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COMPLEMENTARY AND ALTERNATIVE MEDICINE

Complementary and Alternative Medicine Use among Adults with Work-Related and Non-Work-Related Asthma

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Background. The prevalence of complementary and alternative medicine (CAM) use among adults with current asthma has been estimated to be 40%. To our knowledge, there is no information on the prevalence of CAM use among individuals with work-related asthma (WRA). *Objectives.* To examine the associations between WRA, CAM use, and adverse asthma events. *Methods.* We analyzed data from the 2006–2008 Behavioral Risk Factor Surveillance System Asthma Call-Back Survey from 37 states and the District of Columbia for ever-employed adults with current asthma. We defined WRA as health-professional-diagnosed WRA. We calculated prevalence ratios (PRs) adjusted for age, sex, race/ethnicity, education, income, health insurance, and geographic region of residence. *Results.* Of ever-employed adults with current asthma, an estimated 38.1% used CAM and 8.6% had WRA. An estimated 56.6% of individuals with WRA reported using CAM compared with 27.9% of those with non-WRA (PR = 2.0). People with WRA were more likely than those with non-WRA to have adverse asthma events including an asthma attack in the past month (PR = 1.43), urgent treatment for worsening asthma (PR = 1.74), emergency room visit (PR = 1.95), overnight hospital stay (PR = 2.49), and poorly controlled asthma (PR = 1.27). The associations of WRA with adverse asthma events remained after stratifying for CAM use. *Conclusions.* Compared with non-WRA, individuals with WRA were more likely to use CAM to control their asthma. However, there was no evidence that the use of CAM modified the association of WRA with adverse asthma events.

Keywords asthma, Asthma Call-back Survey, complementary and alternative medicine, work-related asthma

INTRODUCTION

Asthma affects over 17.5 million adults in the United States (1) and can be life threatening if inadequately managed (2). A distinct subset of people with asthma have work-related asthma (WRA), which is asthma that is caused or made worse by factors related to work or the workplace environment (3). Based on a review of published studies, the American Thoracic Society estimated that 15% of adult asthma (range 4%–58%) is attributable to workplace exposures (4). We recently reported that 9.7% of ever-employed adults with current asthma in 33 states and District of Columbia (DC) have health-professional-diagnosed WRA, and using a less specific definition we reported that 47.5% may have WRA (5). Research has shown that individuals with WRA have more severe asthma than individuals with non-WRA, including more frequent doctor and emergency room visits for worsening asthma (5, 6) and increased days with asthma symptoms and activity limitation due to asthma (6–9).

Asthma symptoms can be controlled through asthma management; however, it is estimated that 58% of primary care patients with asthma have poorly controlled asthma (10). Poor asthma control may result from non-implementation of asthma management strategies by healthcare providers or poor compliance with asthma therapy by patients (11). Due to a variety of factors, including concerns with side-effects and long-term risks of traditional medications, many asthma patients are turning to complementary and alternative medicine (CAM) to help control their asthma (12).

CAM is defined by the U.S. National Institutes of Health (NIH) National Center for Complementary and Alternative Medicine as "a group of diverse medical and healthcare systems, practices, and products that are not generally considered to be part of conventional medicine" (13). Based on the results of a population-based study in the United States, Saydah and Eberhardt (14) reported that individuals with chronic conditions, including lung diseases, were more likely to have used CAM services in the previous 12 months than individuals without such conditions. Using the 2006 Behavioral Risk Factor Surveillance System (BRFSS) Asthma Call-Back Survey (ACBS), Marino and Shen (15) estimated that 6.4 million US adults with asthma use CAM. Ernst (16) reported that the proportion of CAM used for asthma control increased as patient-rated severity of asthma increased. In addition, in a study conducted in the United Kingdom nearly 30% of asthma patients stated that CAM improved their asthma symptoms (16).

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Although some research has shown positive asthma outcomes associated with CAM use, literature on efficacy is insufficient and adverse effects have been reported (17, 18). For example, herbal therapies and acupuncture are associated with nephrolithiasis, pneumonia, acute hepatitis, sudden death, and cardiac tamponade (17). Also, there is evidence that some patients experience asthma exacerbation when using CAM such as chondroitin, glucosamine, propolis, and senna (19).

To our knowledge, there is no published literature available on CAM use among individuals with WRA. To examine the association between health-professional-diagnosed WRA and CAM use in the past 12 months, we analyzed data from the 2006–2008 ACBS for ever-employed adults with current asthma in 37 states and DC. Furthermore, we examined whether CAM use for asthma control modified the association of WRA with adverse asthma events among ever-employed adults with current asthma.

METHODS

Study Population

BRFSS is an ongoing, state-based, random-digit-dialed telephone survey of the non-institutionalized US civilian population aged ≥18 years (20). In 2006–2008, BRFSS respondents in 37 states and DC who responded "yes" to the question "Have you ever been told by a doctor, nurse, or other health professional that you had asthma?" were eligible to participate in the ACBS. The ACBS collected information on asthma, including WRA and CAM use (21). The BRFSS has a surveillance exemption from Institutional Review Board review at the Centers for Disease Control and Prevention. Participating states are subject to state-specific Institutional Review Board requirements. Informed consent was orally obtained from participants before the start of the telephone interview. Among the states and DC conducting the ACBS, the median Council of American Survey and Research Organizations response rate was 48.6%, 47.6%, and 50.3% in 2006, 2007, and 2008, respectively, for BRFSS and 53.1%, 54.3%, and 50.6% in 2006, 2007, and 2008, respectively, for ACBS.

Definitions

Of ever-employed participants with current asthma, those who responded "yes" to the question "Were you ever told by a doctor or other health professional that your asthma was related to any job you ever had?" were determined to have WRA. Individuals who responded "no" to that question were determined to have non-WRA if they also responded "no" to each of the following four questions: "Was your asthma caused 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?," "Is your asthma made worse by chemicals, smoke, fumes or dust in your current job?," and "Was your asthma made worse by chemicals, smoke, fumes, or dust in any previous job you ever had?" and were determined to have possible WRA if they responded "yes" to any of these four questions. Because individuals with possible WRA expressed concern about a potential association between asthma and work, we examined this group separately.

All ACBS respondents with current asthma were asked about their use of non-traditional, complementary, or alternative healthcare methods other than prescription medications to help treat or control their asthma. In particular, participants were asked about the use of herbs, vitamins, acupuncture, acupressure, aromatherapy, homeopathy, reflexology, yoga, breathing techniques, naturopathy, and any other kind of alternative care to treat or control their asthma. A "yes" response to any of these questions was used to determine whether a respondent used any CAM to control their asthma in the past 12 months. CAM for self-care was determined by a "yes" response to at least one of the questions on herbs, vitamins, aromatherapy, homeopathy, yoga, and breathing techniques. CAM administered by a practitioner was determined by a "yes" response to at least one of the questions on acupuncture, acupressure, reflexology, and naturopathy (15).

To determine whether respondents experienced adverse asthma events, we used "yes" responses to the questions "During the past 12 months, have you had an episode of asthma or an asthma attack?," "During the past 12 months, have you had to visit an emergency room or urgent care center because of your asthma?," and "During the past 12 months, have you had to stay overnight in a hospital because of your asthma?." We also used a response of ≥1 time for the question, "During the past 12 months, how many times did you see a doctor or other health professional for urgent treatment of worsening asthma symptoms or for an asthma episode or attack?" to indicate an adverse asthma event.

Based on the Expert Panel Report 3 (EPR-3): Guidelines for the Diagnosis and Management of Asthma Full Report, we used ACBS respondents' responses to questions on asthma symptoms, nighttime awakenings, and rescue medication use to categorize asthma control as well controlled or poorly controlled (Table 1) (22).

TABLE 1.—Classification of asthma control.

	Well controlled	Poorly controlled
Asthma symptoms[a]	≤8 days in past 30 days	>8 days in the past 30 days
Nighttime awakenings[b]	≤2 times in past 30 days	≥3 times in the past 30 days
Rescue medication[c]	≤0.29 uses per day	>0.29 uses per day

Notes: The level of asthma control is based on the most severe impairment category.
[a]Symptoms were determined based on the response to the question "During the past 30 days, on how many days did you have any symptoms of asthma?."
[b]Nighttime awakenings were determined based on the response to the question "During the past 30 days, on how many days did symptoms of asthma make it difficult for you to stay asleep?."
[c]Frequency of inhaler rescue medication (not nebulizer) uses per day or per week for all reported rescue medications taken in the past 3 months was converted to the number of uses per day and summed. Rescue medications used only for treatment before exercise were excluded.

Statistical Analysis

We used SAS® software version 9.2 (SAS Institute, Inc., Cary, NC, USA) survey procedures and SUDAAN® Release 10.0.1 software (Research Triangle Institute, Research Triangle Park, NC, USA) for analyses. Data were weighted to account for non-response differences in the sample and the unequal probability of sample selection. Data from 2006, 2007, and 2008 for each of the 32 states (Alaska, Arizona, California, Colorado, Connecticut, Florida, Georgia, Hawaii, Illinois, Indiana, Iowa, Kansas, Maine, Maryland, Massachusetts, Michigan, Missouri, Montana, Nebraska, Nevada, New Hampshire, New Mexico, New York, Ohio, Oklahoma, Oregon, Texas, Utah, Vermont, Washington, West Virginia, and Wisconsin) and DC participating in the ACBS during multiple years were combined to ensure sufficient sample sizes. For these states, weights were established by multiplying the proportion of subjects in each survey year by the corresponding survey year's weight. For five states (New Jersey, North Dakota, Pennsylvania, Rhode Island, and Virginia) participating in the ACBS during 1 year only, unaltered weights for that year were used. Sampled persons who did not have current asthma, were never employed, or had missing data on asthma or employment were included in the standard error computations to fully account for the complex sample design.

We used the Rao–Scott χ^2 test to assess associations between WRA and CAM use (23). We used logistic regression to calculate adjusted prevalence ratios (PRs) to determine the associations among WRA, CAM use, and adverse asthma events. We also calculated adjusted PRs to determine the associations of WRA with adverse asthma events among ever-employed adults with current asthma, by CAM status. PRs were adjusted for age, sex, race/ethnicity, education, income, health insurance, and geographic region of residence. We selected these variables *a priori* based on previous research (5, 14, 15, 24) that found that WRA is associated with age, race/ethnicity, education, income, and health insurance status (5, 24), and that CAM use is associated with race/ethnicity, education, income, health insurance status, and geographic region of residence (14, 15). We also examined whether smoking status, body mass index, financial barriers to asthma care, self-reported physical health, self-reported mental health, and self-reported health status modify the association of WRA with adverse asthma event using separate multiple logistic regression models. PRs adjusted for these variables were similar to PRs not adjusted for these variables and had overlapping 95% confidence intervals. We performed a separate analysis examining the associations between possible WRA and (1) CAM use and (2) adverse asthma events.

RESULTS

A total of 41,054 adults were interviewed for the ACBS in 2006–2008 (10,802 in 2006, 15,245 in 2007, and 15,007 in 2008). Of these, 11,207 did not have current asthma, 800 were never employed, and 1120 had missing data on asthma or employment status. The remaining 27,927 respondents (representing an estimated 16 million in these 37 states and DC) were ever-employed adults with current asthma and were included in the analyses. Selected characteristics of the study population are shown in Table 2. An estimated 38.1% of ever-employed adults with current asthma used any CAM. Age, sex, race/ethnicity, annual household income, health insurance status, geographic region of residence, level of asthma control, asthma attack, urgent treatment for worsening asthma, asthma-related emergency room visit, asthma-related hospitalization, and WRA were all significantly associated with any CAM use. The distribution of the proportion of ever-employed adults with current asthma using any CAM did not differ by education or employment status (Table 2).

Among all ever-employed adults with current asthma, CAM for self-care was more common than practitioner-administered CAM (37.3% vs. 4.8%) and breathing techniques were the most frequent therapy (31.5%). Individuals with WRA were more likely than individuals with non-WRA to use any CAM therapy (PR = 2.01), self-care CAM therapy (PR = 2.04), practitioner-administered CAM therapy (PR = 3.81), and in particular, aromatherapy (PR = 4.11), breathing techniques (PR = 2.14), herbs (PR = 2.99), vitamins (PR = 2.84), and yoga (PR = 4.06) to control their asthma (Table 3).

Individuals with WRA were more likely than individuals with non-WRA to have adverse asthma events, including asthma attack in the past 12 months (PR = 1.43), urgent treatment for worsening asthma (PR = 1.74), emergency room visit (PR = 1.95), overnight hospital stay (PR = 2.49), and poorly controlled asthma (PR = 1.27) (Table 4). After stratifying for CAM use, the associations between WRA and adverse asthma events did not change and were similar in both CAM users and non-users (Table 5).

Approximately 37.9% of the ever-employed adults with current asthma had possible WRA with no health-professional-diagnosed WRA. When examining associations for possible WRA respondents, the multivariate analyses produced similar results with slightly weaker associations with CAM and adverse asthma events (data not shown) than the associations for respondents with diagnosed WRA. After stratifying for CAM use, the associations between possible WRA with no health-professional-diagnosed WRA and adverse asthma events did not change and were similar in both CAM users and non-users.

DISCUSSION

We found that, of ever-employed adults with current asthma in the 37 states and DC participating in the ACBS in 2006–2008, an estimated 38.1% used some form of CAM therapy to control their asthma and that individuals with WRA were more likely to use CAM therapy than

TABLE 2.—Demographic characteristics of ever-employed adults with current asthma and CAM users.

Characteristics	Number in sample[a]	Total %[b] (95% CI)	CAM use % (95% CI)
Age group (years)[c]			
18–44	7384	50.3 (48.8–51.8)	38.8 (36.2–41.4)
45–64	13,328	35.2 (34.0–36.4)	39.3 (37.6–41.0)
≥ 65	7103	14.5 (13.8–15.2)	32.5 (30.2–34.7)
Sex[c]			
Male	7366	37.5 (35.9–39.0)	34.3 (31.4–37.2)
Female	20,561	62.5 (61.0–64.1)	40.4 (38.8–42.0)
Race/ethnicity[c]			
White, non-Hispanic	23,113	75.9 (74.5–77.4)	36.0 (34.5–37.5)
Black, non-Hispanic	1456	8.0 (7.2–8.8)	43.2 (38.0–48.3)
Hispanic	1168	9.0 (7.9–10.1)	41.5 (34.9–48.1)
Other, non-Hispanic	1989	7.1 (6.1–8.0)	49.8 (42.6–57.1)
Education level			
≤High school	9836	34.0 (32.6–35.5)	38.0 (35.3–40.7)
>High school	18,069	66.0 (64.5–67.4)	38.1 (36.4–39.9)
Household income[c]			
<$15,000	4072	12.6 (11.7–13.6)	46.9 (42.9–50.9)
$15,000–$24,999	4669	15.6 (14.4–16.8)	44.9 (40.5–49.4)
$25,000–$34,999	3035	10.6 (9.7–11.5)	42.6 (38.0–47.4)
$35,000–$49,999	3826	13.5 (12.5–14.5)	38.1 (34.1–42.2)
≥$50,000	9728	47.7 (46.2–49.2)	32.9 (30.8–34.9)
Health insurance[c]			
Yes	25,383	86.9 (85.6–88.1)	36.5 (35.1–38.0)
No	2464	13.1 (11.9–14.4)	48.7 (43.3–54.1)
Geographic region of residence[c]			
Northeast	5446	20.8 (19.7–21.9)	36.0 (32.5–39.6)
Midwest	7650	26.8 (25.9–27.8)	35.1 (32.9–37.2)
South	4685	23.1 (22.0–24.2)	41.5 (38.2–44.8)
West	9159	29.3 (28.1–30.5)	38.9 (36.0–41.9)
Employment status			
Currently employed	13,792	59.0 (57.6–60.4)	37.1 (35.0–39.2)
Not currently employed	14,114	41.0 (39.6–42.4)	39.5 (37.6–41.5)
Asthma control[b]			
Well controlled	13,083	50.3 (48.8–51.7)	33.5 (31.3–35.8)
Poorly controlled	14,836	49.7 (48.3–51.2)	42.7 (40.8–44.6)
Adverse asthma events			
Asthma attack in past 12 months[c]	14,346	51.2 (49.7–52.7)	45.5 (43.5–47.6)
Urgent treatment[c]	6667	23.4 (22.3–24.6)	48.1 (45.4–50.8)
Emergency room visit[c]	3234	11.6 (10.8–12.5)	49.6 (45.8–53.5)
Overnight hospital stay[c]	1114	3.3 (2.9–3.7)	50.0 (43.8–56.3)
Work-related asthma[c]	2779	8.6 (7.9–9.3)	56.6 (52.5–60.7)
Total	27,927		38.1 (36.6–39.6)

Notes: CAM, complementary and alternative medicine; CI, confidence interval.
[a]Categories do not sum to total due to item non-response.
[b]Weighted average annual estimate.
[c]Association with CAM use was statistically significant ($p < .05$).

individuals with non-WRA. Results of our study support those from a recent US population-based study in which 40% of adults with current asthma reported using any CAM therapy (15). Also, our study is consistent with previous research on CAM use among adults with asthma, which has shown associations between CAM and low income and lack of health insurance (15). In addition, research by Saydeh and Eberhardt (14) found that CAM use was associated with race/ethnicity, education level, and geographic region of residence among those with lung diseases including asthma. In contrast to their findings, we did not find an association between CAM use and education level among adults with asthma but this may be due to different disease definitions. We found that breathing techniques are the most common form of CAM therapy among adults with WRA, which is consistent with previous research on the most common form of CAM therapy in adults with asthma in both the United Kingdom and the United States (15, 16). Previous studies also assert that breathing techniques are the most promising form of CAM for relieving asthma symptoms in adults with asthma (25). However, the EPR-3 concluded that there is insufficient evidence to suggest that breathing techniques, homeopathy, herbal medicine, or chiropractic therapy provides clinical benefits to patients with asthma (22). In addition, the EPR-3 concluded that acupuncture is not recommended for asthma treatment (22).

Patients may use CAM for various reasons. A previous report showed that asthma patients who have severe

TABLE 3.—Prevalence of CAM use among ever-employed adults with current asthma by work-related asthma status.

	Total	Work-related asthma		
		Yes[a]	No[b]	
CAM	%[d] (95% CI)	% (95% CI)	% (95% CI)	PR[c] (95% CI)
Any CAM	38.1 (36.6–39.6)	56.6 (52.5–60.7)	27.9 (26.0–29.7)	2.01 (1.81–2.23)
Self-care CAM	37.3 (35.9–38.8)	55.9 (51.8–60.0)	27.2 (25.4–29.0)	2.04 (1.84–2.27)
Aromatherapy	5.0 (4.3–5.8)	9.5 (7.1–12.0)	2.4 (1.8–2.9)	4.11 (2.82–5.99)
Breathing techniques	31.5 (30.1–32.9)	49.5 (45.3–53.7)	23.2 (21.4–24.9)	2.14 (1.91–2.41)
Herbs	6.0 (5.2–6.8)	11.6 (8.9–14.3)	3.3 (2.7–3.9)	2.99 (2.15–4.16)
Homeopathy	2.3 (1.8–2.8)	5.1 (2.6–7.6)	1.1 (0.7–1.5)	5.38 (2.92–9.92)
Vitamins	8.0 (7.2–8.8)	15.8 (12.8–18.9)	4.5 (3.8–5.2)	2.84 (2.12–3.80)
Yoga	4.5 (3.9–5.1)	10.2 (6.9–13.5)	3.1 (2.4–3.7)	4.06 (2.77–5.97)
Practitioner-administered CAM	4.8 (4.0–5.5)	11.3 (7.8–14.9)	2.5 (1.8–3.2)	3.81 (2.35–6.18)
Acupressure	1.5 (1.2–1.9)	4.4 (2.3–6.6)	0.6 (0.4–0.8)	5.74 (2.64–12.48)
Acupuncture	1.4 (1.2–1.7)	2.9 (1.4–4.4)	0.9 (0.6–1.2)	2.53 (1.25–5.10)
Naturopathy	1.6 (1.2–2.0)	2.6 (1.4–3.7)	1.1 (0.5–1.7)	1.41 (0.60–3.31)
Reflexology	1.7 (1.2–2.2)	5.9 (2.9–8.9)	0.5 (0.3–0.8)	8.91 (4.39–18.10)
Other	9.9 (9.1–10.8)	14.5 (11.8–17.2)	6.6 (5.7–7.5)	2.15 (1.66–2.79)

Notes: CAM, complementary and alternative medicine; CI, confidence interval; PR, prevalence ratio.
[a]"Yes" to the question "Were you ever told by a doctor or other health professional that your asthma was related to any job you ever had?."
[b]"No" to each of the following questions "Were you ever told by 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?," "Was your asthma caused by chemicals, smoke, fumes or dust in any previous job you ever had?," "Is your asthma made worse by chemicals, smoke, fumes or dust in your current job?," and "Was your asthma made worse by chemicals, smoke, fumes or dust in any previous job you ever had?."
[c]In the model, the outcome variable was the CAM use and the predictor variable was WRA. Adjusted for age, sex, race/ethnicity, education, income, health insurance, and geographic region of residence.
[d]Average annual estimate.

TABLE 4.—Multivariate association of work-related asthma with adverse asthma events among ever-employed adults with current asthma.

	Work-related asthma		
	Yes[a]	No[b]	
Adverse asthma events	%[d] (95% CI)	% (95% CI)	PR[c] (95% CI)
Asthma attack in past 12 months	65.2 (61.2–69.2)	44.1 (42.0–46.1)	1.43 (1.32–1.56)
Urgent treatment for worsening asthma	36.1 (32.0–40.1)	19.5 (18.0–21.0)	1.74 (1.51–2.01)
Asthma-related emergency room visit	19.6 (16.4–22.8)	8.6 (7.5–9.7)	1.95 (1.57–2.42)
Overnight stay in hospital because of asthma	6.9 (5.0–8.8)	2.2 (1.7–2.7)	2.49 (1.70–3.66)
Poorly controlled asthma	60.9 (56.8–65.1)	44.0 (42.0–46.1)	1.27 (1.15–1.39)

Notes: CI, confidence interval; PR, prevalence ratio.
[a]"Yes" to the question "Were you ever told by a doctor or other health professional that your asthma was related to any job you ever had?"
[b]"No" to each of the following questions "Were you ever told by 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?," "Was your asthma caused by chemicals, smoke, fumes or dust in any previous job you ever had?," "Is your asthma made worse by chemicals, smoke, fumes or dust in your current job?," and "Was your asthma made worse by chemicals, smoke, fumes or dust in any previous job you ever had?."
[c]In the model the outcome variable was adverse asthma event and the predictor variable was WRA. Adjusted for age, sex, race/ethnicity, education, income, health insurance, and geographic region of residence.
[d]Average annual estimate.

and poorly controlled asthma use CAM more often than those with well-controlled asthma because they are determined to seek help (16). Findings from this and previous research indicating that individuals with WRA have more severe asthma than individuals with non-WRA may partially explain why individuals with WRA were more likely to have poorly controlled asthma and to use CAM than individuals with non-WRA (6–9). Other reasons for using CAM to control asthma include patients' need for active involvement in the decision-making process, more control over treatment (25, 26), and concern about side-effects and long-term risks of traditional medications (12, 26). However, we found that individuals who used CAM did not differ significantly from non-CAM users in their use of any prescription asthma medication (63.4% vs. 66.3% respectively, $p = .07$) (data not shown). This is in contrast to findings by Roy et al. (27) that herbal remedy use was associated with decreased inhaled corticosteroid adherence among asthma patients. The differences may be explained by varying study populations and methods.

TABLE 5.—Multivariate association between work-related asthma and adverse asthma events among ever-employed adults with current asthma by CAM use.

	CAM use			
	Yes[a]		No[b]	
Adverse asthma events	PR[c]	(95% CI)	PR	(95% CI)
Asthma attack in past 12 months				
Non-WRA[d]	1.00	–	1.00	–
WRA[e]	1.28	(1.14 – 1.43)	1.41	(1.24 – 1.59)
Urgent treatment for worsening asthma				
Non-WRA	1.00	–	1.00	–
WRA	1.58	(1.28 – 1.94)	1.60	(1.30 – 1.97)
Asthma-related emergency room visit				
Non-WRA	1.00	–	1.00	–
WRA	1.72	(1.29 – 2.30)	1.86	(1.34 – 2.57)
Overnight stay in hospital because of asthma				
Non-WRA	1.00	–	1.00	–
WRA	2.60	(1.55 – 4.37)	2.03	(1.22 – 3.38)
Poorly controlled asthma				
Non-WRA	1.00	–	1.00	–
WRA	1.13	(0.99 – 1.28)	1.26	(1.11 – 1.44)

Notes: CAM, complementary and alternative medicine; CI, confidence interval; PR, prevalence ratio; WRA, work-related asthma.

[a]"Yes" to the questions on use of non-traditional, complementary, or alternative healthcare methods other than prescription medications to help treat or control their asthma including herbs, vitamins, acupuncture, acupressure, aromatherapy, homeopathy, reflexology, yoga, breathing techniques, naturopathy, and any other kind of alternative care for asthma.

[b]"No" to the questions on use of non-traditional, complementary, or alternative healthcare methods other than prescription medications to help treat or control their asthma including herbs, vitamins, acupuncture, acupressure, aromatherapy, homeopathy, reflexology, yoga, breathing techniques, naturopathy, and any other kind of alternative care for asthma.

[c]In the model the outcome variable was adverse asthma event and the predictor variable was WRA. Adjusted for age, sex, race/ethnicity, education, income, health insurance, and geographic region of residence.

[d]"No" to the questions "Were you ever told by 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?," "Was your asthma caused by chemicals, smoke, fumes or dust in any previous job you ever had?," "Is your asthma made worse by chemicals, smoke, fumes or dust in your current job?," and "Was your asthma made worse by chemicals, smoke, fumes or dust in any previous job you ever had?."

[e]"Yes" to the question "Were you ever told by a doctor or other health professional that your asthma was related to any job you ever had?."

In this study, individuals with WRA were more likely to have adverse asthma events than individuals with non-WRA. These findings corroborate previous research demonstrating that adults with WRA have more frequent emergency department and doctor visits for worsening asthma and more asthma-related hospitalizations (6, 9). We did not find any differences in the association of WRA with adverse asthma events between individuals who used CAM and those who did not use CAM. Although this may indicate that CAM use does not improve adverse asthma events and asthma control among individuals with WRA, no data were available to assess whether participants started using CAM because they had poorly controlled asthma and adverse asthma events or they experienced poorly controlled asthma and adverse asthma events because they used CAM. Furthermore, it is possible that those who seek more healthcare, such as CAM, are more likely to receive additional diagnoses or have providers who are more likely to tell them that their asthma is related to work. However, when examining individuals with possible WRA but no health-professional-diagnosed WRA, we found only slightly weaker associations with CAM use than among those with health-professional-diagnosed WRA. This is likely because the group of individuals with possible WRA but no health-professional-diagnosed WRA includes both individuals who truly have WRA and those who do not.

The findings of this report are subject to additional limitations. The BRFSS and the ACBS rely on self-reported measures that are not validated and thus estimates may be subject to recall bias. Moreover, the 2006–2008 ACBS queried only persons with landline telephone access and did not include persons who resided in households that lacked a landline telephone and persons who only used cellular telephones (28). Also, the levels of asthma control in this study were based on EPR-3 guidelines but do not include information on activity limitation or objective measures of lung function such as spirometry or peak flow measures as recommended in EPR-3 (29). Therefore, the percentage with poorly controlled asthma is likely underestimated. Finally, there is no available information on efficacy of and adverse effects from CAM use for asthma treatment and control (15, 17, 18, 25, 30, 31). However, the ACBS was not designed to address these issues.

CONCLUSIONS

To the best of our knowledge, this is the first study examining the association between WRA and CAM therapy in the United States. These results indicate that, in states participating in the ACBS, ever-employed adults with WRA are more likely to use CAM than individuals with non-WRA. Individuals with WRA are also more

likely to experience adverse asthma events and poor asthma control; associations that are not affected by CAM use. Because of the high prevalence of CAM use, in particular by asthma patients, healthcare providers should be informed about the various types of CAM and ask their patients about CAM use (12, 15, 25, 30, 32, 33). Physicians should also follow the EPR-3 recommendations to ask patients about all medications they are using for asthma and advise patients that CAM are not a substitute for the clinician's recommended asthma treatment (22).

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Declaration of Interest

The authors report no conflicts of interest. The findings and conclusions in this report are those of the authors and do not necessarily represent the views of the Centers for Disease Control and Prevention.

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