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Dear Health Care Provider,

We are pleased to release this issue of the Occupational Lung Disease Bulletin, which presents population-based data on work-related asthma from the 2006 & 2007 BRFSS Adult Asthma Call-back Surveys. These Call-back Surveys are part of a new initiative by the Massachusetts Department of Public Health in collaboration with the CDC. The Call-back Survey is scheduled to continue on an annual basis, providing extensive data on asthma. Of particular interest, the Call-back contains questions about work-related asthma that offer new insight into the impact of workplace exposures on adult asthma.

Especially striking in the Call-back data is the high percentage of respondents who describe the causation or exacerbation of their asthma by workplace conditions and the small proportion of these respondents who also report discussing the role of the workplace with their health care providers. In light of this finding, we encourage you to talk with your asthma patients about work-related symptoms.

This bulletin was prepared by Liza Lutzker, MPH, who subsequently moved to work for the California Department of Public Health.

Sincerely, Occupational Health Surveillance Program

Work-Related Asthma in Massachusetts: Population-Based Data from the 2006 & 2007 Behavioral Risk Factor Surveillance System Adult Asthma Call-Back Survey

Sentinel surveillance is an invaluable tool in Massachusetts (MA) for identifying industries, occupations and exposures associated with work-related asthma (WRA). However, substantial underreporting of WRA in the MA sentinel surveillance system precludes the generation of population-based estimates of the proportion of adult asthma that is work-related, or the total disease burden in the Commonwealth. In order to obtain such population-based estimates, public health officials have relied on large-scale surveys, such as the Behavioral Risk Factor Surveillance System (BRFSS).

The BRFSS is a continuous, random-digit-dial telephone survey of adults ages 18 and older and is

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conducted in all states as a collaboration between the CDC and state health departments. The aim of the survey is to collect data on a variety of health risk factors, preventive behaviors, chronic conditions, and emerging public health issues. While there is some variation in the specific questions asked, each year the MA BRFSS includes a core set of questions developed by the CDC, optional state modules developed by the CDC, and state-added questions developed by programs within the MA Department of Public Health (MDPH).

Annually since 2000, two questions have been asked on the BRFSS to understand the prevalence of lifetime and current asthma among MA adults: "Have you ever been told by a doctor, nurse or other health professional that you have asthma?" and, if yes, "Do you still have asthma?" A respondent who answers 'yes' to the first question is considered to have lifetime asthma; a respondent who answers 'yes' to both questions is considered to have current asthma.

Table 1. Prevalence of Lifetime and Current among MA Adults, MA BRFSS, 2001, 2002, 2005 and 2006-2007

	Lifetime Asthma	Current Asthma
2001, 2002, 2005 Main BRFSS (n=24,963)	13.4% (12.8-13.9)	9.3% (8.9-9.8)
2006 & 2007 Main BRFSS (n=34,233)	14.9% (14.3-15.6)	9.9% (9.3-10.4)

Numbers in parentheses are 95% confidence intervals.

In 2001, 2002 and 2005, the prevalence of lifetime asthma among MA adults was 13.4% (95% CI: 12.8-13.9%), and the prevalence of current asthma among adults was 9.3% (95% CI: 8.9-9.8%) (Table 1). In these years, MA adults with lifetime asthma were asked two questions about WRA:

- 1) "Were you ever told by a doctor or other health professional that your asthma was related to any job you ever had?"
- 2) "Did you ever tell a doctor or other health professional that your asthma was related to any job you ever had?"

The 2001, 2002 and 2005 BRFSS survey results indicate that, among adults reporting lifetime asthma, 8.1% (95% CI: 6.7-9.4%) reported that they had either told or been told by a health professional that their asthma was work-related (Table 2). Similar estimates were found in Michigan and California.¹ Notably, other epidemiological studies have reported substantially higher estimates of the proportion of adult asthma that is work-related.^{2,3,4,5}

Table 2. The Proportion of Adult Asthma Associated with Work, based on WRA-HP, among those with Lifetime Asthma, MA BRFSS (2001, 2002, 2005) and MA Call-back (2006-2007)

	Told WRA To or By HP*	Told WRA By HP*	Told WRA To HP*
2001,2002,2005 Main BRFSS (n=2580)	8.1% (6.7-9.4)	5.9% (4.7-7.0)	4.4% (3.4-5.4)
2006-2007 Asthma Call-back (n=378)	9.0% (5.7-12.2)	4.7% (2.4-7.0)	6.7% (4.0-9.4)

Numbers in parentheses are 95% confidence intervals.

*HP: health professional

Methods

In 2006 and 2007, the prevalence of lifetime asthma among MA adults was 14.9% (95% CI: 14.3-15.6%), and the prevalence of current asthma among adults was 9.9% (95% CI: 9.3-10.4%) (Table 1). In both of these years, MDPH administered the CDC's BRFSS Adult Asthma Call-back Survey (Call-back) to MA adults who reported lifetime asthma on the main BRFSS and who agreed to participate in a follow-up survey. Participants in the Call-back were asked a variety of detailed questions on topics such as asthma triggers, symptoms and disease management. Seven questions pertaining to asthma and the work environment were also asked of Call-back respondents

who had ever worked.⁶ In addition to the two questions asked in the 2001, 2002 and 2005 BRFSS (see questions 1 and 2 above), the following five WRA questions were asked on the Call-back:

- 3) Was your asthma caused by chemicals, smoke, fumes or dust in your current job?
- 4) Is your asthma made worse by chemicals, smoke, fumes or dust in your current job?
- 5) Was your asthma caused by chemicals, smoke, fumes or dust in any previous job you ever had?
- 6) Was your asthma made worse by chemicals, smoke, fumes or dust in any previous job you ever had?
- 7) Did you ever change or quit a job because chemicals, smoke, fumes or dust caused your asthma or made your asthma worse?

Respondents' answers to questions 1-6 allow for an assessment of the proportion of adult asthma that is associated with workplace exposures (PAAW). A "yes" answer to question 1 or 2 limits the definition of WRA to discussions between patients and healthcare providers about the connection between asthma symptoms and work (WRA-HP). Alternatively, a "yes" answer to questions 3, 4, 5 or 6 indicates a respondent's self-assessment that his or her asthma is related to work (WRA-SA). The inclusion of WRA-SA questions is a unique feature of the Call-back, allowing respondents to describe their asthma in relation to work, regardless of whether or not a diagnosis of WRA had ever been discussed in a conversation with a health professional. An affirmative answer to question 7 gives an estimate of how many people suffered WRA symptoms severe enough to leave or quit a job.

WRA encompasses both new-onset occupational asthma and pre-existing asthma exacerbated by work (work-aggravated asthma). The Call-back WRA-SA questions were intended to differentiate between new-onset asthma (questions 3 and 5) and work-aggravated asthma (questions 4 and 6). Unfortunately, it appears that the questions about causation were unclear. For example, of the respondents who reported that their asthma was caused (new-onset asthma) by chemicals, smoke, fumes or dust in either a current or previous job, over 8% reported that they were first diagnosed with asthma before the age of 16 (data not shown). Perhaps this misunderstanding arose because respondents interpreted the question to be asking about the causation of symptoms rather than underlying disease. Because causation and aggravation of asthma could not be differentiated, the two groups were collapsed for all analyses.

¹ Flattery J *et al.* The proportion of self-reported asthma associated with work in three states: California, Massachusetts, and Michigan, 2001. *J Asthma* 2006; 43: 213-218.

² Balmes J *et al.* American Thoracic Society Statement: Occupational Contribution to the Burden of Airway Disease. *Am J Respir Crit Care Med* 2003; 167:787-797.

³ Mannino DM. How much asthma is occupationally related? *Occup Med State Art Rev* 2000; 15: 359-368.

⁴ Milton DK *et al.* Risk and incidence of asthma attributable to occupational exposure among HMO members. *Am J Ind Med* 1998; 33:1-10.

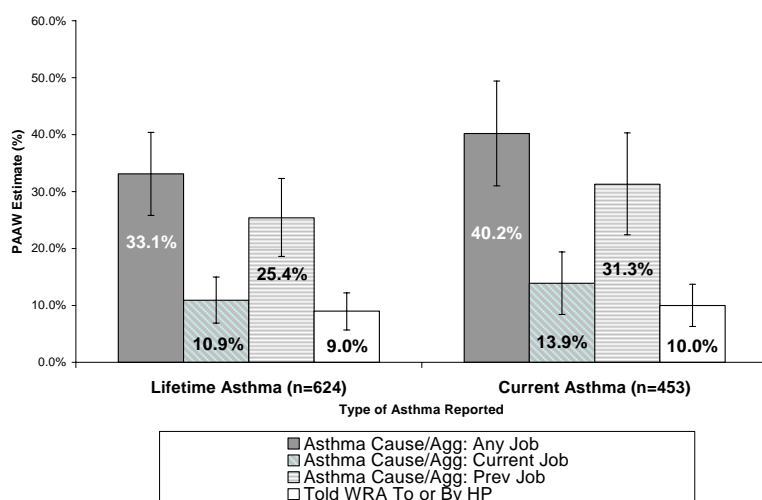
⁵ Vollmer WM *et al.* Incidence of work-related asthma in members of a health maintenance organization. *J Occup Environ Med* 2005; 47(12):1292-1297.

⁶ Asked of respondents who reported either being currently employed or having ever worked outside the home, despite being currently unemployed.

Results

Using the WRA-HP definition, the PAAW among those with lifetime asthma is 9.0% (95% CI: 5.7-12.2%) and is 10.0% (95% CI: 6.3-13.7%) among those with current asthma (Fig. 1). These WRA-HP estimates from the Call-back are slightly higher than those previously obtained, but these differences are not statistically significant (Table 2). Alternatively, using the WRA-SA definition, the PAAW among those with lifetime asthma is 33.1% (95% CI: 25.8-40.4%) and is 40.2% (95% CI: 31.0-49.4%) among those with current asthma (Fig. 1). Additionally, 4.5% (95% CI: 2.4-6.6%) of those with lifetime asthma and 5.1% (95% CI: 2.6-7.6%) of those with current asthma reported changing or quitting jobs because of WRA (data not shown).

Figure 1. The Proportion of Adult Asthma Associated with Work, by Selected Definitions, among those with Lifetime or Current Asthma, MA Call-back (2006-2007)



Of all respondents who reported that their asthma was caused or made worse by any job they had ever had, only 26.8% (95% CI: 24.2-29.4%) reported ever telling or being told by a health professional that their asthma is work-related (Fig. 2).

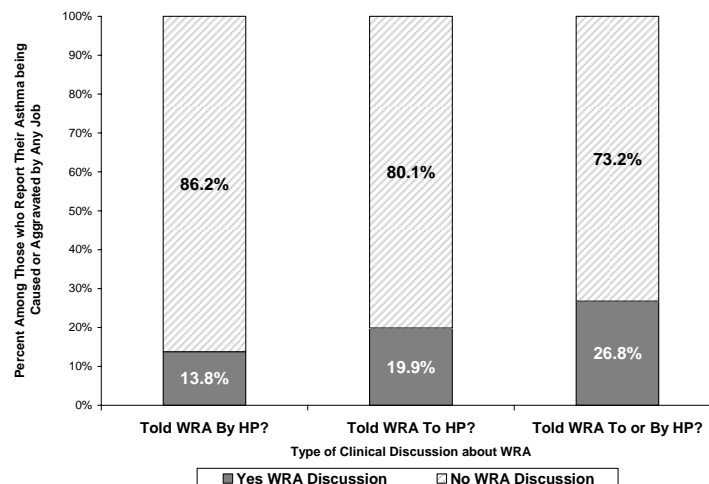
Previous findings indicate that asthma patients with WRA suffer greater numbers of asthma attacks and higher rates of emergency department (ED) use than patients with asthma that is not work-related (non-WRA).^{7,8} Call-back data were analyzed to compare severity between those with WRA and those with non-WRA (where WRA refers to a positive response to any of the WRA-HP or WRA-SA questions). Adults with WRA were more likely to report asthma symptoms in the past 30 days than adults with non-WRA (Table 3). Other characteristics examined, such as reported sleep disturbances and ED visits, were not statistically

⁷ Breton CV *et al.* Characteristics of work related asthma: results from a population based survey. *Occup Environ Med* 2006; 63:411-415.

⁸ Lemiere C *et al.* Characteristics and medical resource use of asthmatic subjects with and without work-related asthma. *J Allergy Clin Immunol* 2007; 120(6):1354-1359.

significant; however, those with WRA consistently tended toward greater severity (Table 3).

Figure 2: Among Those who Report Their Asthma being Caused or Aggravated by Any Job (n=128), the Proportions Who Discussed with a Health Professional that Their Asthma was Work-Related, MA Call-back (2006-2007)



Discussion

The WRA-SA PAAW estimates generated by the 2006 and 2007 BRFSS Adult Asthma Call-back Surveys are striking: nearly one in seven adults with current asthma reports that their current job is causing or aggravating their asthma. Furthermore, two of every five adults with current asthma reports that some job they have had has either caused or aggravated their asthma, and 5% of adults with current asthma report having to change or quit jobs because of workplace exposures that caused or aggravated their asthma.

Table 3. Prevalence of Asthma Characteristics among those with Lifetime Asthma by Work-Relatedness, MA Call-back (2006-2007)

	WRA* (n=134)	Non-WRA* (n=202)
Had asthma symptoms, past 30 days	62.0% (49.5-74.5)	39.6% (30.6-48.7)
Sleep disturbed from asthma, past 30 days	19.3% (10.7-27.8)	13.8% (7.7-19.9)
Had ≥1 asthma attack, past 12 mos.	48.3% (34.7-61.9)	29.6% (21.1-38.2)
Asthma limited usual activities, past 12 mos.	53.1% (39.4-66.8)	38.3% (29.0-47.6)
Had ≥1 ED or other urgent care visit for asthma, past 12 mos.	9.5% (4.1-14.8)	9.5% (3.9-14.3)
Used Rx asthma medications, past 3 mos.	50.2% (36.4-63.6)	42.8% (34.0-51.6)

Numbers in parentheses are 95% confidence intervals.

*WRA: defined here as 'yes' to any of 7 WRA questions

Previous BRFSS surveys have consistently yielded much lower PAAW estimates (approximately 6-10%), which are incongruous with the numerous epidemiologic studies that have PAAW estimates in the range of 10-35%.^{9,10,11,12} The results from the new Call-back Survey are in greater agreement with the epidemiologic literature. These results demonstrate the value of asking respondents to self-assess whether their asthma was caused or made worse by work, not merely whether they had told or been told by a health professional that their asthma is work-related.

Another striking finding from the Call-back is that, among the high proportion of MA adults with asthma who report that their asthma is work-related, the majority (~73%) report that no discussion with a health professional has ever occurred about the work-relatedness. The responsibility for properly diagnosing WRA lies both with the patient and the clinician, and accordingly, there are numerous reasons why WRA so frequently goes undiagnosed.¹³ A patient may feel like a complainer by blaming a health condition on work; fear losing a good job; not have access to, be able to pay for or have time to seek medical care; not think the clinician could do anything to help; or simply not remember that a WRA diagnosis was actually given. A clinician may not be asking appropriate questions about industry, occupation or job duties associated with the onset or aggravation of asthma; not be aware that work-aggravated asthma is considered a type of WRA; not feel comfortable diagnosing a work-related condition without substantial objective evidence; or know that the asthma is work-related, but be uncomfortable confirming a diagnosis without knowledge of how to proceed.

Findings from the Call-back are subject to at least three limitations. First, like all adult data collected by the BRFSS, Call-back data are based on self-reported information from respondents and therefore may be subject to error for several reasons: individuals may have difficulty remembering past events; individuals may respond differentially to questions depending on what they perceive to be the socially desirable answer; and individuals may also respond to survey questions differently due to their respective cultural and linguistic backgrounds. Second, the MA Call-back Survey is administered only to individuals with landline telephones and can be conducted in English or Spanish only; therefore, individuals who do not speak one of these two languages and individuals living in households without landline telephones are not included in the sample, and BRFSS results may not be

generalizable to these populations. Finally, for 2006 and 2007 on average, an estimated 36.6% and 39.1% of eligible MA adults participated in the BRFSS and the Call-back, respectively, and these low response rates may lead to non-response bias. In order to partially adjust for differential non-response, all data were weighted to represent the MA adult population and reflect both the probability that an individual is selected to participate in the survey and differential participation by age, gender and, in 2007, race/ethnicity.

Despite the limitations, these survey results still highlight important issues about WRA that need to be addressed. Regardless of the exact value of PAAW among MA adults, it is clear that a much higher proportion of adult asthma is related to work than has been previously estimated using survey data. Further, this data highlights the high proportion of cases of WRA that are not recognized by health professionals. Clinicians and public health practitioners can learn a great deal from these two strong messages, which are also supported by the comparable estimates generated by other states using their Call-back data.¹⁴

Many individuals with asthma report that their asthma is worse at work. This affects their quality of life, productivity on the job, and current and future health. The early recognition, treatment and management of WRA are crucial for improving a patient's long-term prognosis. An important first step is having clinicians ask patients appropriate questions about the relationship between their asthma symptoms and work. A clinician who suspects WRA but feels uncomfortable confirming a diagnosis WRA should consider referring patients to a pulmonologist or occupational medicine provider. Once a WRA diagnosis is made, an evaluation of the workplace should be considered to determine the feasibility of controlling or modifying the implicated work conditions. Patients and providers working together, with help from MDPH, can take steps to reduce the burden of asthma on individuals and their families.

Work-Related Asthma Cases Reported to the Massachusetts Department of Public Health

Jan. – Feb. 2008	Mar. – Apr. 2008	May – Jun. 2008
6	2	5

⁹ Balmes, *op. cit.*

¹⁰ Mannino, *op. cit.*

¹¹ Milton, *op. cit.*

¹² Vollmer, *op. cit.*

¹³ Azaroff LS *et al.* Occupational injury and illness surveillance: conceptual filters explain underreporting. *Am J Public Health* 2002; 92(9):1421-1429.

¹⁴ NH Department of Health & Human Services, Asthma Control Program. Asthma in New Hampshire - Work Related Asthma Data Brief. <http://www.dhhs.state.nh.us/DHHS/CDPC/LIBRARY/Data-Statistical+Report/asthma-reports.htm>

Please report work-related asthma cases to SENSOR by phone, fax, or mail!