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A National Study of Lifetime Asthma Prevalence and Trends in Metro and Non-Metro Counties, 2000-2003

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by

J. Elizabeth Jackson, PhD
Mark P. Doescher, MD, MSPH
L. Gary Hart, PhD

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WWAMI RURAL HEALTH RESEARCH CENTER

ABOUT THE CENTER

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L. Gary Hart, PhD, Principal Investigator and Director
Susan M. Skillman, MS, Deputy Director
Denise Lishner, MSW, Associate Director/Editor
Martha Reeves, Working Paper Layout and Production
WWAMI Rural Health Research Center
Department of Family Medicine
School of Medicine
University of Washington
Box 354982
Seattle, WA 98195-4982
E-mail: rhrc@fammed.washington.edu
WWW: http://depts.washington.edu/uwrhrc/

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ABOUT THE AUTHORS

J. ELIZABETH JACKSON, PhD, is a Research Assistant in the Department of Family Medicine, University of Washington School of Medicine.

MARK P. DOESCHER, MD, MSPH, is an Associate Professor in the Department of Family Medicine, University of Washington School of Medicine.

L. GARY HART, PhD, is Director of the WWAMI Rural Health Research Center and Professor in the Department of Family Medicine, University of Washington School of Medicine.

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ABSTRACT

BACKGROUND

Asthma has long been considered a problem of urban populations, but it is not an insignificant problem in rural areas. Unfortunately, recent information on asthma prevalence and trends among rural adults is limited.

OBJECTIVES

To estimate the prevalence of and recent trends in asthma among adults residing in metropolitan and non-metropolitan counties in the United States.

METHOD

Analysis of data from the Behavioral Risk Factor Surveillance System (BRFSS) national sample for the years 2000 (n = 184,450), 2001 (n = 212,510), 2002 (n = 247,964), and 2003 (n = 264,684). The outcome measured was lifetime asthma diagnosis from self-report.

RESULTS

In 2003, the adjusted prevalence of lifetime asthma diagnosis was 12.0 percent for metropolitan counties and 11.0 percent for non-metropolitan counties ($p < 0.001$). Prevalence of lifetime asthma diagnosis trended upwards across the rural-urban spectrum between 2000 and 2003, and states with the highest 2003 prevalence and the greatest increase in prevalence among non-metropolitan residents were concentrated in the West Census region (e.g., Arizona, California, Oregon and Washington). Asthma prevalence in non-metropolitan counties was highest for those aged 18 to 34 (15.9%), the unemployed (13.5%), American Indians (12.7%) and women (12.4%).

CONCLUSIONS

The prevalence of lifetime asthma is increasing at a similar rate among residents of both metropolitan and non-metropolitan counties, and is a particular problem for rural residents of some states. The recommended team approach to asthma diagnosis and treatment may be more difficult to implement in rural counties, and rising prevalence indicates the need for greater effort in this area.

INTRODUCTION

While the increasing prevalence of asthma and distribution of risk factors among urban residents has received a great deal of attention, such patterns have received less attention among residents of rural locations, primarily because of a lack of data.[1,2] By 2002, 11.8 percent of adults in the United States reported a lifetime prevalence of asthma and 7.5 percent reported current asthma.[3] Asthma's prevalence is higher among women than men and among African Americans than whites.[1,4] Many of the factors underpinning this increase, such as environmental triggers including tobacco smoke[5-7] and poor air quality,[8-10] and obesity[5,6,11] are related to socioeconomic status and may partly explain the higher incidence of asthma among the poor.[6,12]

The increase in asthma prevalence, combined with lower access to physician services in many rural areas,[13,14] argues for a better understanding of asthma prevalence among persons who reside in rural locales. The aim of this study is to examine the recent prevalence of (2003) and trends in (2000 to 2003) asthma diagnosis ("lifetime asthma prevalence") among a national sample of adults. This study capitalizes on the large sample size of the Behavioral Risk Factor Surveillance System (BRFSS) survey data collected by the Centers for Disease Control and Prevention (CDC); this is one of the few data sets large enough to allow examination of asthma prevalence by state and rural/urban residence. Specifically, we sought to examine whether the lifetime prevalence of asthma differed for adults who resided in rural locations compared to their urban counterparts and also whether the effects of risk factors for asthma, such as low socioeconomic status, differed by location.

METHODS

SAMPLE AND SUBJECTS

In 1984, the CDC established BRFSS for monitoring health risk behaviors.[15] BRFSS collects data annually on health-related behaviors that are useful for planning, initiating, monitoring, and evaluating health promotion and disease prevention programs. BRFSS is a state-based, random-digit-dialed telephone survey of the non-institutionalized U.S. adult population aged 18 years and older. BRFSS is conducted in the 50 states as well as the District of Columbia, Guam, Puerto Rico, and the Virgin Islands. This study focuses on 49 states and the District of Columbia. We obtained non-public use data retaining all county-level Federal Information Processing Standards (FIPS) codes[16] from the CDC. Alaska was excluded because necessary county-level FIPS codes were not available, making it impossible to deal with it in parallel with other states per the study's rural and urban definitions. Data from 2000 (n = 184,450), 2001 (n = 212,510), 2002 (n = 247,964) and 2003 (n = 264,684) were examined; because the study's core asthma questions were not asked in Illinois in 2000, this state was excluded from the 2000 analyses. The median response rate by state was 48.9 percent (range: 28.8 to 71.8%) in 2000 and 53.2 percent (range: 34.4 to 67.3%) in 2003. BRFSS is administered by telephone and its estimates for asthma diagnosis are comparable to estimates obtained by other survey methods. For instance, the BRFSS national estimate for self-reported asthma diagnosis in 2000 of 10.4 percent was slightly higher than the estimate of 9.3 percent produced by the National Health Interview Survey (NHIS) for the same year, an in-home survey with a response rate of 72.1 percent in 2000.[17]

DEPENDENT MEASURE

Lifetime asthma diagnosis was determined through self-report. Respondents were asked, "Have you ever been told by a doctor, nurse, or other health professional that you had asthma?"

INDEPENDENT MEASURES

Rural residence was ascertained by classifying county FIPS codes available on BRFSS. These were broadly grouped as metropolitan (urban) or non-metropolitan (rural) county of residence based on the widely used standard, county-based Office of Management and Budget (OMB) taxonomy, and this classification was further categorized using the 2003 Urban Influence Code (UIC) groupings of the Economic Research Service of the United States Department of Agriculture[18] as follows: "Metropolitan"—large and small metropolitan counties (codes 1-2); "Adjacent Non-Metro"—geographically adjacent to a metropolitan area, including both micropolitan and non-core counties (codes 3-7); "Remote Micropolitan"—not adjacent to a metropolitan county and with a town/urban cluster of 10,000 residents or greater (code 8); and "Remote Non-Core"—not adjacent to a metropolitan county and without a city of 10,000 residents or greater (codes 9-12). UIC adjacency is determined by county boundaries and a minimum work commuting criterion. Other measures included: race/ethnicity (non-Hispanic white, African American, American Indian, Asian/Pacific Islander, and Hispanic); sex; age (18-34, 35-49, 50-64, and 65 years or older); educational attainment (less than high school degree, high school degree or equivalent, greater than high school degree); annual household income (less than $25,000, $25,000-$49,999, $50,000-$74,999, $75,000 or greater); and employment status (employed, unemployed, out of the workforce). The American Indian category for race may include Alaska Natives living outside Alaska. Measures included in adjusted analyses but not presented were self-reported health (excellent, very good, good, fair, poor) and smoking status (current smoker, former smoker, never smoked).

ANALYTICAL PLAN

Analyses were weighted using the BRFSS weighting formula by the sex, age, and race/ethnicity distributions of the population in each area to make estimates nationally representative. Significance tests and 95 percent confidence intervals (CIs) were calculated by using SUDAAN software,[19] which adjusts standard errors to account for the complex sample design of the BRFSS, yielding more conservative statistical tests. Logistic regression analyses were performed to calculate the prevalence of asthma diagnosis and current symptoms, among respondents with a previous diagnosis; selected analyses present the interaction of rural-urban status with each factor individually. To facilitate interpretation of regression results, predicted percentages (i.e., marginal effects) are presented.[20] Temporal changes in prevalence of asthma diagnosis and current symptoms were analyzed by comparing estimates from 2000, 2001, 2002 and 2003.

RESULTS

From 2000 to 2003, in the United States overall, the unadjusted prevalence of lifetime asthma diagnosis increased from 10.4 percent to 11.9 percent. Table 1 presents the unadjusted and adjusted prevalence in the four metro/non-metro categories in 2003. The adjusted analyses show a significantly higher lifetime prevalence of asthma in metro counties than in either adjacent non-metro or remote non-core counties ($p < 0.001$).

Table 2 presents the adjusted lifetime prevalence of asthma for non-metro counties overall versus metro counties for selected covariates. Adjusted asthma prevalence was higher in metro counties than in non-metro counties (9.1%). The prevalence was lower with increasing age in both metro and non-metro counties

Table 1: Percent Respondents with Lifetime Asthma Diagnosis by County Type (2003)*

Factor	Metro		Adjacent Non-Metro		Remote Micropolitan		Remote Non-Core		Chi-Square
	%	(95% CI)	%	(95% CI)	%	(95% CI)	%	(95% CI)	p-value
Ever Diagnosed with Asthma									
Unadjusted	11.9	(11.7 , 12.2)	11.6	(11.1 , 12.1)	12.0	(11.0 , 12.9)	11.4	(10.5 , 12.4)	0.5774
Adjusted	12.0	(11.7 , 12.3)	11.0	(10.4 , 11.5)	11.4	(10.5 , 12.4)	10.8	(9.9 , 11.7)	0.0005

* Control variable included in the regressions are age, sex, race/ethnicity, education, income, employment status, self-reported health, and smoking status.

(test for trend, overall $p < 0.001$), and was significantly higher in women than men in both county types. The prevalence of asthma was highest for metro American Indians (15.6%) and metro African Americans (13.5%), and among non-metro residents, its prevalence was highest among American Indians (12.7%). The unemployed had significantly higher prevalence of asthma than the employed in both metro and non-metro counties.

Table 2: Percent Respondents with Lifetime Asthma Diagnosis by Metro/Non-Metro and Selected Characteristics (2003), Adjusted*

Factor	Metropolitan		Non-Metro	
	%	(95% CI)	%	(95% CI)
Overall	12.0	(11.7 , 12.3)	11.0	(10.6 , 11.5)
Race				
White	12.6	(12.2 , 12.9)	11.8	(11.3 , 12.3)
African American	13.5	(12.5 , 14.5)	10.2	(8.9 , 11.4)
Asian/Pac Islander	8.7	(6.9 , 10.6)	10.3	(6.6 , 14.0)
American Indian	15.6	(12.9 , 18.3)	12.7	(10.3 , 15.1)
Hispanic	8.3	(7.3 , 9.2)	7.6	(5.9 , 9.4)
Age				
18-34	15.9	(15.2 , 16.6)	15.9	(14.7 , 17.0)
35-49	12.0	(11.4 , 12.5)	10.3	(9.6 , 11.0)
50-64	11.2	(10.6 , 11.7)	9.3	(8.6 , 10.0)
65+	7.8	(7.3 , 8.3)	7.7	(7.0 , 8.3)
Sex				
Male	10.4	(9.9 , 10.8)	9.6	(9.0 , 10.2)
Female	13.5	(13.1 , 13.9)	12.4	(11.8 , 12.9)
Education				
< high school	11.3	(10.4 , 12.3)	11.5	(10.5 , 12.5)
High school	11.9	(11.5 , 12.3)	10.6	(10.1 , 11.1)
College degree	12.6	(12.1 , 13.1)	11.7	(10.8 , 12.6)
Income				
< 25K	12.2	(11.6 , 12.8)	11.6	(10.9 , 12.4)
>= 25K, < 50K	11.8	(11.3 , 12.4)	10.6	(9.8 , 11.3)
>= 50K, < 75K	11.9	(11.2 , 12.7)	11.2	(10.0 , 12.4)
75K +	12.8	(12.1 , 13.6)	10.2	(8.9 , 11.4)
Missing	10.7	(9.9 , 11.5)	10.6	(9.4 , 11.7)
Employment Status				
Employed	11.5	(11.2 , 11.8)	10.0	(9.5 , 10.5)
Unemployed	13.5	(12.1 , 14.9)	13.5	(11.4 , 15.6)
Out of labor force	12.7	(12.1 , 13.3)	12.3	(11.6 , 13.0)

* Control variables included in the regressions are age, sex, race/ethnicity, education, income, employment status, self-reported health, and smoking status.

Figure 1 presents the prevalence in asthma diagnosis in 2000 through 2003 for metro and the three non-metro county types. As indicated above, metro residents were significantly more likely in all years to report being diagnosed with asthma than non-metro residents. However, the lifetime prevalence of asthma increased for all but remote non-core counties over the study period (test for trend, metro $p < 0.0001$, adjacent non-metro $p < 0.0001$, remote micropolitan $p < 0.05$) and the slope of the increase was similar across the metro/non-metro spectrum.

Table 3 categorizes states by the 2003 lifetime prevalence of asthma and change in this prevalence (2000 to 2003) among respondents living in non-metro counties. States with the highest prevalence in asthma diagnosis among rural residents were concentrated in the West and Northeast regions, with western states, including the entire west coast, particularly likely to also have had the greatest increase since 2000; states with the highest 2003 asthma prevalence and the greatest increases in asthma

Figure 1: Trends in Adjusted Lifetime Prevalence of Asthma Diagnosis by County Type (95% confidence intervals)

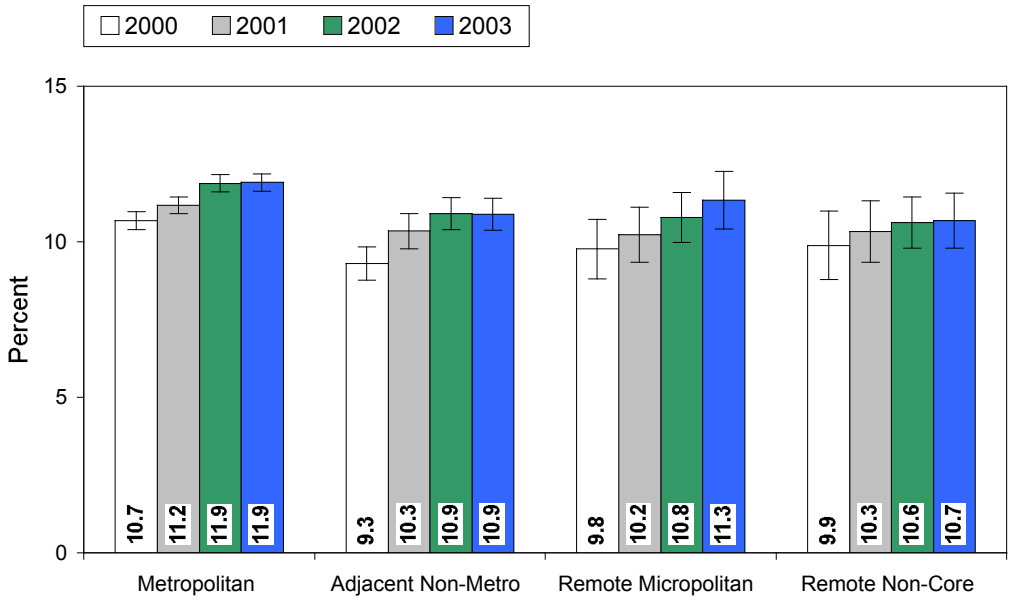

Table 3: Absolute Change in the Adjusted Lifetime Prevalence of Asthma Diagnosis from 2000 to 2003 by Adjusted Lifetime Prevalence of Asthma Diagnosis in 2003 for Non-Metro Adults*

Absolute Change, 2000 to 2003	**Prevalence (2003)**		
	Highest Prevalence (12.36-16.70%)	**Moderate Prevalence** (10.81-12.35%)	**Lowest Prevalence** (8.30-10.80%)
Greatest Absolute Increase (2.21 – 8.20 %)	*Arizona* *California* *Connecticut* Oregon *Pennsylvania* Virginia *Washington*	*Alabama* *Arkansas* Louisiana Ohio *Oklahoma*	
Moderate Absolute Increase (1.11 – 2.20 %)	Colorado *Kentucky* Maine New York	Idaho *Vermont*	Florida Georgia Iowa Kansas Nebraska *South Dakota*
Least Absolute Increase (0.01 – 1.10 %)	Hawaii Utah West Virginia	Missouri Nevada North Carolina Texas Wyoming	Mississippi New Mexico North Dakota South Carolina
Absolute Decrease (2.60 – 0.01%)	Michigan	Illinois Indiana New Hampshire Tennessee	Delaware Maryland Minnesota Montana Wisconsin

* Does not include Alaska (county FIPs codes unavailable), New Jersey, the District of Columbia or Rhode Island (no non-metro counties), or Massachusetts (insufficient observations); states in italics had a significant change in asthma diagnosis ($p < 0.05$).

prevalence since 2000 were Arizona, California, Connecticut, Oregon, Pennsylvania, Virginia and Washington. States with at least a 5 percent absolute increase (at least $p < 0.05$) were Connecticut (5.7%), Arizona (6.5%) and California (8.2%). States with moderate to low 2003 asthma prevalence among non-metro residents were concentrated in the Midwest and South regions. States with the smallest increase in non-metro asthma prevalence were concentrated in the West and South, while states showing a decrease in asthma prevalence were concentrated in the Midwest and South.

DISCUSSION

Asthma was more prevalent in metro than in non-metro counties in 2000 through 2003. It increased significantly and similarly over that period for all but remote non-core counties. The estimated absolute percentage increases of 1.4 percent in metro counties and 1.7 percent in non-metro counties translates into an increase of nearly four million metro residents and one million non-metro residents diagnosed with asthma nationally between 2000 and 2003. In 2003, groups particularly likely to report having asthma (regardless of residence loca-

tion) were American Indians, women, the unemployed, and younger adults (18 to 34 years). The prevalence of asthma also was relatively high for urban African Americans, which is consistent with a CDC report that African Americans experienced more asthma attacks and required treatment more often for asthma than did whites.[21] In contrast, the prevalence for rural African Americans was not elevated relative to non-Hispanic whites. Among rural residents, states with the highest 2003 prevalence of asthma diagnosis were concentrated in the West and Northeast.

These findings are subject to several limitations. BRFSS does not sample persons living in institutions or persons living in households without a telephone. Prevalence estimates and trend data could have been affected by low response rates; however, BRFSS employs post-stratification weights to make the estimates representative of the population.[22] The race/ethnicity groupings available in BRFSS data would not allow any important differences between heterogeneous subgroups within these broad categories to be investigated. The use of self-report rather than objective measurement for asthma diagnosis likely results in an overestimate of asthma prevalence[23] and the use of subjective measures for assessing trends in asthma may result in findings that are confounded by factors like changing public awareness and physician behavior.[24,25] Consequently, the increasing lifetime prevalence of asthma nationally may be due, at least in part, to a more aggressive approach to asthma diagnosis by clinicians in recent years rather than a true increase in its underlying prevalence. None of these limitations, however, seem likely to bias the observed differences between metro and non-metro respondents. For example, the rate of increase in the prevalence of asthma is similar across the metro/non-metro continuum.

Given the increasing prevalence of asthma in rural locations, efforts to better address this illness are needed. For example highly effective interventions, such as controller medications, exist,[26,27] but are underprescribed.[2,28] In particular, intensifying treatment in high-risk groups, including minority group members and those with lower socioeconomic status, is warranted. To do this, a team approach to asthma control has been recommended by the National Heart, Lung and Blood Institute (NHLBI).[29] The NHLBI recommendations for management include control of factors that trigger attacks as well as pharmacologic therapy for long term and short term control.

However, because rural healthcare delivery systems are often financially stressed, with scarce healthcare providers, such a team approach can be difficult to realize in rural areas. The disease can be particularly burdensome to rural residents who either travel long distances for care or forego needed treatment, especially in emergency situations. These situations occur more often among those least able to deal with them: the rural young, unemployed, and/or American Indian. Given the growing burden of this condition, efforts are needed to improve asthma education and training in rural areas for both healthcare professionals and patients, as well as to provide better access to high-quality care.

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