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WORK RELATED ASTHMA

Prevalence of Work-Related Asthma in Michigan, Minnesota, and Oregon

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Introduction. Adults who have asthma that is caused or aggravated by triggers at work experience a reduced quality of life. In this study, the authors sought to estimate the proportion of asthma that is associated with work using a state-based survey of adults with asthma. *Methods*. In 2005, Michigan, Minnesota, and Oregon piloted the Behavioral Risk Factor Surveillance System Adult Asthma Call-Back Survey, with sample sizes of 867, 469, and 1072, respectively. Six questions addressing work-related asthma (WRA) were analyzed to generate estimates of the proportion of adult asthma that is work-related and compare those with and without WRA. *Results*. Over half of all adults with asthma (53%) reported that their asthma was caused or made worse by any job they ever had, and among these respondents reporting WRA, only 21.5% to 25.1% reported ever telling or being told by a health professional that their asthma was work-related. Additionally, adults with WRA consistently reported poorer asthma control and higher health care utilization than adults with non-WRA. *Conclusions*. WRA is a common but frequently unrecognized health problem, and this lack of recognition might contribute to poorer asthma control among adults with WRA. Because early recognition, treatment, and management of WRA are crucial for improving long-term prognosis, clinicians need to include assessment of workplace triggers in both their diagnostic and treatment plans for adult patients with asthma.

Keywords asthma; epidemiology; health surveys; occupational diseases; occupational exposure; prevalence; work-related asthma

Introduction

Adult asthma is a serious public health problem in the United States. In 2004, 14.4 million (6.7%) adults were estimated to have current asthma (1). Work-related asthma (WRA) is asthma caused or exacerbated by exposures in the work environment and includes sensitizer-induced occupational asthma (OA), irritant-induced OA, and work-exacerbated asthma (WEA) (2). Over 400 agents are known to cause sensitizer-induced OA (3), and many other agents are associated with irritant-induced OA and WEA (2). Previous studies show that asthma in adults with WRA is less well controlled than in adults without WRA (4–6), and that WRA has a substantial negative impact on individuals' employment and socioeconomic well-being (7–9).

Numerous epidemiologic studies have reported on the proportion of adult asthma that is work-related, with estimates ranging from 5% to 35% (10–19). Significant underreporting in case-based surveillance programs at the state or national level, such as SENSOR (Sentinel Event Notification System for Occupational Risks) or SWORD (Surveillance of Work-related and Occupational Respiratory Disease), is a well-documented problem, and these systems provide lower estimates (20). Using 2001 Behavioral Risk Factor Surveillance System (BRFSS) data, Flattery et al. estimated 9.7% of adult asthma was work-related; however, the definition of WRA was limited to respondents who had told or been told by a health care provider that their asthma was work-related (21), and because WRA often goes unrecognized and undiagnosed by providers (16, 17, 22, 23), limiting the WRA definition to provider encounters produces a significant underestimate.

In this paper, we report on WRA findings using an expanded definition of WRA from the 2005 BRFSS Adult Asthma Call-Back Survey (ACBS) in three states.

Methods

The BRFSS and ACBS are sponsored and coordinated by the Centers for Disease Control and Prevention (CDC). The BRFSS is an annual, random-digit-dial telephone survey of noninstitutionalized adults aged 18 and older conducted in all states. The ACBS is a follow-up survey to BRFSS allowing states to examine socioeconomic, environmental, and behavioral associations with asthma prevalence and control and the health care experiences of persons with asthma. In 2005, Michigan, Minnesota, and Oregon piloted the ACBS. Both the BRFSS and ACBS were administered in English only in Michigan and Minnesota and in English and Spanish in Oregon. In all three states, both the BRFSS and the ACBS were found to be exempt from institutional review board

At the time this study was conceived and work commenced, Liza A. Lutzker was with the Massachusetts Department of Public Health, Occupational Health Surveillance Program. Currently and during the writing of the manuscript, Liza A. Lutzker's affiliation is with the California Department of Public Health, Environmental Health Investigations Branch, Impact Assessment, Inc., Richmond, California, USA.

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TABLE 1.—Work-related asthma questions from the 2005 ACBS (piloted in Michigan, Minnesota, and Oregon).

1.	Was your asthma caused by chemicals, smoke, fumes, or dust in your current job?
2.	Is your asthma made worse by chemicals, smoke, fumes, or dust in your current job?
3.	Was your asthma caused by chemicals, smoke, fumes, or dust in any previous job you ever had?
4.	Was your asthma made worse by chemicals, smoke, fumes, or dust in any previous job you ever had?
5.	Were you ever told by a doctor or other health professional that your asthma was related to any job you ever had?
6.	Did you ever tell a doctor or other health professional that your asthma was related to any job you ever had?

(IRB) review because they are considered to be public health surveillance.

All BRFSS respondents answering "yes" to: "Have you ever been told by a doctor, nurse or other health professional that you have asthma?" were considered to have lifetime asthma and were asked to participate in the ACBS. Those consenting were called back within approximately 2 weeks and asked many additional questions pertaining to asthma (questions available at: www.cdc.gov/asthma/pdfs/SurveyQuestions05.pdf). BRFSS respondents who reported lifetime asthma were asked "Do you still have asthma?," and if they answered "yes" were also considered to have current asthma.

Six questions pertaining to asthma and the work environment were asked of ACBS respondents who reported either being currently employed or having ever worked outside the home despite being currently unemployed (Table 1). Additionally, ACBS respondents were asked a range of questions about recent experiences with asthma symptoms and health care utilization for asthma.

All three states sent their ACBS data to the CDC, where the data were linked to BRFSS responses and weighted to represent each state's adult population by adjusting for the probabilities of selection and differential participation by age and sex in Oregon and Minnesota and by age, sex, and race (White versus non-White) in Michigan.

All analyses used SAS SURVEY procedures to account for the complex survey design of BRFSS and ACBS (SAS 9.1; SAS Institute). Although programming and coding were compared centrally for consistency, each state analyzed its own ACBS data and provided summary results as weighted estimates with 95% confidence intervals. All respondents were included in the analysis, regardless of work history or current employment status. Groups were compared using Rao-Scott χ^2 with $\alpha = .05$ (24). Estimates and their 95% confidence intervals were suppressed if the relative standard error of the estimate was $\geq$30% or if the cell sample size was less than 50.

RESULTS

Eight hundred sixty-seven adults in Michigan, 469 in Minnesota, and 1072 in Oregon completed the 2005 ACBS. All ACBS respondents were classified as having lifetime asthma; of these, 642 in Michigan, 330 in Minnesota, and 694 in Oregon were classified as having current asthma. The 2005 prevalence estimates for both lifetime and current asthma among adults were similar across states: for Michigan, Minnesota, and Oregon, respectively, lifetime asthma prevalence estimates were 13.9% (95% CI: 13.1–14.7), 11.8% (95% CI: 10.3–13.3), and 15.3% (95% CI: 14.5–16.1), and current asthma prevalence estimates were 9.1% (95% CI: 8.4–9.8), 8.4% (95% CI: 7.1–9.7), and 10.1% (95% CI: 9.4–10.8) (25).

To understand the potential for response bias in the ACBS, participation in both the BRFSS and the ACBS were examined. In Michigan, Minnesota, and Oregon, respectively, the Council of American Survey Research Organizations (CASRO) response rates for the 2005 BRFSS were 51.1%, 61.3%, and 51.5% (26), whereas 54.0%, 66.6%, and 62.9% were the CASRO-based response rates for the 2005 ACBS provided by CDC.

Among adults with current asthma in all three states, the majority (53.4% to 54.1%) reported some association between their asthma and work, as indicated by an affirmative answer to any of the six WRA questions (Table 2). Among adults with current asthma, 18.8% to 25.4% reported their asthma was caused or aggravated by their current job and 32.8% to 39.0% reported their asthma was caused or aggravated by a previous job. However, only 10.5% to 13.5% of adults with current asthma ever told or were told by a health professional that their asthma was work-related.

Among adults with lifetime asthma who reported that their asthma was either caused or aggravated by any job they ever had, only 21.5% in Michigan, 22.1% in Minnesota, and 25.1% in Oregon reported that they ever told or were told by a health professional that their asthma was work-related (Table 3).

Using the most sensitive definition of WRA (an affirmative response to any of the six WRA questions), adults with current asthma were classified as having WRA or non-WRA, and these two groups were compared across a variety of asthma characteristics (Table 4). With the exceptions of asthma hospitalizations in Michigan and prescription asthma medication use in Oregon, the trend across states was for health care utilization and measures of poor asthma control to be higher among those with WRA than those with non-WRA. In all instances except routine checkups, emergency department (ED) visits, and prescription medication use in Michigan and Oregon, and recent asthma symptoms and nighttime awakenings in Oregon only, these differences were statistically significant.

DISCUSSION

Utilizing a highly sensitive definition of WRA, over half of all adults with current asthma reported that their asthma was either caused or aggravated by exposures at some job they have held. This estimate is substantially higher than the widely cited American Thoracic Society (ATS) population attributable risk estimate of 15% (10). However, the ATS estimate reflects only studies conducted prior to 2000 and does not include WEA. Two recent studies based on interviews with health maintenance organization (HMO) members generated considerably higher estimates, 33% and 29% (18, 19). The definition we used to generate the >50% estimate has high sensitivity but lower specificity and appears reasonable when compared to these other recently published estimates.

TABLE 2.—Estimates of the proportion of current asthma attributable to work, by selected definitions, among adults in three states: Michigan, Minnesota, and Oregon*, 2005 ACBS.

	Michigan ($n = 642$)	Minnesota ($n = 330$)	Oregon ($n = 694$)
Caused by current job[1]	11.6 (7.9–15.4)	10.2 (5.7–14.7)	8.2 (4.7–11.7)
Caused by previous job[2]	19.6 (15.6–23.6)	17.1 (12.2–22.0)	22.3 (17.7–26.9)
Aggravated by current job[3]	20.8 (16.3–25.4)	24.2 (17.9–30.5)	17.8 (13.4–22.1)
Aggravated by previous job[4]	32.9 (28.2–37.6)	29.8 (23.1–36.5)	36.7 (31.8–41.7)
Caused by any job[5]	31.9 (26.9–37.0)	27.6 (21.3–33.8)	31.0 (25.7–45.3)
Aggravated by any job[6]	49.4 (44.3–54.6)	49.0 (41.8–56.3)	50.0 (44.8–55.2)
Caused or aggravated by current job[7]	21.8 (17.2–26.4)	25.4 (19.0–31.7)	18.8 (14.4–23.2)
Caused or aggravated by previous job[8]	35.3 (30.5–40.1)	32.8 (26.0–39.7)	39.0 (33.9–44.1)
Asthma caused or aggravated by any job[9]	52.9 (47.7–58.1)	53.3 (46.0–60.6)	52.8 (47.5–58.0)
Ever told by health professional that asthma was work-related[10]	7.6 (4.9–10.3)	5.6 (2.9–8.2)	9.0 (6.7–11.4)
Ever told health professional that asthma was work-related[11]	10.2 (7.1–13.2)	9.2 (5.7–12.8)	11.0 (8.2–13.9)
Ever told or told by health professional that asthma was work-related[12]	12.1 (8.9–15.3)	10.5 (6.7–14.3)	13.5 (10.5–16.6)
Any positive response to any WRA question[13]	54.1 (48.9–59.3)	53.4 (46.1–60.7)	53.9 (48.7–59.1)

*Estimates include all appropriate respondents in their denominators, regardless of work status. Presented here are percentages with 95% confidence intervals.
[1]Responded "yes" to: "Was your asthma caused by chemicals, smoke, fumes, or dust in your current job?"
[2]Responded "yes" to: "Is your asthma made worse by chemicals, smoke, fumes, or dust in your current job?"
[3]Responded "yes" to: "Was your asthma caused by chemicals, smoke, fumes, or dust in any previous job you ever had?"
[4]Responded "yes" to: "Was your asthma made worse by chemicals, smoke, fumes, or dust in any previous job you ever had?"
[5]Responded "yes" to either question in footnotes 1 and 2.
[6]Responded "yes" to either question in footnotes 3 and 4.
[7]Responded "yes" to either question in footnotes 1 and 3.
[8]Responded "yes" to either question in footnotes 2 and 4.
[9]Responded "yes" to at least one question in footnotes 1, 2, 3, and 4.
[10]Responded "yes" to: "Were you ever told by a doctor or other health professional that your asthma was related to any job you ever had?"
[11]Responded "yes" to: "Did you ever tell a doctor or other health professional that your asthma was related to any job you ever had?"
[12]Responded "yes" to either question in footnotes 10 and 11.
[13]Responded "yes" to at least one of the above six questions (in footnotes 1–4, 10, 11).

If instead the most specific WRA definition is applied (an affirmative answer to question 5, Table 1), the range from the three states (5.6% to 9.0%) was very similar to the results of Flattery et al. (5.8% to 6.1% for California, Massachusetts, and Michigan, 2001) and Breton et al. (6.2% for Massachusetts, 2001–2002) using an identical WRA definition on the BRFSS (4, 21).

Although several states, including Michigan, conduct case-based surveillance for WRA, comparing the results derived in this study to estimates generated by such case-based surveillance systems is inappropriate for multiple reasons. First, most cases of WRA reported to case-based surveillance systems are incident cases, whereas the ACBS estimates reflect lifetime prevalence of WRA. Second, there is well-documented underreporting of diagnosed disease by health care providers in these systems, and third, many cases of WRA simply go unrecognized and undiagnosed (20). Therefore, it is not surprising that data derived from the ACBS, which requires neither provider diagnosis nor provider reporting, would generate appreciably greater estimates than those derived from a case-based surveillance system. The two studies discussed previously, which derive estimates from HMO records, are similar to our study in that their design did not rely on reporting or provider diagnosis of WRA (18, 19). Instead, both studies were conducted through chart review followed by telephone interview of patients with adult-onset asthma diagnoses to determine WRA status.

Data from all three states show that a very low proportion of adults who reported that work caused or made their asthma worse ever discussed this association with a health care provider. This finding is consistent with previous findings that health care providers do not routinely consider whether a patient's asthma is work-related (22). Three studies have shown that clinicians document workplace exposures in the

TABLE 3.—Among adults with lifetime asthma who reported their asthma was caused or aggravated by any job*, the proportions who discussed with a health professional that their asthma was work-related, in three states: Michigan, Minnesota, and Oregon†, 2005 ACBS.

	Michigan ($n = 397$)	Minnesota ($n = 215$)	Oregon ($n = 417$)
Told by health professional that asthma was work-related[1]	13.5 (9.1–17.8)	13.8 (8.1–19.6)	15.2 (11.4–19.1)
Told health professional that their asthma was work-related[2]	17.5 (12.6–22.5)	17.0 (11.1–23.0)	21.2 (16.4–26.0)
Ever told or told by health professional that asthma was work-related[3]	21.5 (16.3–26.8)	22.1 (15.2–29.0)	25.1 (20.0–30.1)

*Responded "yes" to one or more of the following 4 questions:
"Was your asthma caused by chemicals, smoke, fumes, or dust in your current job?"
"Is your asthma made worse by chemicals, smoke, fumes, or dust in your current job?"
"Was your asthma caused by chemicals, smoke, fumes, or dust in any previous job you ever had?"
"Was your asthma made worse by chemicals, smoke, fumes, or dust in any previous job you ever had?"
†Estimates include all appropriate respondents in their denominators, regardless of work status. Presented here are percentages with 95% confidence intervals.
[1]Responded "yes" to: "Were you ever told by a doctor or other health professional that your asthma was related to any job you ever had?"
[2]Responded "yes" to: "Did you ever tell a doctor or other health professional that your asthma was related to any job you ever had?"
[3]Responded "yes" to either of the questions in footnotes 1 and 2.

TABLE 4.—Prevalence of select asthma characteristics by work-relatedness*, among adults with current asthma in three states: Michigan, Minnesota, and Oregon†, 2005 ACBS.

	Michigan		Minnesota		Oregon	
	Work-related asthma ($n = 331$)	Non-work-related asthma ($n = 238$)	Work-related asthma ($n = 171$)	Non-work-related asthma ($n = 147$)	Work-related asthma ($n = 348$)	Non-work-related asthma ($n = 305$)
Asthma symptoms, past 30 days[1]	79.6 (73.8–85.3)	61.1 (53.6–68.6) $p <. 0001$	84.6 (78.6–90.6)	56.2 (45.5–66.9) $p <. 0001$	73.7 (67.4–80.0)	66.1 (58.8–73.3) $p = .1156$
Nighttime awakenings from asthma, past 30 days[2]	41.8 (34.5–49.1)	19.7 (14.0–25.4) $p < .0001$	33.9 (24.5–43.2)	13.3 (7.0–19.6) $p = .0004$	31.3 (24.5–38.1)	26.4 (19.3–33.5) $p = .3245$
≥1 asthma attacks/episodes, past year[3]	67.8 (61.1–74.6)	51.4 (43.9–58.9) $p = .0019$	66.8 (58.0–75.5)	36.0 (26.3–45.6) $p < .0001$	61.2 (54.1–68.4)	50.8 (43.3–58.3) $p = .0485$
Activity limitations, past year[4]	77.5 (71.6–83.3)	56.7 (49.2–64.1) $p < .0001$	75.8 (66.0–85.6)	60.7 (50.5–70.9) $p = .0461$	77.2 (71.3–83.1)	59.4 (52.2–66.7) $p = .0002$
≥1 routine checkups for asthma, past year[5]	60.1 (52.9–67.3)	49.9 (42.4–57.5) $p = .0567$	63.8 (54.3–73.3)	40.4 (30.6–50.1) $p = .0005$	44.7 (37.5–51.9)	42.9 (35.6–50.1) $p = .7248$
Had ≥1 ED or urgent care visits for asthma, past year[6]	19.4 (12.8–25.9)	12.4 (6.5–18.3) $p = .1262$	14.7 (7.4–22.1)	~	11.0 (7.0–15.1)	9.0 (5.4–12.5) $p = .4515$
Hospitalized ≥1 times for asthma, past year[7]	3.9 (1.6–6.3)	4.7 (1.2–8.3) $p = .6983$	~	~	~	~
Used prescription asthma medication, past 3 mos.[8]	73.0 (66.7–79.3)	63.8 (56.4–71.1) $p = .0607$	83.3 (76.5–90.1)	60.1 (49.1–71.1) $p = .0001$	56.6 (49.0–64.2)	62.5 (55.0–70.0) $p = .2802$

*Responded "yes" to one or more of the following 6 questions:
"Were you ever told by a doctor or other health professional that your asthma was related to any job you ever had?"
"Did you ever tell a doctor or other health professional that your asthma was related to any job you ever had?"
"Was your asthma caused by chemicals, smoke, fumes, or dust in your current job?"
"Is your asthma made worse by chemicals, smoke, fumes, or dust in your current job?"
"Was your asthma caused by chemicals, smoke, fumes, or dust in any previous job you ever had?"
"Was your asthma made worse by chemicals, smoke, fumes, or dust in any previous job you ever had?"

†Estimates include all appropriate respondents in their denominators, regardless of work status. Presented here are percentages with 95% confidence intervals. Estimates marked "~" are suppressed for stability.

[1]Responded one or more to: "During the past 30 days, on how many days did you have any symptoms of asthma?"

[2]Responded one or more to: "During the past 30 days, on how many days did symptoms of asthma make it difficult for you to stay asleep?"

[3]Responded "yes" to: "During the past 12 months, have you had an episode of asthma or an asthma attack?"

[4]Responded "a little" or more to: "During the past 12 months, would you say you limited your usual activities due to asthma not at all, a little, a moderate amount, or a lot?" or reported missing work ≥1 days due to asthma.

[5]Responded one or more to: "During the past 12 months how many times did you see a doctor or other health professional for a routine checkup for your asthma?"

[6]Responded "yes" to: "An urgent care center treats people with illnesses or injuries that must be addressed immediately and cannot wait for a regular medical appointment. During the past 12 months, have you had to visit an emergency room or urgent care center because of your asthma?"

[7]Responded "yes" to: "During the past 12 months, that is since [1 year ago today], have you had to stay overnight in a hospital because of your asthma? Do not include an overnight stay in the emergency room."

[8]Reported using any kind of prescription medication for asthma in the previous 3 months.

medical records of only 15%, 7%, and 11% of adult patients with asthma (16, 17, 23).

The causes for underrecognition of WRA are numerous (27). A patient might not approach a clinician about a work-related problem because the patient might not want to appear as a complainer by blaming a health condition on work; fear losing a job; not have access to medical care; not think a clinician could do anything to help at work; or already have left the problematic job (22, 27, 28). A health care provider might not take an appropriate work history to uncover exposures and job duties associated with the asthma onset or exacerbation; not see workplace exposures as different than any other asthma triggers (i.e., be unclear that WEA is 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 with treatment and work modification plans (22, 27).

Although using the most sensitive definition of WRA might tend to overestimate of the true proportion of WRA among adults with current asthma because of reliance on self-assessed work-relatedness (questions 1 to 4, Table 1), the documented underrecognition of WRA by clinicians suggests that relying on questions 5 and 6 alone on a surveillance tool like the ACBS will grossly underestimate WRA prevalence. In fact, evidence supports the validity of patients' self-assessment of WRA symptoms: after 3 weeks of using serial peak expiratory flow (PEF) measurements at home and work as a standard, Bolen et al. conducted telephone interviews asking patients whether their symptoms were better or worse at work and found self-reported work-related symptoms had an 87% specificity when compared to PEF results (29). Their additional finding of only 15% sensitivity indicates that, if anything, relying on self-assessment questions alone might actually underestimate the true burden of WRA.

The present study also found that, in most instances, health care utilization and measures of poor asthma control tend to

be higher among adults with WRA compared to those with non-WRA. This was consistent with previous studies, which found that, compared to adults with non-WRA, those with WRA made more doctors' visits for worsening asthma (4, 5) and were more likely to have suffered from an asthma attack (4), visit an ED for asthma (4, 5), and be hospitalized for asthma (5). Moreover, Lemiere et al. found very similar utilization of medical resources among all patients with WRA, regardless of classification as OA or WEA (5). Further, Le Moual et al. found that patients with adult-onset asthma who were exposed to OA-causing agents had a higher score on a constructed asthma severity scale (6).

No information about respondent industry or occupation was collected on the 2005 BRFSS or ACBS, so potential differences in job distributions between those with and without WRA could not be assessed.

Some measures of asthma control and severity are determined by physical examination or breathing tests, and a survey such as the ACBS cannot measure these parameters. However, the recently released National Asthma Education and Prevention Program Expert Panel Report-3 guidelines on asthma diagnosis and treatment characterize both asthma control and severity using measures also found on the ACBS, such as frequency of symptoms, nighttime awakenings due to asthma, and interference with normal activities (30). Visits to the ED and hospitalizations for asthma are generally considered to be markers of poorly controlled asthma. However, measures like prescription drug use and routine check-ups for asthma are not necessarily measures of poorly controlled asthma, but are simply measures of increased health care utilization. In fact, adults with WRA may be more likely to report recent prescription drug use or routine check-ups because these characteristics are frequently associated with health insurance, which is associated with employment, and because individuals who have worked during at least at some point in their lives are more likely to be working at the time of the survey, these relationships may be the cause of the associations between utilization and WRA.

The ACBS WRA module was intended to distinguish between OA and WEA (by asking separate questions about asthma causation [questions 1 and 3] and asthma exacerbation [questions 2 and 4]). However, of those who reported that their asthma was caused by either a current or previous job, about a quarter also reported an age of asthma onset less than 16 years old (data not shown). Although it is possible that some of these individuals actually had asthma caused by a job held prior to age 16 or experienced childhood asthma that became quiescent followed by new-onset OA, we believe it more likely that many of these respondents misunderstood questions 1 and 3 to be asking about causation of asthma symptoms, rather than causation of the underlying asthma. The WRA module of the ACBS is being revised for the 2011 ACBS to clarify the distinction between the questions on causation and exacerbation.

The results from this study are subject to several limitations. There is the potential for selection or nonresponse bias. However, all three states found that after data were weighted, there were no demographic differences between ACBS and BRFSS respondents with asthma (data not shown). To assess the possibility that the asthma of ACBS participants was somehow different than the asthma in a typical population, Michigan also compared the distributions of asthma characteristics shown in Table 4 between the 2005 ACBS and the 2004 Michigan BRFSS. The only significant difference found was that the 2004 BRFSS respondents reported more sleep disturbances from asthma symptoms than the 2005 ACBS respondents (data not shown). Thus, compared to the BRFSS, we believe there is no inherent bias in the ACBS instrument toward a population with significantly poorer asthma control.

The findings presented for each state are based on relatively small sample sizes. Both Michigan and Oregon continue to collect ACBS data and will be able to produce more stable estimates in the future by aggregating several years of data. The ACBS is also subject to the limitations of all surveys, including possible recall bias and social desirability bias, and it may not be culturally appropriate for all respondents. Further, the 2005 ACBS was administered only to noninstitutionalized individuals with land-line telephones and was conducted in a limited number of languages, so results may not be generalizable to populations with different characteristics. The cross-sectional nature of the ACBS data also precludes drawing conclusions regarding causality or directionality for the described associations; however, these associations exist and their strength merits further examination. None of the six WRA questions on the ACBS has gone through psychometric testing. The two health care provider–dependent questions (5 and 6 in Table 1) were taken from a 1988 Occupational Health supplement to the National Health Interview Survey (NHIS). The other four questions (1 to 4 in Table 1) were generated by splitting up a single question that was cognitively tested and appeared on the 2003–2004 State and Local Area Integrated Telephone Survey (SLAITS)/National Asthma Survey. Although the validity of the asthma, WRA, and other related questions on the ACBS is unknown, other studies have demonstrated good agreement between similar questionnaire-derived data and either medical records or objective pulmonary testing (29, 31–33). Lastly, the data presented here come from only three states and may not be generalizable to other areas of the United States. As of 2008, 38 states are administering the adult ACBS, so more representative results will be available in the future.

In summary, data from the 2005 ACBS in three states show that over half of all adults with current asthma report that workplace exposures caused or aggravated their asthma. Had analyses been limited to those adults who had ever worked outside the home, estimates would be even higher. These data also suggest that adults with WRA experience greater asthma morbidity and use more health care resources than adults whose asthma is not work-related. These results make it abundantly clear that WRA is a significant public health problem. Yet, 2005 ACBS data also show that only a small proportion of individuals who report that their asthma is work-related have ever discussed with a health care provider the relationship between their asthma symptoms and the workplace. In particular, this finding underscores the continued need to raise awareness of WRA with the public as well as the clinical community. The much smaller number of WRA cases reported to case-based surveillance systems is consistent with the need for increased awareness on the recognition of WRA. The recently published American College of Chest Physicians consensus statement on the

diagnosis and management of WRA is an important step to help clinicians improve their recognition and care of WRA and reduce the morbidity experienced by their patients (2).

Declaration of Interest

The authors report no conflicts of interest. The authors alone are responsible for the content and writing of the paper.

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