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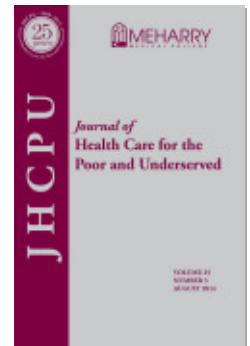
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Self-reported Asthma among American Indian and Alaska Native People in Alaska

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Abstract: This study describes the lifetime prevalence of self-reported asthma among American Indian and Alaska Native (AI/AN) people who participated in the Education and Research Towards Health (EARTH) study in Alaska. We conducted a cross-sectional analysis of asthma prevalence by sex and its associations with sociodemographic, health, and environmental factors. Among 3,828 AI/AN adults, we found a higher age-sex adjusted prevalence of asthma (15.4%) than is found in the general U.S. adult (11.0%) population based on the 2006 National Health Interview Survey. After multivariable analysis, self-reported asthma among men was associated with increased age, unemployment, lower income, and obesity. Among women, self-reported asthma was associated with increased age, being divorced/separated, living in Alaska's southcentral region, self-reported fair/poor health status, obesity, and indoor mold. Our data suggest that AI/AN adults have higher prevalence of lifetime asthma than the general U.S. population. Further study is necessary to understand asthma in this population.

Key words: Asthma, Alaska Native, American Indian, Alaska.

Asthma, one of the most prevalent chronic diseases in the U.S., contributes to increased mortality and morbidity and disproportionately affects certain racial groups.¹⁻⁴ The 2006 National Health Interview Survey (NHIS) reported 11% of the U.S. general adult population had ever been told by a doctor or other health professional that they ever had asthma. The NHIS reported a higher current prevalence of 12.1% and a higher ever-asthma prevalence of 18.1% for American Indian and Alaska Native (AI/AN) people nationally.⁵ Although national surveillance systems include AI/AN people, they provide little information about the rates and associations of asthma among the multiple subgroups of this population because they are often represented in small numbers or grouped with other racial and ethnic categories. Little is known about the factors associated with asthma among AI/AN people.

Most studies of asthma among AI/AN adults have focused on hospitalization rates and doctor visits. Few studies have assessed asthma and its associated risk factors among

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AI/AN adults. One study found a slightly lower age-adjusted hospitalization rate for AI/AN people overall in the U.S. than the U.S. general population (12.9 vs. 16.4 per 10,000 respectively) from 2000 to 2002.⁶ The St. Regis Mohawk tribal health system in New York reported asthma prevalence rates among AI/AN persons similar to the U.S. general population except for individuals aged 75 years and older.⁷ The Strong Heart Study of American Indian (AI) elders over 50 years of age found prevalence rates for asthma similar to other ethnic groups.⁸ Among disabled adults 50 years and older, AI/AN people nationally reported a higher prevalence of asthma than White, Black, Asian or Hispanic people using the 2003 to 2005 Behavioral Risk Factor Surveillance System (BRFSS).⁹ Obesity, lower income, and less education were associated with asthma among AI people living in Montana based on the 2001 to 2006 BRFSS data.¹⁰

An asthma study using data from the Alberta health care system found that Aboriginal Canadians had higher rates for office and emergency room visits, received fewer referrals for specialty care and fewer spirometric tests for asthma than non-aboriginal people.¹¹ In Saskatchewan, registered Indian adults aged 35 to 64 years reported higher prevalence rates of asthma from 1991 to 1998 than the non-registered Indian population reported.¹²

This study describes the self-reported prevalence of a health provider diagnosis of asthma and the associated sociodemographic, health, and environmental factors among a large AI/AN cohort.

Methods

Overview. The Education and Research Towards Health (EARTH) study assessed the risk and protective factors for chronic disease among a cohort of AI/AN adults. Detailed methods have been described elsewhere.¹³ Participants provided information on self-reported medical conditions, sociodemographic, and other health-related factors.

Study population. The study population is a non-random sample of 3,828 AI/AN living in Alaska. Individuals were recruited through open-enrollment in 26 communities in the southcentral, southeastern, and southwestern regions of Alaska between March 2004 and August 2006. The southcentral region included AI/AN from several ethnic groups living in or near Alaska's largest city (population 350,000). Tlingit, Haida, and Tsimshian Indian people living in small communities (population 500–30,000) made up the southeast region. The southwest regions included Yup'ik people living in villages (population 200–5,500). The communities in the southeast and southwest regions were off the road system and accessible only by plane, snow machine, or boat. At each enrollment site, staff recruited individuals who met the following criteria: an AI/AN person eligible for Indian Health Service (IHS), aged 18 years or older, not pregnant at the time of the baseline visit, not undergoing chemotherapy, physically and mentally able to understand the consent form, complete survey instruments, and undergo medical tests.

Data collection. At the baseline visit, participants provided informed consent, completed several questionnaires, and underwent a panel of medical measurements. The intake questionnaire was interviewer-administered and collected data on sociodemographic characteristics. The Health, Lifestyle and Physical Activity Questionnaire was

administered using an audio computer assisted self-interview and collected self-reported information on physical activity, lifestyle, cultural practices, environmental exposures, cancer screenings, medical history, and family health history. Each participant received individual feedback at the end of the baseline study visit.¹³

The Alaska Area Institutional Review Board approved the Alaska EARTH study. In addition, the research committees and the governing bodies of the participating regional tribal health organizations and the local tribal councils of each participating community approved the study. A Tribal Advisory Board and a Scientific Advisory Board provided oversight throughout the study.

Definition of variables. Participants self-reported having asthma by responding affirmatively to the following question: *Did a doctor or other health care provider ever tell you that you had asthma?* Tribal review committees recommended a slight modification of this question from the BRFSS asthma question that asks, *Have you ever been told by a doctor, nurse, or other health professional that you had asthma?* and the NHIS that asks, *Have you ever been told by a doctor or other health professional that you had asthma?* This change more accurately captures the Alaska Tribal Health System, where individuals are exposed to a wider range of health care professionals including certified community health aides in rural areas. Participants were not asked if they currently have a diagnosis of asthma. We will refer to self-reported ever-asthma as *lifetime asthma* throughout this paper.

The sociodemographic variables included in this analysis were age, gender, education, employment, marital status, income, region, and language spoken at home. Educational attainment was categorized into four categories: less than a high school diploma; high school diploma or GED; some college (some vocational/technical school, technical school degree/certificate, Associate degree or some college credits); and Bachelor's degree or higher (Bachelor's or professional degree). Employment status was categorized into the following: employed (employed for wages, self-employed, between seasonal jobs, or out of work for less than one year) and unemployed (out of work for more than one year, homemaker, student, retired, or disabled). Those who were out of work for less than one year were included in the employed category because of the intermittent and seasonal nature of work in rural Alaska. Marital status was separated into five categories: married, widowed, divorced, never married, or living with a partner. Income was dichotomized into \$20,000/year or less and more than \$20,000/year because it matched the NHIS income categories and it was only slightly higher than the median household income of the study population (\$15,000/year). The language spoken at home was categorized as speaking only a Native language, only English, or both.

Self-reported health status was dichotomized as excellent/very good/good *versus* fair/poor. Body mass index (BMI) was calculated based upon the standard formula (kg/m^2) using measurements of height and weight at the baseline study visit and was categorized as normal (18.5–24.9), overweight (25.0–29.9), or obese (≥ 30). Smoking status was categorized into never, former, and current or intermittent. Never smokers were participants who reported that they have never smoked cigarettes. Participants who reported smoking at least 100 cigarettes in their life and smoked regularly (at least one cigarette a day for three months or longer) in the past were categorized as

former smokers. Participants who reported that they smoked more than 100 cigarettes and smoked regularly at the time of the survey were considered current smokers. In addition, *current smokers* includes participants who reported smoking more than 100 cigarettes, but did not report smoking regularly. A participant was categorized as exposed to secondhand smoke if the person reported being in close contact for more than one hour per week with people who were smoking including in the home, work place, restaurants, bars, casinos, bingo halls, and friends' or relatives' houses. In addition, a participant was categorized as exposed to secondhand smoke if s/he reported that people, including regular visitors, smoked cigarettes inside their home. Current smokers were not included in the categorizations of secondhand smoke exposure. Presence of pets in the home, and wood used as fuel to heat the home were dichotomized into yes or no responses.

We asked eight questions about participants' environmental work exposures (six months or more) and one question about environmental exposures during U.S. military service. We aggregated the responses into three groups: asthmogenic, non-asthmogenic, and no exposures. Asthmogenic exposures included mineral or mining dust; pesticides including crop or livestock insecticides, weed killers, or fungicides; heavy metals including cadmium or mercury; and silversmithing or welding. Non-asthmogenic exposures included asbestos; lead; gasoline or other petroleum products; and radioactive materials including x-ray radiation. In addition, exposure to biological/chemical agents in military training or combat including Agent Orange or depleted uranium were included in the non-asthmogenic group.¹⁴⁻¹⁶ Reported indoor mold was categorized as extensive, some, or none. Any participant who reported ever having had more than one square foot of mold for more than two weeks on any interior surface of the home (excluding mold and mildew on bathroom tiles or mold on food) was categorized as having extensive indoor mold. Any participant who reported ever having mold present on interior surfaces of the home but did not meet the criteria for extensive indoor mold was categorized as having some indoor mold.

Analysis. Data were analyzed using the Statistical Analysis Software, 9.1 (SAS Institute Inc., Cary, NC). We excluded 94 participants from the analysis who answered *Don't know* or did not answer the asthma question (2.5% of the total study population). The excluded participants tended to be aged 75 or older. We calculated unadjusted prevalence of lifetime asthma by sociodemographic characteristics. We age and sex adjusted the prevalence to the 2000 U.S. standard population because our study sample was younger and included more women than men, and because the sociodemographic characteristics were significantly different between men and women using chi-squared tests. We compared the adjusted prevalence to the age-adjusted U.S. prevalence of asthma in the NHIS.¹⁷ To evaluate associations between asthma and specified variables, we performed chi-squared tests to determine the differences in proportions between those who had lifetime asthma and those who did not by gender. We included significant variables from the univariable analysis in the multivariable analysis. We analyzed the data by sex because of substantial differences between men and women identified in risk factor associations. We considered p-values less than .05 to be statistically significant.

Results

Table 1 displays the sociodemographic characteristics of 3,828 Alaska EARTH study participants.

Table 2 shows that the age-sex adjusted lifetime asthma prevalence among participants in our study was higher (15.4%) than among the U.S. general population (11.0%) reported from the NHIS. In our study, the age-adjusted lifetime prevalence was higher among women (19.2%) than men (11.6%), similar to the U.S. data (women—12.5% and men—9.5%). The age-specific prevalence of lifetime asthma in this study cohort was higher than the U.S. for those aged 45 years or older. Study participants demonstrated a higher adjusted prevalence of lifetime asthma than the U.S. for all education levels, except those who have some college education; those earning greater than \$20,000; and those married or never married.

Table 3 shows univariable results by sex for sociodemographic and health factors. Lifetime asthma in men and women was associated with increased age except among women aged 75 years or older. Among men, lifetime asthma was associated with higher education, unemployment, being widowed, lower income, and obesity. Among women, lifetime asthma was positively associated with being divorced/separated, living in Alaska's southcentral region, self-reported fair/poor health status, higher BMI, former smoking, and indoor mold. Among women, lifetime asthma was negatively associated with pets in the home and using wood to heat the home.

Table 4 presents the multivariable logistic regression results for men and women. After adjustment for variables significant in univariable analysis, factors associated with lifetime asthma among men were: increased age, unemployment, lower income and higher BMI. Among women, lifetime asthma was associated with increased age, being divorced/separated, living in Alaska's southcentral region, a fair/poor health status, higher BMI, and some or extensive indoor mold.

Discussion

This study found a self-reported age-sex adjusted prevalence of lifetime asthma of 15.4% among AI/AN adults. This is higher than has been found in other large surveillance studies of the general U.S. population such as the 2006 NHIS in which the prevalence of lifetime asthma was 11.0% and the 2006 BRFSS lifetime prevalence which was 13.0%.¹⁸ It is also higher than the prevalence reported among Alaska Native (AN) people for the 2005–2007 Alaska BRFSS (9.0%).¹⁹

People from three different regions of Alaska participated in the study and the asthma prevalence differed by region. Women in the southcentral region reported a higher prevalence of asthma than the other regions. This region includes the largest city in Alaska as well as the Alaska Native Medical Center, the largest hospital for AI/AN people in Alaska. Several national studies of asthma observed regional differences across the U.S.^{1–4,6} We are unable to assess if the high prevalence in the southcentral region is due to environmental causes; whether individuals with chronic conditions move closer to health care services; or whether easier access to health care increases the likelihood of receiving a health provider diagnosis of asthma.

Table 1.**CHARACTERISTICS OF ALASKA EARTH (EDUCATION AND RESEARCH TOWARDS HEALTH) STUDY PARTICIPANTS**

	Total (N=3,734) N (%)	Males (N=1,465) N (%)	Females (N=2,269) N (%)
Age group (years)*			
18–24	667 (17.9)	294 (20.1)	373 (16.4)
25–34	731 (19.6)	266 (18.2)	465 (20.5)
35–44	918 (24.6)	354 (24.2)	564 (24.9)
45–54	775 (20.8)	314 (21.4)	461 (20.3)
55–64	379 (10.2)	142 (9.7)	237 (10.5)
65–74	193 (5.2)	71 (4.9)	122 (5.4)
75+	71 (1.9)	24 (1.6)	47 (2.1)
Education status*			
Less than high school diploma	830 (22.4)	366 (25.2)	464 (20.7)
High school diploma or GED	1371 (37.1)	611 (42.1)	760 (33.8)
Some college	1289 (34.9)	430 (29.6)	859 (38.3)
Bachelor's degree or higher	209 (5.7)	46 (3.2)	163 (7.3)
Employment status*			
Employed	2482 (66.7)	1015 (69.5)	1467 (64.9)
Unemployed	1240 (33.3)	445 (30.5)	795 (35.2)
Marital status*			
Married	1330 (35.8)	398 (27.3)	932 (41.3)
Widowed	178 (4.8)	41 (2.8)	137 (6.1)
Divorced or separated	595 (16.0)	199 (13.6)	396 (17.5)
Never married	1345 (36.2)	713 (48.8)	632 (28.0)
Living with a partner	271 (7.3)	109 (7.4)	162 (7.2)
Income (\$)*			
≤20,000	1588 (49.6)	721 (57.9)	867 (44.3)
>20,000	1614 (50.4)	524 (42.1)	1090 (55.7)
Alaska region*			
Southcentral	1368 (36.6)	448 (30.6)	920 (40.6)
Southwest	1493 (40.0)	693 (47.3)	800 (35.3)
Southeast	873 (23.4)	324 (22.1)	549 (24.2)
Language spoken at home*			
Native only	293 (7.9)	148 (10.1)	145 (6.4)
English only	2492 (67.0)	930 (63.7)	1562 (69.1)
Native and English	936 (25.2)	383 (26.2)	553 (24.5)

*p-value <.05

Table 2.

CRUDE AND AGE-ADJUSTED PREVALENCE (%) OF SELF-REPORTED LIFETIME ASTHMA IN THE
2006 NATIONAL HEALTH INTERVIEW SURVEY (U.S.) AND THE EARTH
(EDUCATION AND RESEARCH TOWARDS HEALTH) STUDY PARTICIPANTS IN ALASKA

	Age Adjusted U.S. ^a	Confidence Interval	Unadjusted EARTH Study	Confidence Interval	Age-sex Adjusted EARTH Study	CI
Overall	11.0	(10.5–11.5)	15.2	(13.9–16.4)	15.4	(14.1–16.6)
Gender						
Male	9.5	(8.8–10.2)	9.8	(8.3–11.5)	11.6 ^b	(9.7–13.4)
Female	12.5	(11.8–13.2)	18.6	(16.8–20.4)	19.2 ^b	(17.4–21.0)
Age (years)						
18–44	11.5	(10.8–12.2)	13.0	(11.5–14.5)	NA	NA
45–64	10.5	(9.7–11.3)	17.7	(15.3–20.1)	NA	NA
65–74	11.7	(10.2–13.2)	22.8	(16.1–29.5)	NA	NA
75+	9.3	(7.9–10.8)	23.9	(12.6–35.3)	NA	NA
Education status						
Less than high school diploma	10.6	(9.4–11.8)	18.3	(14.9–21.7)	16.8	(13.7–20.0)
High school diploma or GED	9.5	(8.6–10.4)	12.4	(10.3–14.5)	12.6	(10.5–14.7)
Some college	12.3	(11.2–13.4)	17.1	(14.7–19.5)	15.1	(13.0–17.3)
Bachelor’s degree or higher	9.9	(8.9–10.9)	18.9	(12.9–24.9)	17.4	(11.8–22.9)
Income (\$) ^c						
≤20,000	15.4	(14.2–16.6)	15.6	(13.6–17.5)	16.2	(14.2–18.2)
>20,000	10.5	(9.9–11.1)	15.2	(13.3–17.1)	13.5	(11.8–15.2)

(Continued on p. 1271)

Table 2. (continued)

	Age Adjusted U.S. ^a	Confidence Interval	Unadjusted EARTH Study	Confidence Interval	Age-sex Adjusted EARTH Study	CI
Marital status						
Married	9.8	(9.1–10.5)	15.6	(13.5–17.8)	15.1	(13.0–17.1)
Widowed	11.0	(5.6–16.4)	21.4	(14.6–28.1)	10.6	(7.2–14.0)
Divorced or separated	14.4	(12.8–16.0)	20.2	(16.6–23.8)	19.0	(15.6–22.4)
Never married	12.2	(10.9–13.6)	11.9	(10.1–13.7)	17.4	(14.7–20.1)
Living with a partner	10.7	(8.4–13.1)	14.0	(9.6–18.5)	13.1	(8.9–17.2)

^aPleis JR, Lethbridge-Çejku M. Summary health statistics for U.S. adults: National Health Interview Survey, 2006. National Center for Health Statistics. Vital Health Stat 10(235). 2007.

^bAge-adjusted only.

^cThe EARTH income categories are ≤\$20,000 and >\$20,000; whereas, the National Health Interview Survey categories are <\$20,000 and ≥\$20,000.

The high asthma prevalence may be due partially to the indoor environment. Our study found a relationship between indoor mold and asthma among women, and strong associations have been found in other studies between mold or dampness and respiratory symptoms and doctor-diagnosed asthma.^{20,21} We did not observe the same relationship among men. Women may spend more time indoors and may be more aware

Table 3.

**SOCIODEMOGRAPHIC AND HEALTH FACTORS BY
SELF-REPORTED LIFETIME ASTHMA STATUS AMONG
EARTH (EDUCATION AND RESEARCH TOWARDS HEALTH)
STUDY PARTICIPANTS**

	Men (N=1,465)		Women (N=2,269)	
	Lifetime Asthma N (%)	p-value	Lifetime Asthma N (%)	p-value
Age group (years)				
18–44	68/846 (7.4)		233/1169 (16.6)	
45–64	53/403 (11.6)		151/547 (21.6)	
65–74	15/56 (21.1)		29/93 (23.8)	
75+	8/16 (33.3)	<.001	9/38 (19.2)	.01
Education status				
Less than high school diploma	40/326 (10.9)		91/373 (19.6)	
High school diploma or GED	44/567 (7.2)		130/630 (17.1)	
Some college	51/379 (11.9)		164/695 (19.1)	
Bachelor's degree or higher	7/39 (15.2)	.03	33/130 (7.9)	.60
Employment status				
Employed	75/940 (7.4)		258/1209 (17.6)	
Unemployed	68/377 (15.3)	<.001	163/632 (20.5)	.09
Marital status				
Married	44/354 (11.1)		164/768 (17.6)	
Widowed	10/31 (24.4)		28/109 (20.4)	
Divorced or separated	20/179 (10.1)		100/296 (25.3)	
Never married	63/650 (8.8)		97/535 (15.4)	
Living with a partner	7/102 (6.4)	.01	31/131 (19.1)	<.01
Income (\$)				
≤\$20,000	82/639 (11.4)		165/702 (19.0)	
>\$20,000	38/486 (7.3)	.02	207/883 (19.0)	.98
Alaska region				
Southcentral	48/400 (10.7)		235/685 (25.5)	
Southwest	34/290 (10.5)		78/471 (14.2)	
Southeast	62/631 (9.0)	.56	109/691 (13.6)	<.001

(Continued on p. 1273)

Table 3. (continued)

	Men (N=1,465)		Women (N=2,269)	
	Lifetime Asthma N (%)	p-value	Lifetime Asthma N (%)	p-value
Language spoken at home				
Native only	20/128 (13.5)		29/116 (20.0)	
English only	92/838 (9.9)		295/1267 (18.9)	
Native and English	31/352 (8.1)	.17	96/457 (17.4)	.66
Self-reported health				
Excellent/Very Good/Good	103/1013 (9.2)		278/1406 (16.5)	
Fair/Poor	40/308 (11.5)	.21	144/441 (24.6)	<.001
Body Mass Index ^a				
Normal (18.5–24.9)	33/424 (7.2)		53/415 (11.3)	
Overweight (25.0–29.9)	45/460 (8.9)		108/550 (16.4)	
Obese (≥ 30)	62/402 (13.4)	.01	254/848 (23.1)	<.001
Smoking status				
Never	34/320 (9.6)		159/795 (16.7)	
Former	45/320 (12.3)		128/417 (23.5)	
Current and Intermittent	65/680 (8.7)	.16	135/634 (17.6)	<.01
Secondhand smoke exposure ^b				
No	40/261 (13.3)		129/558 (18.8)	
Yes	50/456 (9.9)	.17	147/643 (18.6)	.93
Work-related exposures ^c				
Asthmogenic	23/162 (12.4)		26/76 (25.5)	
Non-asthmogenic	49/486 (9.2)		54/168 (24.3)	
No exposures	14/91 (13.3)	.26	6/23 (20.7)	.87
Pets in home				
Yes	103/939 (9.8)		236/1166 (16.8)	
No	40/366 (9.9)	.99	182/666 (21.5)	<.01
Wood as fuel heat				
Yes	15/151 (9.0)		22/150 (12.8)	
No	127/1152 (9.9)	.72	393/1678 (19.0)	.04
Indoor mold				
None	93/872 (9.6)		234/1186 (16.5)	
Some	23/212 (9.8)		93/383 (19.5)	
Extensive	7/68 (9.3)	.99	40/100 (28.6)	<.01

^aDoes not include 23 people with a Body Mass Index.^bDoes not include current smokers.^cAsthmogenic work exposures included: mineral or mining dust; pesticides including crop or livestock insecticides, weed killers, or fungicides; heavy metals including cadmium or mercury; and silversmithing or welding. Non-asthmogenic work exposures included: asbestos; lead; gasoline or other petroleum products; and radioactive materials including x-ray radiation. In addition exposure to biological or other chemical agents in military training or combat including Agent Orange or depleted uranium were included in the non-asthmogenic group.

Table 4.
MULTIVARIATE ASSOCIATIONS WITH SELF-REPORTED
LIFETIME ASTHMA AMONG EARTH (EDUCATION AND
RESEARCH TOWARDS HEALTH) STUDY PARTICIPANTS

	Males		Females	
	Odd Ratio	95% Confidence Interval	Odd Ratio	95% Confidence Interval
Age (Continuous)	1.019	1.003–1.036	1.012	1.002–1.023
Education status (Reference— Less than high school diploma)				
High school diploma or GED	0.884	0.516–1.516		
Some college	1.670	0.983–2.839		
Bachelor’s degree or higher	2.517	0.965–6.561		
Employment status (Reference—Employed)	1.802	1.174–2.768		
Marriage status (Reference—Married)				
Widowed	1.298	0.499–3.377	1.203	0.702–2.060
Divorced or separated	0.718	0.382–1.348	1.482	1.079–2.037
Never married	1.150	0.679–1.948	0.953	0.673–1.350
Living with a partner	0.727	0.306–1.729	1.043	0.642–1.695
Income (Reference— ≤\$20,000)	0.571	0.358–0.910		
Alaska region (Reference—Southeast)				
Southwest			1.209	0.843–1.735
Southcentral			2.730	1.974–3.777
Self-report health status (Reference— Excellent/Very good/Good)			1.643	1.267–2.131
BMI (Continuous)	1.033	1.005–1.063	1.034	1.018–1.051
Smoking status (Reference—Never)				
Former			1.188	0.885–1.595
Current and intermittent			0.854	0.637–1.144
Pets (Reference—None)			1.236	0.967–1.579
Wood (Reference—No wood used to heat home)			0.963	0.569–1.629
Indoor mold (Reference—None)				
Some			1.496	1.120–1.997
Extensive			2.340	1.539–3.558

of and/or exposed to indoor mold. On univariable analysis, our study found negative associations between asthma among women and pets in the home and using wood for heating the home, although these relationships did not reach statistical significance in the multivariable analysis. It is possible that women with asthma may have taken steps to remove these exposures from their homes. The question regarding wood did not clarify the type of wood used or whether the wood was burned in a closed or open device, which would affect exposure levels to wood smoke. The type of wood used for heating in Alaska may vary depending on the location since the arctic tundra does not grow large trees and some areas may use alternate types of wood such as wood pellets, which may impact the relationship between asthma and using wood for heating the home. The question about pets did not clarify whether the pets were always inside the home, which may impact the relationship with asthma. We obtained limited data on secondhand smoke, which restricts the ability to assess the indoor environment in this analysis. The way that the questions were asked about secondhand smoke led to information that was questionable.

We found univariable and multivariable associations between BMI and asthma among both men and women. Other studies observed associations between obesity and asthma, although these studies have not demonstrated a causal pathway and the meaning remains unclear.^{22–27}

There are several limitations to this study. First, we do not know the validity of the participant's self-report of asthma and/or the participant's recall of an asthma diagnosis. A review of asthma questionnaires reported a mean sensitivity of 68% (range: 48%–100%) and a mean specificity of 94% (range: 78%–100%) when self-reported asthma was compared with a physician's clinical diagnosis of asthma.²⁸ Additional limitations associated with these data include the possibility of selection bias (people who frequently visited their health care providers may have been more likely to enroll in the study than those who visited their health care providers less often) and the exclusion of people living in other regions of Alaska whose rates might be different. The recruitment methods may have limited the nature of the study population. While attempts were made to enroll all eligible persons in each community, elders and individuals in poor health may have been unable to reach the enrollment site and may be underrepresented in the sample.

One major limitation of this study is the non-random sampling technique. Attempts were made to enroll 100% of eligible individuals in each community. The participation ranged from 2% to 49%, with a median of 29%, based upon the community's AI/AN population in the 2000 U.S. Census.²⁹ Random sampling would not have been culturally or socially acceptable in Alaska's rural and frontier communities. While there are limitations to the sample, this is one of the largest studies of AI/AN people with nearly 4,000 participants and the study participants' sociodemographics were similar to the U.S. census data for the AI/AN population of each region with the exception of sex.¹³ In this study, we accounted for the sex difference through the age-sex adjustments and sex specific analysis of associations. In addition, the people included in this study were from three of the largest tribal health organizations in Alaska, which collectively serve 60% of the statewide AI/AN population. For these reasons, we believe prevalence estimates may be established from the sample.

In summary, we found a prevalence of lifetime asthma among a cohort of AI/AN adults in Alaska of 15.4%. This analysis provides preliminary estimates of the burden of asthma in AI/AN people from three regions of Alaska. Factors associated with asthma varied between men and women. There are few data available on this population and this analysis documents some of the sociodemographic and environmental factors associated with asthma among this population. Further study is necessary to understand asthma among AI/AN people.

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Conflict of Interest

No authors have any financial support or benefits from commercial sources for the work reported or any other potential financial conflicts of interest.

Abbreviations

AI/AN	American Indian and Alaska Native
AI	American Indian
AN	Alaska Native
BMI	Body Mass Index
BRFSS	Behavioral Risk Factor Surveillance System
EARTH	Education and Research Towards Health
GED	General Education Diploma
IHS	Indian Health Service
NCI	National Cancer Institute
NHIS	National Health Interview Survey

Notes

1. Evans R 3rd, Mullally DI, Wilson RW, et al. National trends in the morbidity and mortality of asthma in the U.S. Prevalence, hospitalization and death from asthma over two decades: 1965–1984. *Chest*. 1987 Jun;91(6 Suppl):65S–74S.
2. Mannino DM, Homa DM, Akinbami LJ, et al. Surveillance for asthma—United States, 1980–1999. *MMWR Surveill Summ*. 2002 Mar 29;51(1):1–13.
3. Mannino DM, Homa DM, Pertowski CA, et al. Surveillance for asthma—United States, 1960–1995. *MMWR CDC Surveill Summ*. 1998 Apr 24;47(1):1–27.
4. Moorman JE, Rudd RA, Johnson CA, et al. National surveillance for asthma—United States, 1980–2004. *MMWR Surveill Summ*. 2007 Oct 19;56(8):1–54.

5. Pleis JR, Lethbridge-Cejku M. Summary health statistics for U.S. adults: National Health Interview Survey, 2006. *Vital Health Stat* 10. 2007 Dec;(235):1–153.
6. Singleton RJ, Holman RC, Cobb N, et al. Asthma hospitalizations among American Indian and Alaska Native people and for the general U.S. population. *Chest*. 2006 Nov;130(5):1554–62.
7. Negoita S, Swamp L, Kelley B, et al. Chronic diseases surveillance of St. Regis Mohawk Health Service patients. *J Public Health Manag Pract*. 2001 Jan;7(1):84–91.
8. Dixon AE, Yeh F, Welty TK, et al. Asthma in American Indian adults: the Strong Heart Study. *Chest*. 2007 May;131(5):1323–30.
9. Okoro CA, Denny CH, McGuire LC, et al. Disability among older American Indians and Alaska Natives: disparities in prevalence, health-risk behaviors, obesity, and chronic conditions. *Ethn Dis*. 2007 Autumn;17(4):686–92.
10. Loveland KM, Kessler AC, Helgeson SD, et al. Is there a disparity in the prevalence of asthma between American Indian and White adults? *J Asthma*. 2008 Sep;45(7):557–60.
11. Sin DD, Wells H, Svenson LW, et al. Asthma and COPD among aboriginals in Alberta, Canada. *Chest*. 2002 Jun;121(6):1841–6.
12. Senthilselvan A, Lawson J, Rennie DC, et al. Stabilization of an increasing trend in physician-diagnosed asthma prevalence in Saskatchewan, 1991 to 1998. *Chest*. 2003 Aug;124(2):438–48.
13. Slattery ML, Schumacher MC, Lanier AP, et al. A prospective cohort of American Indian and Alaska Native people: study design, methods, and implementation. *Am J Epidemiol*. 2007 Sep 1;166(5):606–15.
14. Kennedy SM, Le Moual N, Choudat D, et al. Development of an asthma specific job exposure matrix and its application in the epidemiological study of genetics and environment in asthma (EGEA). *Occup Environ Med*. 2000 Sep;57(9):635–41.
15. Le Moual N, Siroux V, Pin I, et al. Asthma severity and exposure to occupational asthmagens. *Am J Respir Crit Care Med*. 2005 Aug 15;172(4):440–5.
16. Bates DV, Gotsch AR, Brooks S, et al. Prevention of occupational lung disease. Task Force on Research and Education for the Prevention and Control of Respiratory Diseases. *Chest*. 1992 Sep;102(3 Suppl):257S–76S.
17. Pleis JR, Lethbridge-Cejku M. Summary health statistics for U.S. adults: National Health Interview Survey, 2005. *Vital Health Stat* 10. 2006 Dec;(232):1–153.
18. Wells R. Health risks in Alaska among adults. Alaska Behavioral Risk Factor Survey 2006 (annual report). Juneau, AK: Alaska Department of Health and Social Services, 2007.
19. Holck P. Alaska Native Behavioral Risk Factor Surveillance System—2008 Report. Alaska Native Epidemiology Center. Alaska Native Tribal Health Consortium. Forthcoming 2010.
20. Heseltine E, Rosen J, eds. WHO guidelines for indoor air quality: dampness and mould. Copenhagen, Denmark: World Health Organization, 2009.
21. Fisk WJ, Lei-Gomez Q, Mendell MJ. Meta-analyses of the associations of respiratory health effects with dampness and mold in homes. *Indoor Air*. 2007 Aug;17(4):284–96.
22. Chen Y, Dales R, Jiang Y. The association between obesity and asthma is stronger in nonallergic than allergic adults. *Chest*. 2006 Sep;130(3):890–5.
23. Luder E, Ehrlich RI, Lou WY, et al. Body mass index and the risk of asthma in adults. *Respir Med*. 2004 Jan;98(1):29–37.
24. Akerman MJ, Calacanis CM, Madsen MK. Relationship between asthma severity and obesity. *J Asthma*. 2004 Aug;41(5):521–6.

25. Elamin EM. Asthma and obesity: a real connection or a casual association? *Chest*. 2004 Jun;125(6):1972–4.
26. Chen Y, Rennie D, Cormier Y, et al. Sex specificity of asthma associated with objectively measured body mass index and waist circumference: the Humboldt study. *Chest*. 2005 Oct;128(4):3048–54.
27. Kronander UN, Falkenberg M, Zetterstrom O. Prevalence and incidence of asthma related to waist circumference and BMI in a Swedish community sample. *Respir Med*. 2004 Nov;98(11):1108–16.
28. Toren K, Brisman J, Jarvholm B. Asthma and asthma-like symptoms in adults assessed by questionnaires. A literature review. *Chest*. 1993 Aug;104(2):600–8.
29. Schumacher MC, Slattery ML, Lanier AP, et al. Prevalence and predictors of cancer screening among American Indian and Alaska native people: the EARTH study. *Cancer Causes Control*. 2008 Sep;19(7):725–37. Epub 2008 Feb 29.