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Occupation and the Prevalence of Respiratory Health Symptoms and Conditions: The Atherosclerosis Risk in Communities Study

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Abstract

Objectives—To examine associations between occupation and respiratory health in a large, population-based cohort of adults in the United States.

Methods—Data from 15,273 participants, aged 45-64 years, in the Atherosclerosis Risk in Communities (ARIC) study were used to examine associations of current or most recent job held with the prevalence of self-reported chronic cough, chronic bronchitis, wheeze, asthma, and measures of lung function collected by spirometry.

Results—Eleven percent of participants reported wheeze and 9% were classified as having airway obstruction. Compared to individuals in managerial and administrative jobs, increased prevalences of respiratory outcomes were observed among participants in selected occupations, including construction and extractive trades (wheeze: prevalence ratio [PR]: 1.92, 95% confidence interval [CI]: 1.35, 2.73; airway obstruction: PR: 1.31, 95% CI: 1.05, 1.65).

Conclusions—Specific occupations are associated with adverse respiratory health.

Keywords

ARIC study; epidemiology; occupation; respiratory tract disease

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INTRODUCTION

Occupational exposures contribute to airway disease and impaired lung function (1-5). Exposures to respiratory irritants or sensitizing agents on the job can initiate respiratory symptoms among individuals without previous respiratory health conditions or exacerbate symptoms in individuals with pre-existing conditions (6, 7). Extensive epidemiologic research has identified workplaces and occupations in which employees and others are known to be at high risk for developing work-related symptoms of asthma; such occupations include animal handlers, bakers, electronics workers, healthcare workers, machinists, photographers, and other jobs in which workers are exposed to animals, plants, chemicals, enzymes, latex, metals, particulates, pharmaceuticals, wood dust, and other asthmagenic agents (7-19). A growing body of research now suggests that occupation may also be associated with impaired lung function, including chronic obstructive pulmonary disease (2-5).

Findings from general population-based epidemiologic research have provided evidence of elevated risk of respiratory disease in a wide range of occupational groups and among persons with specific workplace exposures (11, 17, 18, 20, 21). Data from the Atherosclerosis Risk in Communities (ARIC) study provide an additional opportunity to assess associations of occupation with self-reported and objective measures of respiratory health in a large, population-based cohort of men and women in the United States.

METHODS

The ARIC Study

We conducted an epidemiologic analysis using data collected from the ARIC study, a prospective cohort study designed to assess the etiology of atherosclerosis and its clinical sequelae in a general population-based sample of adults. The study design and methods are described in detail elsewhere (22). Briefly, 15,792 men and women, aged 45-64 years, were enrolled from four U.S. communities: Forsyth County, North Carolina; Jackson, Mississippi; suburbs of Minneapolis, Minnesota; and Washington County, Maryland. Initial survey of the population began in 1987-1989 with a baseline examination (‘visit 1’) that included extensive questionnaire and clinical evaluations. Each participant completed interviewer-administered questionnaires to provide information about his/her health history, current health status, and other social, demographic, and behavioral factors. Clinical examinations included spirometry. Institutional review boards of participating study centers approved the study protocol and instruments, and participants provided written informed consent.

Study Population

For this analysis, we selected 15,273 (97%) of the 15,792 participants who completed the visit 1 exam. Participants who restricted the use of their data to analysis of cardiovascular health outcomes (n=41) were not eligible for inclusion in this analysis of respiratory health. We then excluded participants who reported a race other than black or white (n=48), and those with missing information for the respiratory health (n=91), occupation (n=16), or smoking history (n=271) variables included in our analysis. To prevent deductive disclosure of the identities of the few remaining black participants recruited from suburbs of Minneapolis, Minnesota and from Washington County, Maryland, these participants (n=52) were also excluded.

Occupational Exposure Assessment

Each participant responded to a series of questions about his/her current employment status and current (or most recent) occupation. Responses about current employment status were

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used to identify a population of homemakers. For the remaining participants, the occupation identified as the current or most recent occupation was assigned a three-digit occupation code using the occupational classification system used for the 1980 Census of Population and Housing (23). Coding was performed centrally at the ARIC Coordinating Center. For our analyses, we grouped occupation codes into major categories of occupations using categories published by the 1980 Census of Population and Housing. Within each major category, occupational groups that included <1% of the study population (n<152) were classified into groupings of "other" occupations (e.g., other technical and sales occupations, other service occupations, other precision occupations).

Respiratory Health

Asthma was assessed using responses to a pair of questions that prompted the respondent to indicate whether he/she ever had asthma ("Have you ever had asthma?). Respondents who indicated that they have had asthma were then asked, "Do you still have it?" Those who indicated that they still have asthma were identified as currently having asthma; all others, including those who reported ever, but not still, having asthma were categorized as not having asthma. Responses to questionnaire items about individual respiratory symptoms were used to identify participant with chronic bronchitis, chronic cough, and wheeze. Chronic cough was assessed using a question about cough ("Do you usually cough as much as 4 to 6 times a day, 4 or more days out of the week?"). Participants with chronic cough and chronic phlegm ("Do you usually bring up phlegm like this as much as twice a day, 4 or more days out of the week?") were categorized as having chronic bronchitis. Wheeze was assessed using response about wheezing symptoms ("Does your chest ever sound wheezy or whistling apart from colds?").

Spirometry was conducted using Collins Survey II spirometers (24, 25). Testing methods were standardized across the four field centers and quality control measures were coordinated by a single pulmonary function reading center (25). Spirometry measurements used in this analysis include forced expiratory volume in one second (FEV_1) in mL and forced vital capacity (FVC) in mL; bronchodilation was not included in the spirometry protocol. For each participant, we applied race- and sex-specific equations to calculate values for the lower limit of normal (LLN) distributions of FEV_1 and the FEV_1/FVC ratio (26). We categorized participants with FEV_1<LLN and FEV_1/FVC<LLN as having airway obstruction.

Covariates

Demographic covariates used in this analysis include age, race, and sex. Health-related covariates included height, cigarette smoking status (lifetime non-smoker, former smoker with five or more years since quitting, former smoker with less than five years since quitting, current smoker), pack-years of smoking, and asthma history. Asthma history was categorized based on two questionnaire items: "Have you ever had asthma?" and "At what age did it start?" Individuals who reported having had asthma with onset at or before the age of 16 years were considered to have had childhood asthma.

Statistical Analysis

Associations between occupational group and asthma, chronic bronchitis, chronic cough, and wheeze were estimated using Poisson regression, specified with a log link and robust error variance estimation. For each outcome, associations are presented as prevalence ratios (PRs) with 95% confidence intervals (CIs) estimated using a single model in which the prevalence of the respiratory outcome was evaluated in each occupational category, relative to that in the referent category. The referent category included all participants who reported managerial occupations (occupation codes 003-037) or administrative support occupations,

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including clerical jobs (occupation codes 303-389). Unless otherwise specified, all models were adjusted for age, history of asthma, pack-years of smoking, race, sex, smoking status, and study center. Age was categorized into five-year age categories, which were also quartiles of the age distribution of our final study population (45-49, 50-54, 55-59, 60-64). We categorized the number of pack-years of smoking with less than 0.05 pack-years as the referent category and using quartiles of the distribution of pack-years among those with 0.05 or more than pack-year of smoking (0.05-11.0, 11.1-24.0, 24.1-39.0, 39.1-242.6).

To examine the associations between occupation and measures of lung function, we used data from participants for whom the best FVC measurement was generated during an exhalation of 6 seconds or more (n=14,497; 95%). Associations of occupation with FEV_1 and FVC were conducted using sex-stratified linear regression models; effect estimates are differences in FEV_1 and in FVC between each occupational group and the comparison population. The differences are presented as absolute differences in FEV_1 and FVC (in mL), adjusted for age (as a continuous variable), age squared, height, height squared, history of asthma, pack-years, race, smoking status, and study center. Finally, we examined associations between occupation and airway obstruction using a Poisson regression model similar to those used to examine associations with the prevalence of asthma, chronic bronchitis, chronic cough, and wheeze. All analyses were conducted using SAS version 9.2 (SAS Institute Inc., Cary, North Carolina, USA).

RESULTS

Of the 15,273 participants in our final study population, 90% reported a current or most recent job apart from homemaking and 25% reported that job to be managerial or administrative, the referent occupational category for our analysis (Table 1). Overall, 3% of participants reported having asthma at the time of the ARIC exam, 10% reported chronic cough, and 11% reported wheeze. Among the 14,497 participants with FVC maneuvers of 6 seconds or longer, 9% were categorized as having airway obstruction. Airway obstruction, chronic bronchitis, chronic cough, and wheeze were each more common at older ages, with increased pack-years of smoking, among white participants, and among individuals with a history of asthma.

Adjusted associations of occupational group with asthma, chronic bronchitis, chronic cough, and wheeze are presented in Table 2. Relative to the prevalences of the respiratory outcomes in the comparison population, statistically significant and elevated adjusted PRs were generated for technical and sales occupations, service occupations, precision occupations, and machine operating occupations. Effect estimates for asthma were elevated for food preparation and service (PR: 1.96, 95% CI: 1.27, 3.01) and mechanics and repairers (PR: 1.83, 95% CI: 1.17, 2.85). Elevated PRs for chronic bronchitis were generated for cleaning and building service occupations (PR: 1.60, 95% CI: 1.06, 2.40) and all precision occupation groups, including mechanics and repairers (PR: 1.75, 95% CI: 1.21, 2.53) and construction and extractive trades (PR: 1.91, 95% CI: 1.34, 2.72), two relatively large occupational categories in the ARIC study population. Associations with chronic cough, a component symptom of our definition of chronic bronchitis, were similar in direction and somewhat attenuated compared to those generated for chronic bronchitis, with the notable exception of motor vehicle operation (PR: 1.50, 95% CI: 1.18, 1.91), where an elevated prevalence of chronic cough (13%) was observed. Elevated prevalences of wheezing were observed in protective services (PR: 1.44, 95% CI: 1.00, 2.06), construction and extractive trades (PR: 1.27, 95% CI: 1.02, 1.59), and hand working occupations (PR: 1.52, 95% CI: 1.11, 2.08), where the highest prevalence of wheeze (17%) was reported.

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Percentages of men and women in each occupational group and sex-stratified, adjusted associations of occupational group with FEV_1 and FVC are shown in Table 4. Among men, no statistically significant associations between occupation and FEV_1 were observed and, in contrast to the elevated symptom-related associations shown in Table 2, modestly elevated FVC was observed among mechanics and repairers (76.8 mL, 95% CI: 13.6, 139.9) (Table 3). Among women, adjusted mean FEV_1 was lower among respondents in health technology occupations (−73.0 mL, 95% CI: −141.8, −4.2) and among homemakers (−31.1 mL, 95% CI: −58.1, −4.1). None of the occupational groups evaluated was associated with lower adjusted FVC among women.

Highest prevalences of airway obstruction were observed among mechanics and repairers (15%), construction and extractive trades (14%), and protective service occupations (14%) (Table 4). Elevated PRs were observed for private household occupations (PR: 1.40, 95% CI: 1.05, 1.86), construction and extractive trades (PR: 1.32, 1.05, 1.65), and the category of “other” service occupations (PR: 1.45, 95% CI: 1.05, 2.00).

DISCUSSION

We observed elevated risk of respiratory health outcomes among ARIC study participants in selected occupational categories, including the precision occupations, such as mechanic and repair occupations and construction and extractive trades, and cleaning and building services. Despite the low overall prevalence of the respiratory outcomes, these findings are remarkably consistent across the range of respiratory health symptoms, conditions, and measures of lung function we assessed. We also observed elevated risks for work in food preparation and service occupations, motor vehicle operation, and protective services such as firefighting occupations and police, though in some cases, the number of participants in these occupations was small.

Our results are consistent with the state of the knowledge about the initiation and exacerbation of respiratory disease by agents found in the workplace (7). Our finding that men and women working in cleaning and building service jobs may be at increased risk for adverse respiratory health has also been observed in population-based studies (9, 27-29), workforce-based studies (30, 31), cases reported in the literature (32), and with descriptions of the hazards of cleaning and janitorial work (33-35). Potential inhalation exposures for this population include allergens, cleaning products, dusts, indoor air, pesticides, and any additional hazards originating in the buildings being cleaned (35). Construction and extractive occupations include jobs and apprenticeships in brick and stonemasonry, carpentry, drilling, electrical work, mining, painting, roofing, and numerous other trades (23). Despite the wide range of jobs in this occupational category, the inhalation exposures largely occur in the form of vapors, gases, dusts, and fumes (VGDF) arising from physical processes (e.g., drilling, sawing, stonecutting) and chemical compounds used on the job (e.g., adhesives, paints, solvents). Exposure to VGDF has been associated with respiratory disease and mortality (36-39).

These data were collected between 1987 and 1992. Because the ARIC study included information about occupation and respiratory health in the baseline exam and the cohort is still under study, these findings provide an opportunity to assess the progression of respiratory health in a well-characterized population with more than 20 years of follow-up information about cardiovascular and respiratory disease outcomes and mortality. Although detailed respiratory health questionnaire items and spirometry testing were not included in ARIC study visits 3 and 4, their inclusion in visit 5 (2011-2013) will provide a unique opportunity to assess the relationship between work status, occupation, and lung disease.

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Indeed, the combination of questionnaire-based information and spirometry measures in a large, population-based cohort is an important strength of our study.

Our data have several limitations. Our occupational categories are based on responses about the current or most recent job held. If participants changed occupations shortly before their ARIC visit 1 clinical examination or, more specifically, if they changed occupations because of their respiratory health symptoms, then our analysis may incorrectly attribute respiratory health symptoms to the current occupation, rather than to the occupation that was responsible for their symptoms. More detailed job histories would provide additional information with which to assess the extent to which the healthy worker effect impacts our findings. Information about specific exposures are not available in the ARIC study, therefore our findings cannot be used to draw conclusions about particular respiratory irritants or sensitizing agents. Ventilation, respirators, face masks, gloves, and other personal protective equipment are not accounted for in these analyses, nor are behaviors that may intensify or attenuate inhalation exposures or modify respiratory disease risk. In addition, occupational hazards have changed in the past 20 years. Personal protective equipment, workplace regulations, and exposures limits have also changed. Some occupations have nearly disappeared, while new jobs have emerged. Interpretation of our findings and use of these data to make generalizations about risks of occupational and work-related asthma should carefully take into consideration changes that may have occurred in occupational hazards during this time period.

Using these data, we were able to evaluate numerous respiratory health outcomes and a wide range of occupational categories for each outcome. It has already been established that occupational exposures account for a large proportion of adult-onset asthma (18). Our findings do not suggest new or previously unrecognized high-risk occupations and our findings largely support what previous research has revealed about occupations that place workers at risk for adverse respiratory health. Indeed, the main objective of this analysis was to examine associations between respiratory health and the entire range of occupations reported by ARIC study participants. Our results provide valuable information about the occupational contribution to respiratory disease risk in the ARIC cohort, particularly among participants in cleaning jobs, precision occupations, and transportation, and they justify further efforts to assess changes in employment and in respiratory health among ARIC study participants. Follow-up of this cohort for the development of new cardio-respiratory conditions and exacerbations of existing conditions will continue to reveal the extent to which occupational exposures may have long-term and irreversible health consequences (40, 41).

There are few large, prospective, population-based studies with sufficiently detailed information about occupation and respiratory health. Our analysis takes advantage of these data in order to assess the role of occupation in the prevalence respiratory health outcomes among working adults. Our findings identify several plausible relationships between occupation and respiratory health in this population and point towards specific occupational groups in the ARIC cohort that may be at risk of developing new work-related respiratory symptoms or exacerbating existing symptoms because of on-the-job exposures. Our results also highlight several occupational groups for which work-related exposures may have the potential to contribute to the progression of lung function decline and individuals may be at risk of progressing towards more severe obstructive airway disease. These findings should be used by occupational medicine and public health personnel who are interested in understanding possible respiratory health consequences for employees and others with potential inhalation hazards.

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Table 1

Demographic characteristics and the prevalence of chronic cough, chronic bronchitis, wheeze, asthma, and airway obstruction at ARIC study visit 1, N=15,273.

	All Participants					Participants with ≥6 second FVC exhalation	
	No. (col. %)	Asthma No. (row %)	Chronic Bronchitis No. (row %)	Chronic Cough No. (row %)	Wheeze No. (row %)	No. (col %)	Airway Obstruction No. (row %)
Total [1]	15,273 (100.)	516 (3.4)	628 (4.1)	1,475 (9.7)	1,655 (10.8)	14,497 (100.)	1,368 (9.4)
Demographic characteristics							
Age, in years							
45-49	4,096 (26.8)	157 (3.8)	147 (3.6)	354 (8.6)	426 (10.4)	3,848 (26.5)	242 (6.3)
50-54	3,965 (26.0)	122 (3.1)	125 (3.2)	358 (9.0)	401 (10.1)	3,782 (26.1)	297 (7.9)
55-59	3,733 (24.4)	122 (3.3)	166 (4.4)	384 (10.3)	397 (10.6)	3,555 (24.5)	408 (11.5)
60-64	3,479 (22.8)	115 (3.3)	190 (5.5)	379 (10.9)	431 (12.4)	3,312 (22.9)	421 (12.7)
Race							
Black	4,017 (26.3)	140 (3.5)	141 (3.5)	326 (8.1)	289 (7.2)	3,609 (24.9)	215 (6.0)
White	11,256 (73.7)	376 (3.3)	487 (4.3)	1,149 (10.2)	1,366 (12.1)	10,888 (75.1)	1,153 (10.6)
Sex							
Female	8,440 (55.3)	310 (3.7)	309 (3.7)	764 (9.1)	875 (10.4)	7,900 (54.5)	625 (7.9)
Male	6,833 (44.7)	206 (3.0)	319 (4.7)	711 (10.4)	780 (11.4)	6,597 (45.5)	743 (11.2)
Health-related characteristics							
History of asthma							
No	14,332 (93.8)	--	519 (3.6)	1,266 (8.8)	1,236 (8.6)	13,592 (93.7)	1,130 (8.3)
Yes, onset ≤ age 16	432 (2.8)	162 (37.5)	35 (8.1)	76 (17.6)	147 (34.0)	417 (2.9)	93 (22.3)
Yes, onset ≥ age 17	509 (3.3)	354 (69.5)	74 (14.5)	133 (26.1)	272 (53.4)	488 (3.4)	145 (29.7)
Pack-years of smoking							
0	6,477 (42.4)	214 (3.3)	98 (1.5)	321 (5.0)	413 (6.4)	6,041 (41.7)	164 (2.7)
0.05-11.0	2,280 (14.9)	73 (3.2)	46 (2.0)	115 (5.0)	165 (7.2)	2,173 (15.0)	74 (3.4)
11.1-24.0	2,115 (13.9)	54 (2.6)	57 (2.7)	157 (7.4)	206 (9.7)	2,031 (14.0)	175 (8.6)
24.1-39.0	2,288 (15.0)	91 (4.0)	161 (7.0)	374 (16.3)	376 (16.4)	2,209 (15.2)	371 (16.8)
39.1-242.6	2,113 (13.8)	84 (4.0)	266 (12.6)	508 (24.0)	495 (23.4)	2,043 (14.1)	584 (29.6)
Smoking status							

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	All Participants					Participants with ≥6 second FVC exhalation	
	No. (col. %)	Asthma No. (row %)	Chronic Bronchitis No. (row %)	Chronic Cough No. (row %)	Wheeze No. (row %)	No. (col %)	Airway Obstruction No. (row %)
Lifetime non-smoker	6,477 (42.4)	214 (3.3)	98 (1.5)	321 (5.0)	413 (6.4)	6,041 (41.7)	164 (2.7)
Former smoker, ≥5 years since quitting	3,739 (24.5)	140 (3.7)	78 (2.1)	174 (4.7)	292 (7.8)	3,622 (25.0)	253 (7.0)
Former smoker, <5 years since quitting	1,114 (7.3)	37 (3.3)	27 (2.4)	68 (6.1)	124 (11.1)	1,072 (7.3)	169 (15.8)
Current smoker	3,943 (25.8)	125 (3.2)	425 (10.8)	912 (23.1)	826 (20.9)	3,762 (26.0)	782 (20.8)

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Table 2

Associations between current/most recent occupation and the prevalence of respiratory health symptoms at ARIC study visit 1, N=15,273.

	1980 Census Occupation Code	All Participants No. (col. %)	Asthma		Chronic Bronchitis		Chronic Cough		Wheeze	
			No. (row. %)	PR (95% CI)[1]	No. (col. %)	PR (95% CI)[1]	No. (row %)	PR (95% CI)[1]1	No. (row %)	PR (95% CI)[2]
Total	--	15,273 (100.)	516 (3.4)		628 (4.1)		1,475 (9.7)		1,655 (10.8)	
Managerial and Administrative Support	003-037,	3,863 (25.3)	115 (3.0)	1.00 (referent)	119 (3.1)	1.00 (referent)	312 (8.1)	1.00 (referent)	394 (10.2)	1.00 (referent)
Occupations	303-389									
Professional Specialty Occupations	043-199	2,117 (13.9)	67 (3.2)	1.09 (0.81, 1.47)	45 (2.1)	0.90 (0.65, 1.26)	142 (6.7)	1.04 (0.87, 1.25)	190 (9.0)	1.08 (0.92, 1.26)
Technical and Sales Occupations										
Health technology	203-208	162 (1.1)	7 (4.3)	1.40 (0.67, 2.95)	5 (3.1)	1.18 (0.49, 2.84)	20 (12.4)	1.71 (1.13, 2.58)	11 (6.8)	0.81 (0.47, 1.38)
Sales	243-285	1,322 (8.7)	29 (2.2)	0.76 (0.50, 1.13)	68 (5.1)	1.55 (1.17, 2.06)	155 (11.7)	1.38 (1.17, 1.64)	160 (12.1)	1.13 (0.96, 1.33)
Other technical and sales occupations	213-235	216 (1.4)	13 (6.0)	2.14 (1.23, 3.74)	8 (3.7)	1.27 (0.66, 2.43)	19 (8.8)	1.20 (0.80, 1.80)	23 (10.7)	1.01 (0.69, 1.47)
Service Occupations										
Private household occupations	403-407	686 (4.5)	23 (3.3)	1.12 (0.71, 1.77)	27 (3.9)	1.29 (0.86, 1.94)	50 (7.3)	0.96 (0.72, 1.27)	52 (7.6)	0.88 (0.67, 1.15)
Protective service	413-427	181 (1.2)	5 (2.8)	1.02 (0.42, 2.46)	5 (2.8)	0.98 (0.40, 2.39)	19 (10.5)	1.39 (0.91, 2.13)	26 (14.4)	1.44 (1.00, 2.06)
Food preparation and service	433-444	440 (2.9)	25 (5.7)	1.96 (1.27, 3.01)	13 (3.0)	0.87 (0.50, 1.53)	37 (8.4)	1.01 (0.73, 1.39)	39 (8.9)	0.85 (0.62, 1.16)
Health service	445-447	347 (2.3)	15 (4.3)	1.47 (0.86, 2.52)	14 (4.0)	1.42 (0.80, 2.51)	27 (7.8)	1.03 (0.70, 1.51)	36 (10.4)	1.15 (0.84, 1.57)
Cleaning and building service	448-455	399 (2.6)	18 (4.5)	1.63 (0.99, 2.70)	24 (6.0)	1.60 (1.06, 2.40)	55 (13.8)	1.55 (1.22, 1.98)	51 (12.8)	1.18 (0.92, 1.53)
Other service occupations	456-468	281 (1.8)	12 (4.3)	1.41 (0.78, 2.56)	8 (2.9)	0.97 (0.48, 1.97)	24 (8.5)	1.08 (0.74, 1.57)	25 (8.9)	0.91 (0.64, 1.31)
Farming, Forestry, and Fishing Occupations	473-476	145 (1.0)	2 (1.4)	0.56 (0.14, 2.27)	7 (4.8)	1.46 (0.69, 3.08)	15 (10.3)	1.24 (0.75, 2.05)	13 (9.0)	0.87 (0.51, 1.47)
Precision Occupations										
Mechanics and repairers	503-549	483 (3.2)	24 (5.0)	1.83 (1.17, 2.85)	35 (7.3)	1.75 (1.21, 2.53)	71 (14.7)	1.45 (1.15, 1.82)	63 (13.0)	1.00 (0.78, 1.28)
Construction and extractive trades	553-617	564 (3.7)	15 (2.7)	1.03 (0.59, 1.77)	41 (7.3)	1.91 (1.34, 2.72)	81 (14.3)	1.55 (1.24, 1.93)	78 (13.8)	1.27 (1.02, 1.59)
Other precision occupations	633-699	545 (3.6)	16 (2.9)	1.07 (0.64, 1.80)	29 (5.3)	1.57 (1.06, 2.31)	64 (11.7)	1.37 (1.07, 1.75)	72 (13.2)	1.24 (0.99, 1.56)
Machine Operating Occupations										
Textile, apparel, furnishing machine operators	738-749	175 (1.2)	8 (4.6)	1.49 (0.73, 3.01)	10 (5.7)	1.78 (0.99, 3.19)	18 (10.3)	1.15 (0.76, 1.74)	24 (13.7)	1.25 (0.86, 1.82)
Machine operators, assorted materials	753-779	369 (2.4)	12 (3.3)	1.12 (0.62, 2.00)	22 (6.0)	1.58 (1.05, 2.39)	43 (11.7)	1.21 (0.92, 1.59)	38 (10.3)	0.91 (0.68, 1.21)
Hand working occupations	783-795	172 (1.1)	8 (4.7)	1.60 (0.79, 3.22)	12 (7.0)	1.94 (1.15, 3.25)	18 (10.5)	1.15 (0.76, 1.73)	30 (17.4)	1.52 (1.11, 2.08)
Motor vehicle operation	803-814	469 (3.1)	17 (3.6)	1.38 (0.83, 2.29)	24 (5.1)	1.36 (0.89, 2.07)	63 (13.4)	1.50 (1.18, 1.91)	57 (12.2)	1.15 (0.88, 1.49)
Transportation, excl. motor vehicle	823-859	155 (1.0)	4 (2.6)	0.96 (0.36, 2.60)	14 (9.0)	2.20 (1.37, 3.52)	24 (15.5)	1.62 (1.14, 2.31)	18 (11.6)	1.00 (0.66, 1.53)
Handlers, equipment cleaners, helpers, laborers	863-889	356 (2.3)	12 (3.4)	1.27 (0.70, 2.28)	18 (5.1)	1.41 (0.88, 2.26)	38 (10.7)	1.21 (0.89, 1.64)	38 (10.7)	1.00 (0.72, 1.38)

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	1980 Census Occupation Code	All Participants No. (col. %)	Asthma		Chronic Bronchitis		Chronic Cough		Wheeze	
			No. (row. %)	PR (95% CI)[1]	No. (col. %)	PR (95% CI)[1]	No. (row %)	PR (95% CI)[1]1	No. (row %)	PR (95% CI)[2]
Other machine operating occupations	703-737, 796-799	311 (2.0)	10 (3.2)	1.08 (0.57, 2.03)	21 (6.8)	1.83 (1.19, 2.82)	42 (13.5)	1.42 (1.07, 1.88)	47 (15.1)	1.29 (0.97, 1.72)
Homemaker, no other job reported	--	1,515 (9.9)	59 (3.9)	1.30 (0.94, 1.81)	59 (3.9)	1.33 (0.97, 1.82)	138 (9.1)	1.12 (0.92, 1.35)	170 (11.2)	1.04 (0.87, 1.23)

[1] Adjusted for age, history of asthma, pack-years, race, sex, smoking status, and study center

[2] Adjusted for age, pack-years, race, sex, smoking status, and study center

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Table 3

Adjusted, sex-specific FEV_1 and FVC in the comparison population of managerial and administrative support occupations and adjusted mean differences between current/most recent occupation and the comparison population at ARIC study visit 1, N=14,497.

	Men (N=6,597)			Women (N=7,900)		
	No. (col. %)	FEV_1, in mL[1]	FVC, in mL1	No. (col. %)	FEV_1, in mL[1]	FVC, in mL1
Managerial and Administrative Support Occupations	1,633 (24.8)	3,069.0 (27.8)	4,398.3 (28.9)	2,081 (26.3)	2,217.3 (16.7)	3,074.6 (17.9)
Professional Specialty Occupations	926 (14.0)	26.6 (−16.4, 69.6)	42.6 (−6.4, 91.6)	1,093 (13.8)	36.5 (8.9, 64.1)	61.7 (28.7, 94.7)
Technical and Sales Occupations						
Health technology	15 (0.2)	132.5 (−99.6, 364.6)	186.2 (−113.0, 485.4)	138 (1.8)	−73.0 (−141.8, −4.2)	−44.9 (−127.8, 38.0)
Sales	732 (11.1)	14.7 (−31.7, 61.1)	20.7 (−32.0, 73.3)	557 (7.1)	−12.6 (−46.7, 21.6)	3.5 (−38.3, 45.4)
Other technical and sales occupations	172 (2.6)	69.2 (−14.6, 153.0)	77.7 (−15.1, 170.5)	39 (0.5)	42.0 (−62.0, 146.0)	3.0 (−113.7, 119.8)
Service Occupations						
Private household occupations	2 (<0.1)	294.4 (−400.9, 989.7)	112.5 (−448.7, 673.7)	631 (8.0)	−9.0 (−44.9, 26.9)	−8.0 (−48.6, 32.6)
Protective service	140 (2.1)	−69.3 (−165.3, 26.6)	−50.5 (−161.3, 60.4)	32 (0.4)	−49.5 (−193.0, 94.0)	−60.4 (−219.8, 99.1)
Food preparation and service	36 (0.6)	−32.3 (−199.2, 134.5)	11.8 (−183.7, 207.2)	355 (4.5)	−33.7 (−76.7, 9.2)	−48.2 (−100.5, 4.0)
Health service	18 (0.3)	199 (−66.9, 465.0)	425.4 (177.8, 673.1)	306 (3.9)	−3.7 (−49.6, 42.2)	−6.3 (−61.7, 49.0)
Cleaning and building service	183 (2.8)	−58.7 (−147.7, 30.3)	−23.8 (−122.9, 75.2)	178 (2.3)	−35.3 (−91.9, 21.3)	−31.8 (−101.1, 37.6)
Other service occupations	40 (0.6)	−22.4 (−220.7, 175.9)	36.9 (−190.4, 264.2)	226 (2.9)	−41.5 (−94.0, 11.0)	−23.1 (−86.2, 40.0)
Farming, Forestry, and Fishing Occupations	123 (1.9)	16.5 (−85.6, 118.5)	49.4 (−62.0, 160.7)	19 (0.2)	39.0 (−137.7, 215.8)	123.1 (−107.1, 353.3)
Precision Occupations						
Mechanics and repairers	446 (6.8)	45.7 (−11.2, 102.5)	76.8 (13.6, 139.9)	19 (0.2)	73.0 (−79.0, 225.0)	68.6 (−126.0, 263.2)
Construction and extractive trades	531 (8.0)	−12.7 (−70.9, 45.5)	65.2 (−0.1, 130.5)	10 (0.1)	36.5 (−298.8, 371.8)	203.6 (−149.9, 557.2)
Other precision occupations	388 (5.9)	−13.3 (−77.4, 50.7)	10.3 (−60.2, 80.8)	139 (1.8)	6.2 (−56.0, 68.4)	−23.3 (−96.1, 49.6)
Machine Operating Occupations						
Textile, apparel and furnishing machine operators	18 (0.3)	−30.2 (−219.9, 159.4)	−28.2 (−278.2, 221.7)	143 (1.8)	−55.4 (−127.2, 16.4)	8.9 (−77.6, 95.4)
Machine operators, assorted materials	187 (2.8)	−62.6 (−144.4, 19.3)	−84.6 (−180.0, 10.7)	165 (2.1)	−36.5 (−98.7, 25.7)	−17.7 (−85.9, 50.5)
Hand working occupations	74 (1.1)	−33.8 (−160.2, 92.6)	−21.2 (−158.0, 115.6)	92 (1.2)	22.0 (−54.4, 98.3)	34.9 (−52.9, 122.8)
Motor vehicle operation	396 (6.0)	−17.3 (−79.1, 44.6)	14.6 (−56.7, 85.8)	50 (0.6)	−105.0 (−205.8, −4.2)	−100.6 (−216.4, 15.2)
Transportation, excl. motor vehicle	141 (2.1)	−66.6 (−172.0, 38.9)	−95.0 (−209.1, 19.2)	8 (0.1)	99.0 (−196.0, 393.9)	245.3 (−62.4, 553.0)
Handlers, equipment cleaners, helpers, laborers	235 (3.6)	−1.5 (−78.7, 75.7)	10.4 (−80.3, 101.2)	95 (1.2)	44.3 (−31.6, 120.2)	55.2 (−34.5, 145.0)
Other machine operating occupations	149 (2.3)	16.5 (−75.1, 108.2)	−13.9 (−117.5, 89.7)	148 (1.9)	−51.4 (−112.6, 9.8)	−2.1 (−76.0, 71.8)

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	Men (N=6,597)			Women (N=7,900)		
	No. (col. %)	**FEV_1, in mL[1]**	**FVC, in mL1**	**No. (col. %)**	**FEV_1, in mL[1]**	**FVC, in mL1**
Homemaker, no other job reported	13 (0.2)	−83.5 (−480.9, 314.0)	−131.8 (−542.1, 278.5)	1,376 (17.4)	−31.1 (−58.1, −4.1)	−12.3 (−44.2, 19.7)

[1]Values of FEV_1 and FVC shown for the comparison population are adjusted means (with standard errors). All others are least-square mean differences (with 95% CIs) from the mean values of the comparison population (managerial and administrative support occupations), adjusted for age, age squared, height, height squared, history of asthma, pack-years, race, smoking status, and study center.

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Table 4

Associations between current/most recent occupation and the prevalence of airway obstruction at ARIC study visit 1, N=14,497.

	All Participants No. (col. %)	Airway Obstruction	
		No. (row %)	PR (95% CI)[1]
Total	14,497 (100.)	1,368 (9.4)	
Managerial and Administrative Support Occupations	3,714 (25.6)	302 (8.1)	1.00 (referent)
Professional Specialty Occupations	2,019 (13.9)	126 (6.2)	1.05 (0.87, 1.27)
Technical and Sales Occupations			
Health technology	153 (1.1)	12 (7.8)	1.35 (0.79, 2.31)
Sales	1,289 (8.9)	131 (10.2)	1.12 (0.93, 1.35)
Other technical and sales occupations	211 (1.5)	19 (9.0)	1.01 (0.66, 1.53)
Service Occupations			
Private household occupations	633 (4.4)	52 (8.2)	1.40 (1.05, 1.86)
Protective service	172 (1.2)	24 (14.0)	1.43 (0.99, 2.05)
Food preparation and service	391 (2.7)	27 (6.9)	0.92 (0.63, 1.33)
Health service	324 (2.2)	23 (7.1)	1.16 (0.78, 1.74)
Cleaning and building service	361 (2.5)	41 (11.4)	1.18 (0.89, 1.56)
Other service occupations	266 (1.8)	27 (10.2)	1.45 (1.05, 2.00)
Farming, Forestry, and Fishing Occupations	142 (1.0)	13 (9.2)	0.91 (0.55, 1.52)
Precision Occupations			
Mechanics and repairers	465 (3.2)	68 (14.6)	1.13 (0.90, 1.43)
Construction and extractive trades	540 (3.7)	78 (14.4)	1.32 (1.05, 1.65)
Other precision occupations	527 (3.6)	64 (12.1)	1.20 (0.94, 1.53)
Machine Operating Occupations			
Textile, apparel and furnishing machine operators	161 (1.1)	17 (10.6)	1.27 (0.81, 1.97)
Machine operators, assorted materials	352 (2.4)	37 (10.5)	1.12 (0.83, 1.52)
Hand working occupations	166 (1.2)	17 (10.2)	1.07 (0.70, 1.63)
Motor vehicle operation	446 (3.1)	60 (13.5)	1.19 (0.93, 1.52)
Transportation, excl. motor vehicle	149 (1.0)	18 (12.1)	1.00 (0.66, 1.52)
Handlers, equipment cleaners, helpers, laborers	330 (2.3)	34 (10.3)	1.05 (0.77, 1.43)
Other machine operating occupations	297 (2.1)	39 (13.1)	1.26 (0.95, 1.66)
Homemaker, no other job reported	1,389 (9.6)	139 (10.0)	1.21 (1.00, 1.47)

[1] Adjusted for age, history of asthma, pack-years, race, sex, smoking status, and study center