

ORIGINAL ARTICLE

Sex Differences in Asthma Prevalence and Other Disease Characteristics in Eight States

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Objectives. We assessed the sex differences in asthma prevalence and asthma-control characteristics within eight states. **Methods.** We analyzed data from the 2001 Behavioral Risk Factor Surveillance System survey. **Results.** Lifetime and current asthma prevalence were higher for females in each of the eight states compared to males. Adult onset of asthma was reported more often by females with current asthma, and childhood onset was reported more often by males. Sex differences were identified for the eight asthma-control characteristics. **Conclusions.** Females in eight states presented higher asthma risk and poorer asthma profiles than males. State surveillance data can be used to identify disparities and to develop appropriate public health interventions.

Keywords asthma, sex differences, prevalence, control

INTRODUCTION

Improved tracking for asthma is critical for planning and evaluating efforts to reduce the health burden from this disease. Data collected routinely through the Center for Disease Control's (CDC) National Center for Health Statistics surveys provide a good basis for descriptions of national trends in asthma prevalence, mortality, and several indirect indicators of morbidity such as hospitalization. Generally, these data become publicly available 2 to 3 years after collection. Two considerations have guided CDC's efforts to improve surveillance for asthma: 1) develop systems that make data available at the state or local level—the same level that intervention efforts will be targeted and 2) shorten the interval between data collection and data dissemination.

Beginning in 1999, the Behavioral Risk Factor Surveillance System (BRFSS), administered through CDC's National Center for Chronic Disease Prevention and Health Promotion, has included questions to determine asthma prevalence in adults. Summaries of state-specific prevalence for asthma collected in 2000, 2001, and 2002 have been published (1). Beginning with data collection in 2001, additional questions have been included to provide a more comprehensive assessment of asthma management and control indicators. In the current report, we examine differential indicators of asthma management and control between men and women. Because the BRFSS permits analysis at the state level, we can also compare sex differences in prevalence and asthma management/control indicators among states.

METHODS

We used data from the Behavioral Risk Factor Surveillance System (BRFSS), an ongoing, state-based, random-digit-dialed telephone survey of the noninstitutionalized civilian U.S. population ≥ 18 years of age. The survey collects information about modifiable risk factors for chronic disease and other leading causes of death. In 2001, 50 states, the District of Columbia, Puerto Rico, the Virgin Islands, and Guam participated in the BRFSS. The median response rate of all states in 2001 was 51.1% based on the definitions of the Council of American Survey Research Organization (CASRO).

The 2001 questionnaire was composed of a core set of questions asked in all states, optional module questions about selected topics asked at the discretion of each state, and questions asked in a particular state to meet a specific need. Two asthma questions have been part of the core survey since 2000. These core questions ask respondents about their asthma status and are used to determine lifetime and current asthma prevalence. The adult asthma optional module questions were first available to states in 2001. These questions are asked only of respondents who answered "yes" to one of the two core questions (reporting medically diagnosed asthma). The first question asks the age at which the respondent was told they had asthma and is asked of respondents who report lifetime, medically diagnosed asthma. The remaining eight questions are asked of respondents who report current asthma. These eight questions include occurrence of asthma attacks or episodes, frequency of symptoms, the number of emergency room visits, urgent care visits, and routine office visits, days of activity limitation and sleep disturbance and the frequency of medication use.

Sampling and Weighting

A disproportionate stratified sample (DSS) design was used by all states, the District of Columbia, Puerto Rico,

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and the Virgin Islands in 2001. Additionally, several states used geographic stratification in their sampling designs. The data are weighted to the respondent's probability of selection and to the age and sex-specific population or race, age, and sex-specific population from the most current census data adjusted using annual estimates for each state.

Data Analysis

We examined the data from eight states (Indiana, Iowa, Michigan, Mississippi, Missouri, Pennsylvania, South Dakota, and Washington) that included the adult asthma module as part of their 2001 BRFSS state survey. The age and sex distributions of the respondents in these eight states did not differ from the distributions for the remainder of the United States. However, respondents in these eight states were more likely to be white and less likely to be Hispanic than respondents in the remainder of the United States.

The core asthma questions and nine adult asthma optional module questions were the focus of this analysis. The number of interviews completed in the eight states using the asthma module was 31,666. Asthma prevalence was determined by the respondent's answer to the two core survey questions: 1) Have you ever been told by a doctor, nurse, or other health professional that you had asthma? and 2) Do you still have asthma? Respondents answering "yes" to the first question were categorized as lifetime asthma. Respondents answering "yes" to both questions were categorized as current asthma. Former asthma was determined by respondents answering "yes" to the first question and then responding "no" to the second question. "Never had" asthma was determined by respondents answering "no" to the first question.

Missing data and respondents answering "Don't know/unsure" or "Refused" were excluded from the denominators presented in Tables 1–4. SUDAAN (Research Triangle Institute, Research Triangle Park, NC), a software package for analyzing complex survey data, was used in this report to calculate the standard errors and the 95% confidence intervals (CI) around the prevalence and control characteristic estimates (2). We also calculated an asthma status estimate for respondents reporting they still have asthma within the group of respondents reporting lifetime medical diagnosis of asthma. Asthma status is the percent of those reporting lifetime asthma who still have asthma.

We compared the reported age at asthma diagnosis for respondents reporting they still have asthma with respondents reporting they no longer have asthma. The calculated mean age at medical diagnosis for asthma excluded any respondent reporting they were age 10 or younger because an exact age is provided only for those medically diagnosed with asthma at age 11 or older. Consequently, the mean age at asthma diagnosis for males and females is based on the subset of respondents reporting lifetime asthma diagnosis at age 11 or older.

Eight of the nine adult asthma module questions were asked of respondents reporting they still have asthma ($n = 2,297$). We combined the data from the eight states to reduce the likelihood of producing unstable estimates when

stratifying the data by sex. In addition, the response categories for seven of the asthma module questions were collapsed to create dichotomous variables. Questions asking the number of emergency room visits, urgent doctor's office visits, routine doctor's office visits, and days of activity limitation were collapsed, combining any occurrence (reported days or visits) as one response category. Respondents reporting "no" visits or days of limitation comprised the second category. Questions asking respondents to report an occurrence of symptoms, medication usage, or day range for sleep disturbance were similarly collapsed. Any occurrence, usage, or indication of event were combined into one response category and compared to a "no" response. Chi-square statistics were calculated to test the significance of the differences between males and females for the asthma prevalence questions and eight module questions defining asthma characteristics. The mean number of emergency room visits, urgent care doctor visits, and routine doctor visits were estimated using the responses, as reported by the respondents, with the exception of the "don't know" and "refused" responses. The mean number of days of activity limitation does not include 131 responses reported as "88" days because this response indicated a coding error resulting from the numerical similarity with the code for no days (888).

RESULTS

Adult Asthma Prevalence

In 2001, 31,618 respondents in eight states (Indiana, Iowa, Michigan, Mississippi, Missouri, Pennsylvania, South Dakota, and Washington) provided a useable response to a question on medical diagnosis of asthma in their lifetime (Table 1). The lifetime prevalence estimated for the eight states was 11.2% ($n = 31,618$), which was similar to the overall estimate (11.0%) for the United States (50 states and the District of Columbia). Lifetime asthma prevalence ranged from 7.7% in South Dakota to 12.4% in Michigan. In the eight states, lifetime prevalence was 12.6% for females and 9.8% for males, which was similar to the estimates for the United States (12.6% females, 9.2% males). Lifetime asthma prevalence differed significantly by sex for the eight states combined ($p < 0.001$) and separately for Indiana, Iowa, Michigan, and Washington (all $p \leq 0.01$). Lifetime asthma prevalence for males and females in South Dakota represented the lower end of the range for lifetime asthma prevalence among the eight states (7.5% and 7.9% for males and females, respectively). Males in Missouri and females in Washington represented the high end of the prevalence range (11.3% and 14.1%, respectively).

For the eight states combined, asthma prevalence (current/former/never) for females was significantly different from males ($p < 0.001$). Significant differences in asthma prevalence by sex were found in five of the eight states, Indiana, Iowa, Michigan, Missouri, and Washington (all $p \leq 0.03$). The current asthma prevalence for the eight states combined was 7.7% ($n = 31,553$; Table 1). Current asthma ranged from 5.3% in South Dakota to 9.0% in Michigan. The current asthma prevalence estimate for

TABLE 1.—Self-reported adult asthma prevalence^a by state and sex: BRFSS 2001.

State	<i>n</i>	Lifetime	<i>p</i> ^b	<i>n</i>	Current	Former	Never (had)	<i>p</i>
		% (95% CI)			% (95% CI)	% (95% CI)		
Eight-states	31,618	11.2 (10.7–11.8)	< 0.001	31,553	7.7 (7.3–8.1)	3.4 (3.1–3.7)	88.9 (88.4–89.4)	< 0.001
Male	12,803	9.8 (9.0–10.6)		12,778	6.1 (5.5–6.8)	3.5 (3.0–3.9)	90.4 (89.6–91.2)	
Female	18,815	12.6 (11.9–13.3)	< 0.001	18,775	9.1 (8.6–9.7)	3.3 (2.9–3.7)	87.6 (86.9–88.3)	< 0.001
Indiana	3,991	11.3 (10.2–12.4)		3,985	7.5 (6.7–8.4)	3.6 (3.0–4.3)	88.8 (87.8–89.9)	
Male	1,614	9.0 (7.5–10.6)	0.01	1,611	5.4 (4.2–6.6)	3.5 (2.5–4.4)	91.1 (89.6–92.7)	< 0.001
Female	2,377	13.4 (11.9–14.9)		2,374	9.5 (8.2–10.8)	3.8 (2.9–4.7)	86.7 (85.2–88.2)	
Iowa	3,629	9.7 (8.6–10.8)	0.01	3,623	6.7 (5.8–7.7)	2.8 (2.1–3.4)	90.5 (89.4–91.6)	< 0.001
Male	1,481	8.2 (6.6–9.8)		1,479	4.9 (3.6–6.1)	3.1 (2.1–4.1)	92.0 (89.6–92.7)	
Female	2,148	11.1 (9.5–12.6)	< 0.01	2,144	8.4 (7.0–9.9)	2.4 (1.7–3.1)	89.1 (87.6–90.7)	0.01
Michigan	3,823	12.4 (11.1–13.7)		3,814	9.0 (7.9–10.2)	3.2 (2.5–3.9)	87.8 (86.5–89.1)	
Male	1,515	10.6 (8.6–12.6)	0.52	1,511	7.2 (5.4–9.0)	3.2 (2.2–4.2)	89.6 (87.6–91.6)	0.49
Female	2,308	14.0 (12.4–15.7)		2,303	10.7 (9.2–12.1)	3.2 (2.3–4.1)	86.1 (84.5–87.7)	
Mississippi	3,040	9.2 (8.0–10.4)	0.40	3,034	5.5 (4.6–6.5)	3.5 (2.7–4.3)	91.0 (89.8–92.2)	0.03
Male	1,146	8.7 (6.8–10.7)		1,145	5.0 (3.5–6.5)	3.7 (2.4–5.0)	91.3 (89.4–93.3)	
Female	1,894	9.5 (8.0–11.0)	0.10	1,889	6.0 (4.9–7.2)	3.3 (2.3–4.3)	90.6 (89.2–92.1)	0.17
Missouri	4,175	12.0 (10.6–13.3)		4,167	8.2 (7.0–9.3)	3.6 (2.8–4.4)	88.2 (86.8–89.5)	
Male	1,652	11.3 (9.2–13.5)	0.61	1,649	6.9 (5.2–8.7)	4.3 (3.0–5.7)	88.7 (86.6–90.9)	0.09
Female	2,523	12.5 (10.8–14.2)		2,518	9.3 (7.8–10.8)	3.0 (2.1–3.9)	87.7 (86.0–89.4)	
Pennsylvania	3,658	10.7 (9.5–11.9)	< 0.001	3,652	7.3 (6.4–8.3)	3.2 (2.4–4.0)	89.5 (88.2–90.7)	< 0.001
Male	1,479	9.6 (7.8–11.4)		1,475	6.4 (4.9–7.9)	2.9 (2.0–3.9)	90.7 (88.9–92.4)	
Female	2,179	11.7 (10.0–13.4)	< 0.001	2,177	8.2 (6.9–9.5)	3.4 (2.2–4.6)	88.4 (86.7–90.1)	< 0.001
South Dakota	5,109	7.7 (6.9–8.6)		5,101	5.3 (4.6–6.0)	2.3 (1.8–2.8)	92.4 (91.5–93.2)	
Male	2,164	7.5 (6.2–8.8)	< 0.001	2,162	4.7 (3.6–5.8)	2.7 (2.0–3.9)	92.6 (91.2–93.9)	< 0.001
Female	2,945	7.9 (6.8–9.0)		2,939	5.9 (4.9–6.8)	1.9 (1.3–2.5)	92.2 (91.1–93.3)	
Washington	4,193	12.0 (10.9–13.1)	< 0.001	4,177	7.7 (6.8–8.5)	4.0 (3.4–4.7)	88.3 (87.2–89.4)	< 0.001
Male	1,752	9.8 (8.3–11.3)		1,746	5.1 (4.0–6.2)	4.4 (3.3–5.5)	90.5 (88.9–92.0)	
Female	2,441	14.1 (12.5–15.6)		2,431	10.1 (8.7–11.5)	3.6 (2.8–4.5)	86.2 (84.7–87.8)	

^aAsthma prevalence as determined by respondent's answer to core BRFSS 2001 Survey questions ("Have you ever been told by a doctor, nurse or other health professional that you had asthma?"; "Do you still have asthma?") where CURRENT asthma = "Yes" to both questions. FORMER asthma = "Yes" to "Ever Told" and "No" to "Still Have" and NEVER (Had) asthma = "No" to "Ever Told." Eight-state denominator excludes 113 "Don't Know, Refused" responses to both questions.

^bSignificance level (*p*) is based on general association χ^2 test comparing percent differences for males and females.

females in the eight states was similar to that for the United States (9.1% v 8.9%, respectively), whereas the estimate for males was somewhat higher than that for the United States (6.1% v 5.3%). The current asthma prevalence for males and females in South Dakota represented the lower end of the eight state range (4.7% and 5.9%, respectively) compared to Michigan (7.2% and 10.7%, respectively) at the high end of the range for males and females.

Of all respondents, 3.4% reported they formerly had asthma. The percent of respondents reporting they formerly had asthma ranged from 2.3% (South Dakota) to 4.0% (Washington). The percent reporting former asthma was similar for males (3.5%) and females (3.3%) in the eight states. Respondents reporting they had never been diagnosed with asthma represented 88.9% of the respondents in the eight states. The range was 87.8% (Michigan) to 92.4% (South Dakota). Proportionally fewer females reported no lifetime medical diagnosis for asthma (87.6%) than did males (90.4%) in the eight states.

Asthma Status

Among respondents reporting lifetime asthma, 69.4% reported they still have asthma compared to 30.6% who reported they no longer have asthma (Table 2). Likewise, both males and females in each state were more likely to report they still have asthma than they no longer have asthma. In Mississippi, 61.3% of respondents reported they

still had asthma, compared to 73.8% in Michigan. In the eight states, females were more likely than males to report they still had asthma (73.4% and 63.8%, respectively, $p < 0.001$). Significant differences were found by sex for respondents reporting asthma status in Indiana, Iowa, Missouri, South Dakota, and Washington (all $p \leq 0.04$). The range for females reporting they still had asthma was 64.6% (Mississippi) to 77.6% (Iowa). The range for males reporting they still had asthma was 53.4% (Washington) to 69.3% (Michigan).

Age at Asthma Diagnosis

We compared the age at asthma diagnosis for respondents reporting lifetime medical diagnosis of asthma by current and former asthma prevalence and sex (Table 3). Among the respondents reporting current asthma, 56.5% ($n = 2,149$) stated they were first diagnosed when they were 18 years of age or older. The percent of females reporting adult onset (18 years and older) was 63.9% compared to 44.4% of males. Asthma diagnosis at 10 years of age and younger was reported by 39.8% of males compared to 21.6% of females reporting current asthma. Within these age categorizations, the differences by sex were significant ($p < 0.001$) for respondents reporting current asthma. The 11- to 17-year age at diagnosis group produced nearly equivalent percentages for males and females reporting current asthma (15.8% and 14.6%, respectively).

TABLE 2.—Asthma status among respondents reporting lifetime asthma diagnosis^a by state and sex: BRFSS 2001.

State	n	Still have	No longer have	p ^b
		% (95%CI)	% (95%CI)	
Eight-states	3,256	69.4 (67.1–71.7)	30.6 (28.3–32.9)	< 0.001
Male	1,104	63.8 (59.9–67.7)	36.2 (32.3–40.1)	
Female	2,152	73.4 (70.5–76.3)	26.6 (23.7–29.5)	0.04
Indiana	472	67.5 (62.7–72.3)	32.5 (27.7–37.3)	
Male	150	60.9 (52.3–69.5)	39.1 (30.5–47.7)	0.01
Female	322	71.5 (65.8–77.2)	28.5 (22.8–34.2)	
Iowa	337	71.0 (65.5–76.5)	29.0 (23.5–34.5)	0.14
Male	116	61.2 (51.2–71.1)	38.8 (28.9–48.8)	
Female	221	77.6 (71.7–83.6)	22.4 (16.4–28.3)	0.31
Michigan	452	73.8 (69.0–78.7)	26.2 (21.3–31.0)	
Male	137	69.3 (60.5–78.0)	30.7 (22.0–39.5)	0.02
Female	315	77.0 (71.4–82.5)	23.0 (17.5–28.6)	
Mississippi	267	61.3 (54.4–68.2)	38.7 (31.8–45.6)	0.75
Male	93	57.3 (45.8–68.8)	42.7 (31.2–54.2)	
Female	174	64.6 (56.3–72.9)	35.4 (27.1–43.7)	0.03
Missouri	461	69.3 (63.5–75.0)	30.7 (25.0–36.5)	
Male	159	61.5 (51.7–71.3)	38.5 (28.7–48.3)	< 0.001
Female	302	75.7 (69.5–82.0)	24.3 (18.0–30.5)	
Pennsylvania	388	69.7 (63.5–75.9)	30.3 (24.1–36.5)	0.03
Male	132	68.5 (59.5–77.6)	31.5 (22.4–40.5)	
Female	256	70.5 (62.2–78.9)	29.5 (21.1–37.8)	< 0.001
South Dakota	381	69.8 (64.4–75.2)	30.2 (24.8–35.6)	
Male	152	63.4 (54.6–72.3)	36.6 (27.7–45.4)	< 0.001
Female	229	75.5 (69.2–81.9)	24.5 (18.1–30.8)	
Washington	498	65.5 (60.7–70.2)	34.5 (29.8–39.3)	< 0.001
Male	165	53.4 (45.1–61.8)	46.6 (38.2–54.9)	
Female	333	73.5 (68.2–78.7)	26.5 (21.3–31.8)	

^aAsthma, (Still Have v No Longer Have) is estimated among respondents with a medical diagnosis of asthma. Defined as “Yes” to Core BRFSS 2001 Survey questions, “Have you ever been told by a doctor, nurse or other health professional that you had asthma?” Eight-state denominator excludes 65 “Don’t Know, Refused” responses to “Do you still have asthma?”

^bSignificance level (*p*) is based on general association χ^2 test comparing percent differences for males and females.

In contrast to the respondents reporting current asthma, respondents reporting former asthma were diagnosed at an earlier age. The largest percentage of respondents reporting former asthma status reported they were medically diagnosed at 10 years of age or younger (48.1%). Adult onset was reported by 29.3% and diagnosis at age 11 to 17 years by 22.6% of respondents reporting former asthma. More than 25 percentage points separated the males and females with former asthma who responded they were age 10 years or younger when first diagnosed, (61.8% and 35.0%, respectively, $p < 0.001$). The percentage of females reporting adult onset of asthma (18 years or older) was

twice that of males, 39.8% compared to 18.2%, for those reporting formerly having asthma ($p < 0.001$).

Reported Asthma Control Characteristics

We used eight of the adult asthma module questions to define asthma control characteristics among those with current asthma (Table 4). Responding “yes” to the module question or providing the number of occurrences was considered a characteristic of a person with asthma. For each of the eight questions, females were more likely to report the asthma control characteristic than males. While more females than males with current asthma reported

TABLE 3.—Age at asthma diagnosis for current and former asthma^a by sex in eight states: BRFSS 2001.

	All ages	10 years and younger	11–17 years	18 years and older	p ^c	11 years and older ^b	Mean age
	n	% (95%CI)	% (95%CI)	% (95%CI)		n	
Eight states							
Current	2,149	28.4 (25.5–31.4)	15.0 (12.7–17.4)	56.5 (53.6–59.4)	< 0.001	1,608	34.3
Male	637	39.8 (34.1–45.5)	15.8 (11.5–20.1)	44.4 (39.0–49.8)		409	33.6
Female	1,512	21.6 (18.6–24.5)	14.6 (12.0–17.2)	63.9 (60.5–67.2)	< 0.001	1,199	34.6
Former	889	48.1 (43.4–52.8)	22.6 (17.8–27.5)	29.3 (25.3–33.2)		474	26.5
Male	390	61.8 (55.3–68.3)	20.0 (14.4–25.5)	18.2 (13.3–23.2)		144	23.2
Female	499	35.0 (28.8–41.2)	25.2 (17.4–33.0)	39.8 (33.5–46.1)		330	28.3

^aAsthma prevalence as determined by respondent’s answer to core BRFSS 2001 Survey questions, (“Have you ever been told by a doctor, nurse or other health professional that you had asthma?”; “Do you still have asthma?”) where CURRENT asthma = “Yes” to both questions. FORMER asthma = “Yes” to “Ever Told” and “No” to “Still Have” and NEVER (Had) asthma = “No” to “Ever Told.”

^bRespondents reporting a medical diagnosis of asthma s “10 years or younger” are excluded, $n = 956$.

^cSignificance level (*p*) is based on general association χ^2 test comparing percent differences for males and females.

TABLE 4.—Characteristics of respondents reporting current asthma^a by sex in eight states: BRFSS 2001.

Eight states	<i>n</i>	% (95%CI)	<i>p</i> ^b	Mean days/visits	<i>n</i>	Mean days/visits (1 or more)
Had asthma symptoms	2,172	78.2 (75.9–80.6)	0.17	n/a ^c	n/a	n/a
Male	647	75.9 (71.4–80.4)		n/a	n/a	n/a
Female	1,525	79.6 (77.0–82.2)		n/a	n/a	n/a
Had difficulty staying asleep	1,725	50.0 (46.6–53.4)	0.06	n/a	n/a	n/a
Male	497	45.3 (38.8–51.8)		n/a	n/a	n/a
Female	1,228	52.7 (49.0–56.5)		n/a	n/a	n/a
Took asthma medications	2,205	71.6 (68.8–74.3)	0.03	n/a	n/a	n/a
Male	654	67.3 (61.9–72.6)		n/a	n/a	n/a
Female	1,551	74.2 (71.1–77.2)		n/a	n/a	n/a
Had asthma attack	2,225	52.8 (49.8–55.7)	< 0.001	n/a	n/a	n/a
Male	664	45.9 (40.4–51.4)		n/a	n/a	n/a
Female	1,561	57.0 (53.6–60.3)		n/a	n/a	n/a
Had activity limitation	2,027	28.4 (25.6–31.1)	< 0.001	10.9	560	38.3
Male	605	21.6 (16.4–26.8)		12.0	122	55.5
Female	1,422	32.4 (29.2–35.6)		10.3	438	31.8
Had ER visit	2,228	17.3 (15.1–19.4)	< 0.001	0.4	384	2.2
Male	665	13.1 (9.8–16.4)		0.3	94	2.2
Female	1,563	19.8 (17.1–22.5)		0.4	290	2.2
Had doctor visit (urgent)	2,196	29.0 (26.3–31.7)	< 0.001	0.9	634	3.2
Male	655	22.4 (17.4–27.5)		0.7	137	3.1
Female	1,541	33.1 (29.9–36.2)		1.1	497	3.3
Had doctor visit (routine)	2,206	54.4 (51.3–57.5)	< 0.001	1.7	1,208	3.1
Male	660	45.0 (39.3–50.6)		1.4	299	3.1
Female	1,546	60.2 (56.9–63.5)		1.8	909	3.0

^aAsthma status was determined by respondent answer to Core BRFSS 2001 Survey questions, “Have you ever been told by a doctor, nurse or other health professional that you had asthma?”; “Do you still have asthma?” where CURRENT asthma = “Yes” to both questions.

^bSignificance level (*p*) is based on general association χ^2 test comparing percent differences for males and females.

^cMean cannot be estimated because of categorical response values.

asthma symptoms in the past 30 days (79.6% compared to 75.9%) and difficulty staying asleep (52.7% compared to 45.3%), these differences were not statistically significant. For the remaining six asthma control characteristics, the differences by sex were significant ($p < 0.05$), with females more likely than males to report:

- taking asthma medications in the past 30 days (74.2% compared to 67.3%),
- having an asthma attack or episode in the past 12 months (57.0% compared to 45.9%),
- days of activity limitation due to asthma (32.4% compared to 21.6%),
- emergency room visits for asthma (19.8% compared to 13.1%),
- doctor visits for worsening symptoms (33.1% compared to 22.4%),
- doctor visits for routine asthma checkups (60.2% compared to 45.0%).

We found considerable variation in the male/female differences in these asthma control indicators among the eight states using the module. For example, in Iowa there is a 24.9 percentage point difference between men and women who reported an asthma attack in the past year (38.9% and 63.8%, respectively), while in Mississippi, the difference is negligible (57.1% for men and 57.5% for women). In general, in each of the eight states, a higher proportion of females reported having a characteristic of poor asthma control (e.g., had an attack, had days of limitation because of asthma) than did males. However, most of the observed differences between males and females in the individual

states are not statistically significant because of small sample sizes.

We calculated the mean number of visits to the emergency room, the mean number of doctor's office visits for urgent care or routine asthma care, and the mean number of days of activity limitation due to asthma. The mean number of visits to the emergency room was similar for the sexes, with males reporting an average of 0.3 visits during the past year and females reporting an average of 0.4 visits. The mean number of visits to the doctor's office for urgent care or routine asthma care was higher for females compared to males. Females averaged 1.1 visits to the doctor's office for urgent care and 1.8 visits for routine asthma care. Males averaged 0.7 visits for urgent care and 1.4 visits for routine asthma care. While more females reported days of activity limitation, males were found to have a higher mean number of days of activity limitation. Males reported an average of 12.0 days of activity limitation in the past 12 months compared to 10.3 days for females. When restricting the analysis to the number of respondents that reported at least one day of activity limitation, the difference was more pronounced, with males reporting an average of 55.5 days of activity limitation compared to an average of 31.8 days of activity limitation for females.

DISCUSSION

Prevalence estimates for lifetime asthma diagnosis reported in this analysis for males and females (9.8% and 12.6%, respectively) are consistent with estimates reported in other national surveys. The 2001 National Health

Interview Survey, for example, reported 9.4% prevalence for males and 12.3% for females. The sex distribution for the respondents in the eight states was comparable to the 2000 U.S. Census Bureau distribution for males and females in each state (3). The lifetime asthma prevalence and current asthma prevalence reported for the eight states individually and combined were within the range for the 50 states, the District of Columbia, and the three territories asking the asthma prevalence questions in the 2001 BRFSS (4). Current asthma prevalence for the eight states was within the range of the state-specific estimates reported in the 2000 BRFSS and the sex-specific estimates within the states (5). The sex differences identified here are consistent with the self-reported annual asthma prevalence estimates for males and females found in the National Health Interview Survey between 1980 and 1999 (6).

The age at diagnosis question in the adult asthma module requires a lifetime medical diagnosis of asthma. Our results indicate a statistically significant difference in age at diagnosis for males and females at two distinct age levels: childhood (age 10 years and younger) and adulthood (age 18 years and older). Adult onset of asthma was reported more often by females and childhood onset reported more often by males. Stratification by respondents reporting current asthma and those reporting former asthma did not alter the results, with differences between males and females ranging from 18 to 26 percentage points. Our calculation of the mean age at diagnosis is limited by the inability to determine the age of diagnosis for those diagnosed at age 10 years or younger. However, after removing these respondents from the calculation, the mean age at diagnosis was still higher for females compared to males, regardless of current or former asthma status.

Our analysis of emergency department visits, physician office visits, and occurrence of asthma attacks or episodes support evidence from prior studies reporting annual rates of emergency department visits, physician office visits, and asthma attacks by sex. As reported in these studies, females reported emergency department visits, physician office visits, asthma attacks or episodes during the year more frequently than did males (7). We found that the differences between males and females were statistically significant for the respondents from these eight states combined. Differences at the state level were apparent, but statistical significance was not met because of the smaller sample sizes in the individual states.

In addition to our findings that corroborate previous studies, we also found previously unreported differences between males and females in prescribed asthma medication use, occurrence of asthma symptoms, days of activity limitation, and sleep disturbance attributed to asthma symptoms. Females were more likely to use medication, experience sleep difficulty because of asthma, and more often reported symptoms, but males had a higher mean number of days of activity limitation attributed to asthma. This result may be a function of the length of time males have been diagnosed with asthma compared with females. The difference between the mean number of days of activity limitation for males and females may also have

been influenced by the exclusion of miscoded responses to this question in the analysis.

The data presented are limited to the eight states using adult asthma module in 2001 and the male/female respondents with current asthma. The results from these eight states may not represent characteristics that would be found if similar data were available for all states. We also acknowledge that the accuracy of respondent reports of asthma diagnosis or asthma-control characteristics in the BRFSS has not been validated using medical records. However, a 1993 review of asthma survey questions by the Medical Research Council of Great Britain reported a mean sensitivity of 68% (range 48% to 100%) and a mean specificity of 94% (range 78% to 100%) when self-reported asthma was compared with a clinical diagnosis of asthma (8).

CONCLUSIONS

Self-reported lifetime and current asthma prevalence are higher among adult females than males. The data presented in this analysis support past results and provide additional insight about asthma control characteristics in the eight states using the BRFSS adult asthma module in 2001. Sex differences were found in each of the eight states. All eight states reported higher estimates for females from the core prevalence questions and the adult asthma module questions compared with males. State variation was evident by sex, but results should be interpreted with caution.

This report is a first step toward gaining a better understanding of asthma as a disease through self-report of diagnosis and asthma-control characteristics by survey respondents with current asthma in eight states. Identifying poorly controlled asthma in states or demographic subgroups within states will enable states to develop surveillance plans and to define intervention programs or policies specific to their needs.

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