurring after the end of a working day, the Farm and Ranch Safety Survey was not designed to allow comparison of the average number of exacerbations per working day with the average number of exacerbations per day off work. The use of a proxy respondent for information on asthma diagnosis and work-related asthma attack and the potential lack in ability to recall asthma attack episodes in a 12-month period could lead to under-reporting. In contrast, temporal displacement or telescoping of infrequent but consequential events such as an asthma attack might lead to the reporting of events that occurred outside the 12-month period of interest.³⁹

There is also the possibility of non-response bias. Nonrespondents were not contacted because the survey was not designed to allow for a follow-back interview. However, the age and gender distributions of participating operators were similar to that reported by the 2007 Census of Agriculture.⁴⁰

Finally, because of lack of data on the operator's health insurance status or health care utilization practices, we were not able to examine association of health care access with operator reporting of asthma.

Conclusions

This study identified a large proportion of farm operators with asthma who had not been told by a health professional that their asthma was related to work on the farm but who reported an asthma attack that occurred while doing farm work. This suggests the need for improving clinicians' occupational health-related practices and clinician-patient communication to educate asthma patients on work-related asthma and asthma prevention, including, for example, the benefits of using personal respiratory protection when exposed to aggravating exposures.^{6,16,41-43} Additional studies, focusing on operators' health care utilization or their physicians' asthma care and educational practices would help to identify barriers to effective collaboration of health care professionals and their patients in asthma management.

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Corresponding Author: Address correspondence to Dr Mazurek, National Institute for Occupational Safety and Health, DRDS, Surveillance Branch, 1095 Willowdale Road, Mailstop HG 900.2, Morgantown, WV 26505. 304-285-5983. Fax: 304-285-6111. acq8@cdc.gov.

REFERENCES

- Centers for Disease Control and Prevention. 2006 National Health Interview Survey (NHIS) data. 2006 lifetime and current asthma. www.cdc.gov/asthma/nhis/06/data.htm. Accessed November 5, 2009.
- Moorman JE, Rudd RA, Johnson CA, et al. National surveillance for asthma—United States, 1980–2004. *MMWR Surveill Summ* 2007;56:1-54.
- National Heart Lung and Blood Institute. Morbidity & mortality: 2007 chart book on cardiovascular, lung, and blood diseases, 2007.
- Balmes J, Becklake M, Blanc P, et al. American Thoracic Society Statement: occupational contribution to the burden of airway disease. *Am J Respir Crit Care Med* 2003;167:787-97.
- Leigh JP, Romano PS, Schenker MB, Kreiss K. Costs of occupational COPD and asthma. *Chest* 2002;121:264-72.
- Tarlo SM, Balmes J, Balkissoon R, et al. Diagnosis and management of work-related asthma: American College of Chest Physicians Consensus Statement. *Chest* 2008;134:1S-41S.
- Vandenplas O, Toren K, Blanc PD. Health and socioeconomic impact of work-related asthma. *Eur Respir J* 2003;22:689-97.
- Tarlo SM, Malo JL. An official ATS proceedings: asthma in the workplace: the Third Jack Pepys Workshop on Asthma in the Workplace: answered and unanswered questions. *Proc Am Thorac Soc* 2009;6:339-49.
- Arif AA, Whitehead LW, Delclos GL, Tortolero SR, Lee ES. Prevalence and risk factors of work-related asthma by industry among United States workers: data from the third National Health and Nutrition Examination Survey (1988-94). *Occup Environ Med* 2002;59:505-11.
- May JJ, Schenker MB. Agriculture. In: Harber P, Schenker MB, Balmes JR, eds. *Occupational and environmental respiratory disease*. St. Louis: Mosby, 1995:617-36.
- Schenker MB, Farrar JA, Mitchell DC, et al. Agricultural dust exposure and respiratory symptoms among California farm operators. *J Occup Environ Med* 2005;47:1157-66.
- Arif AA, Delclos GL, Whitehead LW, Tortolero SR, Lee ES. Occupational exposures associated with work-related asthma and work-related wheezing among US workers. *Am J Ind Med* 2003;44:368-76.
- Glazer CS, Pacheco K. Making the diagnosis of occupational asthma: when to suspect it and what to do. *Prim Care* 2008;35:61-80, vi.
- Breton CV, Zhang Z, Hunt PR, Pechter E, Davis L. Characteristics of work-related asthma: results from a population-based survey. *Occup Environ Med* 2006;63:411-5.
- Ortega HG, Kreiss K, Schill DP, Weissman DN. Fatal asthma from powdering shark cartilage and review of fatal occupational asthma literature. *Am J Ind Med* 2002;42:50-4.
- Nicholson PJ, Cullinan P, Taylor AJ, Burge PS, Boyle C. Evidence-based guidelines for the prevention, identification, and management of occupational asthma. *Occup Environ Med* 2005;62:290-9.
- National Heart Lung and Blood Institute. National Asthma Education and Prevention Program. www.nhlbi.nih.gov/about/naepp/. Accessed May 8, 2009.
- National Heart Lung and Blood Institute. National Asthma Education and Prevention Program. Expert Panel Report 3: Guidelines for the Diagnosis and Management of Asthma. Full Report. Washington, DC: US Department of Health and Human Services, National Institutes of Health, August 2007. NIH publication no. 07-4051.
- US Department of Agriculture. Farm household economics and well-being: glossary. www.ers.usda.gov/Briefing/WellBeing/glossary.htm. Accessed May 8, 2009.
- Lax MB, Manetti FA, Klein RA. Medical evaluation of work-related illness: evaluations by a treating occupational medicine specialist and by independent medical examiners compared. *Int J Occup Environ Health* 2004;10:1-12.
- Milton DK, Solomon GM, Rosiello RA, Herrick RF. Risk and incidence of asthma attributable to occupational exposure among HMO members. *Am J Ind Med* 1998;33:1-10.
- Sama SR, Hunt PR, Cirillo CI, et al. A longitudinal study of adult-onset asthma incidence among HMO members. *Environ Health* 2003;2:10.

23. Michas MG, Iacono CU. Overview of occupational medicine training among US family medicine residency programs. *Fam Med* 2008;40:102-6.
24. McCurdy SA, Morrin LA, Memmott MM. Occupational history collection by third-year medical students during internal medicine and surgery inpatient clerkships. *J Occup Environ Med* 1998;40:680-4.
25. Demers RY, Wall SJ. Occupational history-taking in a family practice academic setting. *J Med Educ* 1983;58:151-3.
26. Finkelstein JA, Lozano P, Shulruff R, et al. Self-reported physician practices for children with asthma: are national guidelines followed? *Pediatrics* 2000;106:886-96.
27. Grant EN, Moy JN, Turner-Roan K, Daugherty SR, Weiss KB. Asthma care practices, perceptions, and beliefs of Chicago-area primary-care physicians. Chicago Asthma Surveillance Initiative Project Team. *Chest* 1999;116:145S-154S.
28. Grant EN, Li T, Lyttle CS, Weiss KB. Characteristics of asthma care provided by hospitals in a large metropolitan area: results from the Chicago Asthma Surveillance Initiative. *Chest* 1999;116:162S-167S.
29. McDermott MF, Grant EN, Turner-Roan K, Li T, Weiss KB. Asthma care practices in Chicago-area emergency departments. Chicago Asthma Surveillance Initiative Project Team. *Chest* 1999;116:167S-173S.
30. Moy JN, Grant EN, Turner-Roan K, Li T, Weiss KB. Asthma care practices, perceptions, and beliefs of Chicago-area asthma specialists. Chicago Asthma Surveillance Initiative Project Team. *Chest* 1999;116:154S-162S.
31. Curwick CC, Bonauto DK, Adams DA. Use of objective testing in the diagnosis of work-related asthma by physician specialty. *Ann Allergy Asthma Immunol* 2006;97:546-50.
32. Donohoe MT. Comparing generalist and specialty care: discrepancies, deficiencies, and excesses. *Arch Intern Med* 1998;158:1596-1608.
33. Storey E, Thal S, Johnson C, et al. Reinforcement of occupational history taking: a success story. *Teach Learn Med* 2001;13:176-82.
34. Coye MJ, Rosenstock L. The occupational health history in a family practice setting. *Am Fam Physician* 1983;28:229-34.
35. Frumkin H. Occupational and environmental medicine and primary care. *Prim Care* 2000;27:813-30.
36. Lax MB, Grant WD, Manetti FA, Klein R. Recognizing occupational disease—taking an effective occupational history. *Am Fam Physician* 1998;58:935-44.
37. Krieger JW, Takaro TK, Song L, Weaver M. The Seattle-King County Healthy Homes Project: a randomized, controlled trial of a community health worker intervention to decrease exposure to indoor asthma triggers. *Am J Public Health* 2005;95:652-9.
38. Martin MA, Hernandez O, Naureckas E, Lantos J. Reducing home triggers for asthma: the Latino community health worker approach. *J Asthma* 2006;43:369-74.
39. Gaskell GD, Wright DB, O'Muircheartaigh CA. Telescoping of landmark events: implications for survey research. *Public Opin Q* 2000;64:77-89.
40. US Department of Agriculture. Farm household economics and well-being: beginning farmers, demographics, and labor allocations. www.ers.usda.gov/Briefing/WellBeing/demographics.htm. Accessed May 8, 2009.
41. Henneberger PK. Work-exacerbated asthma. *Curr Opin Allergy Clin Immunol* 2007;7:146-51.
42. Taivainen AI, Tukiainen HO, Terho EO, Husman KR. Powered dust respirator helmets in the prevention of occupational asthma among farmers. *Scand J Work Environ Health* 1998;24:503-7.
43. Muller-Wening D, Neuhauss M. Protective effect of respiratory devices in farmers with occupational asthma. *Eur Respir J* 1998;12:569-72.