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Asthma, chronic obstructive pulmonary disease, and asthma-COPD overlap among US working adults

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Abstract

Background: Asthma-COPD overlap (ACO) is a respiratory condition with more severe respiratory symptoms, poorer quality of life, and increased hospital admissions compared with asthma or COPD alone.

Objectives: Estimate asthma, chronic obstructive pulmonary disease (COPD), and ACO prevalence among workers by industry and occupation and assess physical and mental health status, healthcare utilization, among workers with ACO.

Methods: The 2014–2018 National Health Interview Survey (NHIS) data for working adults aged ≥18 years employed (sample $n = 99{,}424$) in the 12 months prior to the survey were analyzed. Age-adjusted ACO, COPD and asthma prevalence and prevalence ratios adjusted for age, sex, race and smoking status were estimated.

Results: During 2014–2018, of the estimated 166 million (annual average) US workers, age-adjusted asthma, COPD, and ACO prevalence was 6.9%, 4.0%, and 1.1%, respectively. ACO prevalence was highest among workers aged ≥65 years (2.0%), females (1.6%), current smokers

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Authors' contributions

Girija Syamlal contributed to conceptualization, methodology, data analyses, interpretation and writing – original draft preparation. Katelynn Dodd contributed to conceptualization, writing – reviewing and editing of the manuscript. Jacek Mazurek contributed to supervision, writing – reviewing and editing of the manuscript.

Disclosure statement

The authors report there are no competing interests to declare.

Disclaimer

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Institution and ethics approval and informed consent

The National Health Interview Survey (NHIS) data was approved by the Research Ethics Review Board of the National Center for Health Statistics. For this study, a secondary data analysis, publicly available NHIS data were used, and National Institute for Occupational Safety and Health Internal Review Board approval was not required.

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(1.9%), those living below the federal poverty level (2.3%), and workers in the accommodation and food services (1.6%) industry and personal care and service (2.3%) occupations. Workers with ACO had more frequent ($p < 0.05$) physician office visits, emergency department visits; and were more likely to be in poorer mental health, obese, have more lost workdays, more bed days, and comorbidities compared to workers with asthma alone and workers with COPD alone.

Conclusion: Higher ACO prevalence among worker groups and increased healthcare utilization underscores the need for early identification of asthma and COPD, assessment of potential workplace exposures, and implementation of tailored interventions to reduce ACO among working adults.

Keywords

Asthma-COPD overlap; prevalence industry; occupation; workers; exposures; workplace

Introduction

Asthma and chronic obstructive pulmonary disease (COPD) are chronic lung diseases caused by inflammation of the airways (1–4). Adults with asthma have variable expiratory airflow limitation and intermittent respiratory symptoms including shortness of breath, wheezing, cough, and chest tightness, whereas COPD is usually a progressive disease with poorly reversible airflow limitation, and persistent respiratory symptoms including, dyspnea, cough and/or sputum production (2,3). Asthma-COPD overlap (ACO) is characterized by overlapping clinical features of both asthma and COPD, posing diagnostic and therapeutic challenges (1,4,5). In the US, an estimated 1.6% of adults aged ≥20 years self-reported ACO, and ACO was more prevalent among those aged ≥ 65 years, women and tobacco users (6,7). ACO has been associated with worse health outcomes (i.e. impaired pulmonary function, more respiratory symptoms, frequent exacerbations, hospitalizations), higher healthcare utilization and higher mortality than asthma or COPD separately (6–9). During 1999 – 2016, an estimated 19 thousand decedents had both asthma and COPD as the underlying or contributing cause of death among US adults aged ≥25 years (10).

Among US workers, an estimated 5.8 million have COPD and 11 million have asthma (11,12). Data from 31 US states indicate that greater than one-third of the working adults with current asthma have COPD and the ACO prevalence was higher (52%) among workers with work-related asthma (13). Additionally, occupational exposures including vapors, dust, gases, irritants and fumes are associated with higher prevalence for both COPD and asthma, suggesting workplace exposures could be associated with the development of ACO (13–17). Effective workplace health promotion programs and policies can reduce health risks and improve overall workers health. Limited information is available on ACO among workers by industry and occupation. Identifying workers with higher prevalence who may benefit from tailored inventions are essential to reduce work-related chronic diseases. Therefore, objectives of the current study were to estimate the prevalence of workers with asthma, COPD and ACO by industry and occupation, and to assess the health status, healthcare utilization, lost workdays and bed days among workers with ACO using the National Health Interview Survey (NHIS) data.

Methods

The 2014–2018 (sample n = 155 489) National Health Interview Survey (NHIS) data for participants aged ≥18 years who were employed during the 12 months prior to the survey interview (sample n = 99 424) were analyzed. NHIS is an annual, nationally representative, in-person survey of the noninstitutionalized US civilian population (18). The survey response rates for the sample adult component during the study period ranged from 53.1% in 2018 to 58.9% in 2014. The NHIS adult questionnaire is administered to one adult aged ≥18 years randomly selected from each family within the sampled household. The NHIS data was approved by the Research Ethics Review Board of the National Center for Health Statistics. For this study, a secondary data analysis, publicly available NHIS data were used, and National Institute for Occupational Safety and Health Internal Review Board approval was not required.

An employed person was defined as “working at a job or business,” “with a job or business but not at work,” or “working, but not for pay, at a family-owned job or business” during the 12 months prior to the survey interview. Industry of employment and occupation information were classified by the National Center for Health Statistics using a standardized coding system which is consistent with 2012 North American Industry Classification System (NAICS) and 2010 Standard Occupational Classification (SOC) (18). Participants who self-reported that they were told by a doctor or other health professional that they ever had asthma and still have asthma were considered to have current asthma. Participants who self-reported that they were told by a doctor or other health professional that they had either COPD, emphysema, or chronic bronchitis were considered to have COPD. Workers with both current asthma and COPD were identified as having ACO.

Healthcare utilization included office visits, (if visited a doctor or other health care professional at least once in the past 12 months for your own health at a doctor’s office, a clinic, or some other place), and emergency department visits (if reported a hospital ED visit at least once in the past 12 months for your health), and the responses were grouped as ‘0′, ‘1–3 visits’, and ‘>3 visits’. Lost workdays were determined from the reported number of days of missed work at a job or business because of illness or injury in the past 12 months and were grouped as ‘0′, ‘1–7 days’, and ‘>7 days’. Bed days were determined from the reported number of days that illness or injury kept the respondent in bed for more than half of the day in the past 12 months, and were grouped as ‘0′, ‘1–3 days’, and ‘>3 days’. Physical health status was determined based on the question “would you say your health in general is excellent, very good, good, fair, or poor?” and mental health status based on the ‘yes’ response to the question “whether participant experienced feelings of sadness, nervousness, restlessness, hopelessness, worthlessness, or that everything was an effort in the past 30 days?” Workers were considered to have heart disease, hay fever, any cancers, hypertension, or high cholesterol if they reported ever being told by a doctor or other health professional that they had such a condition.

Five years of the NHIS data (2014–2018) were combined to improve precision and reliability of the estimates. Sample weights were adjusted for pooled data to provide nationally representative estimates. Age-adjusted asthma, COPD, and ACO prevalence with

corresponding 95% confidence intervals (CI) using the standard age distribution of the 2000 US Census Population were calculated (19) for working adults by socio-demographic characteristics, industry, and occupation. Multinomial logistic regression was used to estimate adjusted prevalence ratios (PR) using the predicted marginal risk ratio method to assess the association of asthma, COPD, and ACO with select socio-demographic characteristics. The predicted marginal method computes the model-adjusted risk for each level of the predictor variable, then computes the model-adjusted risk ratio. Age, sex, race and smoking status were considered independently associated with the dependent variables using backward selection at a p values of <0.05 and were included in the models. Measures of socioeconomic status, such as family income or education, were not included because of the associations between occupational status and these variables (14). To assess ACO association with healthcare utilization, lost workdays, bed days, health status (physical and mental) and comorbidities (heart disease, hay fever, any cancer, diabetes, high cholesterol and hypertension) among workers with asthma, COPD and ACO, four distinct groups were created i.e. 1) asthma alone, 2) COPD alone, 3) ACO and 4) no asthma, no COPD or no ACO (n for each category by sociodemographic characteristics is available in the supplemental table). Multinomial logistic regression was used to estimate PR's (adjusted for age, sex, race and smoking status) with corresponding 95% CI. PRs compared workers with ACO to workers with asthma alone and those with COPD alone. Two-sided t-tests were used to determine statistically significant ($p < 0.05$) differences between point estimates.

For all analyses, estimates with a relative standard error ≥30% (standard error of estimate divided by the estimate) were not reported. SAS® 9.4 (SAS Institute Inc., Cary, North Carolina, USA) and SAS® 9.4 Callable SUDAAN (SAS Institute Inc., Cary, North Carolina, USA) were used.

Results

During 2014 − 2018, of the estimated 166 million working adults, 11.6 million (crude prevalence: 7.0%; age-adjusted prevalence: 6.9%) workers had current asthma, 4.2 million (crude prevalence: 3.6% and age-adjusted prevalence: 4.0%) had COPD, and 1.7 million (crude prevalence: 1.1% and age-adjusted prevalence: 1.1%) had ACO (Table 1). These results indicate that 29.3% of workers with COPD had current asthma and 15.0% of workers with current asthma had COPD.

Current asthma among working adults declined with increasing age, from 8.3% among those aged 18–24 years to 4.2% among those aged ≥65 years (Table 1). Age-adjusted asthma prevalence was highest among females (9.0%), non-Hispanic blacks (8.0%), those with > high school education (7.2%), those with health insurance (7.1%), those living below the federal poverty level (9.0%), former smokers (8.0%), those employed in the healthcare and social assistance industry (8.6%) and in the education, training, and library occupations (9.2%) (Tables 1 and 2). Workers with current asthma were more likely ($p < 0.05$) to be females (PR = 1.7); non-Hispanic blacks (PR = 1.5); and former smokers (PR = 1.2) compared with males, other race group, and never smokers, respectively.

COPD prevalence among working adults increased with increasing age, from 1.4% among those aged 18–24 years to 5.8% among those aged ≥65 years (Table 1). Age-adjusted prevalence of COPD was highest among females (4.7%), non-Hispanic whites (4.4%), those with ≤ high school education, General Educational Development (GED) (5.1%), current smokers (8.5%), those employed in the accommodation and food services industry (5.5%) and in the food preparation and serving related occupations (5.8%) (Tables 1 and 2). Workers with COPD were more likely ($p < 0.05$) to be aged ≥65 years (PR = 3.6), females (PR = 1.4); non-Hispanic whites (PR = 1.7); with ≤ high school education, GED (PR = 1.2); current smokers (PR = 4.0); those residing in the Midwest (PR = 1.2) and South regions (PR = 1.2) compared with males, other race group, those with > high school education, never smokers, and those residing in the Northeast region, respectively.

ACO prevalence among working adults increased with increasing age, from 0.7% among those aged 18–24 years to 2.0% among those aged ≥65 years (Table 1). Age-adjusted ACO prevalence was highest among females (1.6%), non-Hispanic blacks (1.3%), those with ≤ high school education, GED (1.5%), current smokers (1.9%), those employed in the accommodation and food services industry (1.6%) and in the personal care and service occupations (2.3%) (Tables 1 and 2). Workers with ACO were more likely ($p < 0.05$) to be aged ≥65 years (PR = 2.5); females (PR = 2.8); non-Hispanic blacks (PR = 2.1); with ≤ high school education, GED (PR =1.3); living below the federal poverty level (PR = 2.4), current smokers (PR= 2.8) and former smokers (PR = 1.9) compared with younger workers (≥18–24 years), males, other race group, those with more than a high school education, those living above the federal poverty level and never smokers, respectively.

Findings from Table 3 indicate that compared to workers with asthma alone and COPD alone respectively, workers with ACO were more likely ($p < 0.05$) to be overweight or obese (PR= 1.2 and 1.1), report poor/fair physical health (PR = 3.4 and 1.3), have more frequent physician office visits (1.9 and 1.2), higher number of emergency department visits (PR = 5.7 and 1.2), >7 lost workdays (2.4 and 1.1), >3 bed days (PR = 3.4 and 1.3), and have comorbidities including hay fever (PR = 3.7 and 2.4), heart disease (PR = 2.4 and 1.2), cancer (PR = 1.5 and 1.2), and hypertension (PR = 1.7 and 1.2) (Table 3). Similar associations were observed among workers with ACO compared to those with no disease (no asthma, no COPD and no ACO), workers with ACO had significantly ($p < 0.05$) higher number of emergency department visits, physician office visits, lost workdays, bed days and reported poor/fair physical health, heart disease, hay fever, diabetes, high cholesterol and hypertension (Table 3).

Discussion

During 2014 − 2018, an estimated 1.7 million (annual average) US workers had ACO. Similar to previous findings among all US adults, workers with ACO were more likely to be older (≥65 years), females, non-Hispanic blacks, living below the federal poverty level, with a high school education or less, and current or former smokers (1,20,21). Current study findings of nearly 2-fold higher ACO risk among current smokers and nearly 3-fold higher ACO risk among former smokers underscores the importance of smoking interventions

to reduce asthma and COPD exacerbations and prevent the development of irreversible obstruction and minimize the risk for ACO (22).

Female workers generally had a higher prevalence of asthma, COPD and ACO, which was similar to previous findings (11,12,21). Important modifiable risk factors including obesity and smoking have been associated with higher ACO prevalence among women (21). To et.al. reported that a third of the women with prevalent asthma who developed ACO were never smokers (21). Moreover, never smokers with work-related asthma, were twice as likely to have COPD as compared to adults with non-work-related asthma (13) suggesting that other risk factors could be associated with ACO, including occupational exposures and environmental tobacco smoke. For example, air pollution (particulate matters, ozone) and exposure to irritants (smoke, dust) among firefighters have been shown to increase the risk of asthma and COPD, as well as ACO (21,23,24). Identifying and managing risk factors, understanding how asthma severity can impact the progression from asthma to a fixed airway obstruction, and implementing optimal long-term asthma management can be beneficial in reducing ACO and the associated health burden among working adults (21,25).

ACO prevalence was high among workers in certain industries and occupations, including the healthcare and social assistance, retail trade, and accommodation and food services industries and the personal care services, food preparation and serving related, sales and related, and transportation and material moving occupations. Previous findings suggest that workers in these industries and occupations also had higher asthma or COPD prevalence, increased tobacco use, and high workplace exposures, including dust, vapors, fumes, irritant chemicals, environmental tobacco smoke, and allergens (12,15,16). Additionally, an estimated 2%-3% of never smokers in these industries and occupations have COPD (11), further indicating that risk factors, including workplace exposures, may contribute to ACO. Workplace exposure to vapors, gases, dusts or fumes (VGDF) in combination with smoking have been shown to increase ACO prevalence among those with adult-onset asthma (16). Workplace exposure to VGDF has been independently associated with ACO among patients with more than 10 pack-years of smoking history (16), underscoring the importance of tailored interventions for both smoking cessation and protection against occupational exposures. The workplace is an important venue for implementing intervention programs (25,27). Effective workplace programs and policies have contributed to increased productivity and overall improvement in worker health (26–28).

Current findings show that workers with ACO have increased healthcare utilization, comorbidities, poorer physical and mental health and were more likely to report higher number of physician office visits, emergency department visits, lost workdays and poorer physical health compared to workers with asthma alone, COPD alone and workers with no disease. Higher unscheduled healthcare utilization, increased lost workdays, and bed days, have been associated with severe health outcomes and disability (5,29). A study based on medical claims data indicates higher health and economic burden among those with ACO, including significantly higher average healthcare costs for impatient, emergency department, and medication expenses compared to those with asthma or COPD alone (29,30). Early diagnosis, treatment and management of asthma may prevent the condition from progressing to ACO and thereby reducing and/or preventing the associated adverse health outcomes.

This study has some limitations. Asthma and COPD diagnoses were self-reported and not validated by medical records. No objective evidence of airway obstructive disease using pulmonary lung function testing was available leading to a possible misclassification of asthma or COPD status. However, a previous study has shown that self-reported COPD and current asthma yielded similar estimates of disease burden compared to spirometry-confirmed COPD and current asthma (6,30). Additionally, individuals with self-reported COPD and current asthma had higher healthcare utilization than those with spirometry-confirmed COPD and current asthma, suggesting that questions on self-reported COPD and current asthma could capture individuals with more severe disease in population-based studies (6). Because of the cross-sectional nature of the study, the temporal relationships between ACO and work, health status, healthcare utilization, lost workdays and bed days could not be assessed. Current findings of increased lost workdays and bed days among those with asthma, COPD, and ACO are based on having any illness or injury in the 12 months prior to the survey interview and may not be specific to asthma, COPD, or ACO. A previous study showed similar findings (31). Information on industry and occupation was collected only for the year prior to the interview. Workers with severe disease may have changed or left jobs with higher exposures, therefore, industry and occupation might not reflect those in which potential workplace exposures occurred. However, additional analyses were conducted to examine the association of ACO and longest held job and found similar results (i.e. higher ACO prevalence in accommodation and food services and healthcare and social services industries and personal care and services occupations). Finally, small sample sizes in certain industry and occupation groups resulted in unreliable estimates. Nonetheless, the study has its strengths; especially, it provides age-adjusted national prevalence estimates for asthma, COPD and ACO in a very large sample that is generalizable to the U.S. working population.

Conclusions

During 2014–2018, an estimated 1.7 million working adults had ACO and the age-adjusted ACO prevalence varied significantly by certain socio-demographic characteristics, industry, and occupation. Higher prevalence of ACO in certain industries and occupations underscores the potential impact of workplace exposures on respiratory health. ACO among workers is associated with a high healthcare utilization and increased number of lost workdays and bed days. Continued surveillance, collection of detailed occupational histories from patients, and assessment of potential workplace exposures can inform treatment and interventions (such as workplace smoking cessation programs, workplace smoke-free policies, reducing workplace exposures) aimed at reducing the burden of ACO among working adults.

Supplementary Material

Refer to Web version on PubMed Central for supplementary material.

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Table 1.

Age-adjusted prevalence and adjusted prevalence ratio for asthma, COPD and asthma-COPD overlap among working adults by socio-demographic characteristics—National Health Interview Survey, United States, 2014–2018.

		Asthma				COPD				ACO				
Socio-demographic characteristics	**Working adults[b] N × 1000**	**P**	**95% CI**	**PR[c]**	**95% CI**	**P**	**95% CI**	**PR[c]**	**95% CI**	**N × 1000**	**P**	**95% CI**	**PR[c]**	**95%CI**
Total (100%)	166 461	**6.9**	**6.7–7.1**	–	–	**4.0**	**3.8–4.2**	–	–	**1 745**	**1.1**	**1.0–1.2**	–	–
18–24	22 521	8.3	7.4–9.0	Ref	–	1.4	1.1–1.8	Ref	–	154	0.7	0.5–0.9	Ref	–
25–44	71 161	6.0	5.7–6.3	0.7	07–0.8	1.7	1.5–1.9	1.1	0.8–1.4	491	0.7	0.6–0.8	0.9	0.6–1.3
45–64	62 299	5.4	5.1–5.6	0.6	0.5–07	3.3	3.1–3.5	**2.0**	1.6–2.6	892	1.4	13–1.6	**1.8**	13–2.5
≥65	10 480	4.2	3.7–4.7	0.5	0.4–0.6	5.8	5.2–6.4	**3.6**	2.8–4.7	208	2.0	1.6–2.4	**2.5**	1.8–3.6
Sex														
Male	87 227	5.0	4.7–5.3	Ref	–	3.4	3.1–3.6	Ref	–	522	0.7	0.6–0.8	Ref	–
Female	79 233	9.0	8.7–9.4	**1.7**	1.6–1.8	4.7	4.4–4.9	**1.4**	1.2–1.5	1 224	1.6	1.5–1.8	**2.8**	2.4–3.3
Race/ethnicity														
Hispanic	27 525	5.0	4.4–5.5	1.0	0.9–1.3	2.4	2.0–2.9	1.2	0.9–1.7	132	0.6	0.4–0.8	0.9	0.6–1.4
White, non-Hispanic	107 330	7.4	7.1–7.6	**1.4**	1.2–1.7	4.4	4.2–4.7	**1.7**	1.3–2.2	1 293	1.2	1.1–1.4	**1.7**	1.2–2.4
Black, non-Hispanic	19 879	8.0	7.3–8.7	**1.5**	1.3–1.8	3.8	3.4–4.2	**1.4**	1.1–1.9	254	1.3	1.0–1.6	**2.1**	1.4–3.1
Other	11 727	5.1	4.3–5.9	Ref	–	2.4	1.8–3.1	Ref	–	66	0.8	0.4–1.2	Ref	–
Education														
≤High school, GED	51 513	6.2	5.9–6.6	0.8	07–0.9	5.1	4.8–5.5	**1.2**	1.1–1.4	674	1.5	1.3–1.7	**1.3**	1.1–1.6
>High school	114 345	7.2	6.9–7.5	Ref	–	3.5	3.5–3.7	Ref	–	1 071	1.0	0.9–1.1	Ref	–
Poverty index [d]														
Poor	13 597	9.0	8.1–9.9	1.2	1.0–1.4	6.3	5.3–7.2	1.2	1.0–1.5	253	2.3	1.8–27	**2.4**	2.0–3.0
Near poor	23 658	7.1	6.6–7.7	1.0	0.8–1.0	5.7	5.1–6.3	**1.3**	1.1–1.5	337	1.8	1.4–2.1	**1.7**	1.4–2.1
Not poor	115 774	6.7	6.4–7.0	Ref	–	3.6	3.4–3.8	Ref	–	1 024	0.9	0.8–1.0	Ref	–
Unknown	9 464	6.4	5.4–7.3	0.9	0.8–1.1	3.3	27–3.9	0.8	0.7–1.0	95	1.1	0.7–1.5	1.1	0.8–1.2
Health insurance status														
Not insured	19 841	4.6	3.9–5.2	0.7	0.6–0.8	3.4	2.7–4.0	1.0	0.9–1.2	167	0.7	0.6–0.9	0.9	0.7–1.1
Insured	145 599	7.1	6.9–8.0	Ref	–	4.0	3.8–4.1	Ref	–	1 577	1.1	1.0–1.2	Ref	–
Region														
Northeast	29 377	7.4	6.9–8.0	Ref	–	3.6	3.2–4.0	Ref	–	307	1.0	0.8–1.2	Ref	–

Socio-demographic characteristics	Working adults[b] N × 1000	Asthma				COPD				ACO				
		P	95% CI	PR[c]	95% CI	P	95% CI	PR[c]	95% CI	N × 1000	P	95% CI	PR[c]	95%CI
Midwest	38 527	7.4	7.0–7.9	0.9	0.9–1.0	4.7	4.2–5.1	**1.2**	1.1–1.5	470	1.3	1.1–1.6	1.2	0.9–1.5
South	59 101	6.2	5.8–6.6	0.8	0.7–0.9	4.3	4.0–4.6	**1.2**	1.1–1.4	613	1.1	1.0–1.3	1.0	0.8–1.3
West	39 455	7.1	6.6–7.6	0.9	0.9–1.0	3.2	2.9–3.5	1.0	0.8–1.1	355	1.0	0.8–1.2	1.0	0.8–1.2
Smoking status														
Current	24 845	6.7	6.2–7.3	0.9	0.8–1.0	8.5	7.8–9.2	**4.0**	3.5–4.5	462	1.9	1.5–2.2	**2.8**	1.4–3.4
Former	31 966	8.0	7.4–8.6	**1.2**	1.1–1.3	5.2	4.7–5.7	**2.0**	1.8–2.3	494	1.4	1.2–1.7	**1.9**	1.6–2.3
Never	109 096	6.7	6.4–7.0	Ref	–	2.5	23–2.6	Ref	–	781	0.8	0.7–0.9	Ref	–

Abbreviations: ACO = asthma-COPD overlap; COPD = chronic obstructive pulmonary disease; CI = confidence interval; GED = general educational development certificate or diploma; P = prevalence; PR = prevalence ratio.

Boldface indicates statistical significance ($p < 0.05$).

[a]Age-adjusted to the 2000 U.S. Census Standard Population.

[b]Adults who reported “working at a job or business”; “with a job or business but not at work”; or “working, but not for pay, at a family-owned job or business” during the week before the survey interview.

[c]Prevalence ratio adjusted for age, sex, race and smoking status, reference groups (Ref) are as listed in the table.

[d]Poverty status is based on family income and family size using the U.S. Census Bureau’s poverty thresholds for the previous calendar year.

In National Health Interview Survey, “poor” persons are defined as having incomes below the poverty threshold, “near poor” are defined as having incomes of 100% to less than 200% of the poverty threshold, and “not poor” are defined as having incomes that are 200% of the poverty threshold or greater. Additional information available at http://ftp.cdc.gov/pub/Health_Statistics/NCHS/Dataset_Documentation/NHIS/2015/srvydesc.pdf.

Note: Totals may not add up due to rounding and or due to unknown or missing information. The data were weighted to provide national annual average estimates. PR adjusted for age, sex, and smoking status. All estimated Ns are presented in 1000s. The estimated number of workers with asthma $n = 11.6$ million, COPD $n = 6.0$ million and asthma-COPD overlap $n = 1.7$ million.

Table 2.

Age-adjusted[a] prevalence for asthma, COPD and asthma-COPD overlap among working adults by industry and occupation—National Health Interview Survey, United States, 2014–2018.

		Asthma		COPD		ACO		
Industry and occupation	**Working adults[b] N × 1000**	**P**	**95% CI**	**P**	**95% CI**	**N × 1000**	**P**	**95%CI**
Agriculture, Forestry, Fishing, and Hunting	2 335	4.4	3.1–5.7	3.4	2.4–4.3	23	1.1	0.5–1.7
Mining	901	6.6	3.4–9.8	5.2	2.1–8.3	_[c]	–	–
Utilities	1 421	6.4	3.7–9.1	2.6	1.3–3.8	–	–	–
Construction	10 803	4.4	3.6–5.1	4.4	3.5–5.2	68	0.7	0.4–1.0
Manufacturing	16 293	5.4	4.8–6.0	3.4	2.9–3.9	101	0.7	0.5–0.8
Wholesale Trade	3 976	4.8	3.6–6.0	4.3	3.0–5.6	33	1.3	0.5–2.1
Retail Trade	16 848	7.4	6.7–8.0	4.4	3.8–4.9	220	1.4	1.1–1.7
Transportation and Warehousing	7 031	6.5	5.4–7.7	4.9	4.0–5.8	80	1.2	0.8–1.6
Information	3 265	7.8	6.2–9.5	4.7	3.3–6.2	45	1.3	0.7–2.0
Finance and Insurance	7 498	7.7	6.6–8.7	3.8	3.0–4.6	69	1.0	0.6–1.4
Real estate and Rental and leasing	3 333	5.7	4.2–7.1	2.7	1.9–3.5	25	0.9	0.4–1.3
Professional, Scientific and Technical Services	12 892	6.8	5.9–7.6	3.2	2.7–3.8	95	0.8	0.5–1.0
Administrative & Support and Waste Management & Remediation Services	7 402	6.3	5.3–7.4	4.9	3.9–5.9	75	1.3	0.7–1.8
Education Services	16 007	8.5	7.8–9.2	3.5	3.0–4.0	188	1.2	0.9–1.5
Health Care and Social Assistance	22 499	8.6	8.0–9.2	4.1	3.7–4.6	326	1.5	1.2–1.8
Arts, Entertainment, and Recreation	3 632	7.5	6.1–8.9	4.6	3.4–5.8	33	1.1	0.6–1.7
Accommodation and Food Services	11 393	7.3	6.2–8.3	5.5	4.4–6.5	130	1.6	1.0–2.1
Other services (except Public Administration)	8 027	6.2	5.3–7.1	4.0	3.3–4.8	81	1.0	0.6–1.4
Public Administration	8 045	8.2	6.9–9.6	4.1	3.4–4.8	108	1.2	0.8–1.6
Management of Companies and Enterprises and armed forces	371	–	–	–	–	–	–	–
Unknown	2 490	3.1	2.0–4.2	–	–	–	–	–
Occupation								
Management	16 308	6.6	5.8–7.4	3.3	2.7–3.8	142	0.9	0.6–1.2
Business and Financial Operations	8 734	7.7	6.6–8.8	3.6	2.9–4.4	91	1.0	0.6–1.4
Computer and Mathematical	5 874	8.0	5.6–10.4	2.8	1.8–3.9	27	0.6	0.1–1.0
Architecture and Engineering	3 682	5.9	4.3–7.5	1.8	1.1–2.4	13	0.4	0.1–0.6

Industry and occupation	Working adults[b] N × 1000	Asthma		COPD		ACO		
		P	95% CI	P	95% CI	N × 1000	P	95%CI
life Physical, and Social Science	1 783	5.6	3.9–7.4	2.8	1.4–4.1	–	–	–
Community and Social Services	3 061	7.9	6.4–9.3	3.6	2.6–4.6	28	0.9	0.5–1.3
legal	1 826	8.0	5.9–10.1	2.9	1.7–4.1	19	1.1	0.3–1.8
Education, Training, and library	10 760	9.2	8.2–10.2	3.5	2.9–4.2	129	1.2	0.9–1.6
Arts, Design, Entertainment, Sports, and Media	3 670	8.0	6.6–9.5	2.5	1.7–3.3	32	0.9	0.5–1.3
Healthcare Practitioners and Technical	9 620	9.0	8.0–10.1	2.7	2.1–3.3	93	0.9	0.6–1.3
Healthcare Support	3 909	8.7	7.0–10.3	4.6	3.5–5.8	64	1.6	1.1–2.2
Protective Service	3 420	5.5	4.1–7.0	4.7	3.2–6.2	28	0.9	0.4–1.4
Food Preparation and Serving Related	8 820	6.6	5.6–7.6	5.8	4.6–6.9	111	1.8	1.2–2.4
Building and Grounds Cleaning and Maintenance	6 333	6.7	5.6–7.7	5.1	4.2–6.1	72	1.2	0.8–1.7
Personal Care and Service	5 988	8.9	7.6–10.1	5.5	4.5–6.5	127	2.3	1.6–3.0
Sales and Related	16 082	6.7	6.0–7.3	3.8	3.3–4.3	201	1.3	1.0–1.6
Office and Administrative Support	20 031	7.8	7.1–8.5	5.1	4.6–5.6	261	1.4	1.1–1.7
Farming, Fishing, and Forestry	1 324	5.1	3.2–7.0	3.4	2.0–4.8	–	–	–
Construction and Extraction	8 287	4.1	3.3–4.9	4.3	3.2–5.3	56	0.9	0.4–1.3
Installation, Maintenance, and Repair	5 231	5.9	4.6–7.2	4.5	3.2–5.7	43	0.8	0.4–1.2
Production	9 305	5.1	4.3–5.9	3.7	3.0–4.5	65	0.8	0.5–1.0
Transportation and Material Moving	9 720	5.7	4.8–6.6	5.4	4.6–6.2	107	1.3	0.9–1.8
Military	290	–	–	–	–	–	–	–
Refused, not ascertained, don’t know	2 403	2.7	1.7–3.7	2.3	1.3–3.2	–	–	–

Abbreviations: COPD = chronic obstructive pulmonary disease; ACO = asthma-COPD overlap; P = prevalence; CI = confidence interval; PR = prevalence ratio.

[a]Age-adjusted to the 2000 U.S. Census Standard Population.

[b]Adults who reported “working at a job or business”; “with a job or business but not at work”; or “working but not for pay at a family-owned job or business” during the week before the survey interview. All estimated Ns are presented in 1000 s.

[c]Estimate suppressed because relative standard error >30%.

Note: Totals may not add up due to rounding and or due to unknown or missing information. The data were weighted to provide national annual average estimates. All estimated Ns are presented in 1000 s. The estimated number of workers with asthma *n* = 11.6 million, COPD *n* = 6.0 million and asthma-COPD overlap *n* = 1.7 million.

Table 3.

Proportion of working adults[a] with asthma alone, COPD alone, and asthma-COPD overlap and adjusted prevalence ratios by healthcare utilization, lost workdays, bed days, health status, body mass index and co-morbidities—National Health Interview Survey, United States, 2014–2018.

	Asthma alone		COPD alone		ACO		ACO vs. asthma alone		ACO vs. COPD alone		ACO vs. workers with no disease[d]	
Characteristics	**%**	**95% CI**	**%**	**95% CI**	**%**	**95% CI**	**PR[b]**	**95% CI**	**PR[c]**	**95% CI**	**PR[c]**	**95% CI**
Physician office visits												
Zero	13.0	11.8–14.1	12.4	10.7–14.2	8.8	6.3–11.4	0.5	0.4–0.7	0.7	0.5–1.0	0.5	0.4–0.6
1–3 times	53.2	51.5–55.0	49.2	46.8–51.7	46.4	41.9–50.9	0.9	0.8–1.0	0.9	0.8–1.0	0.9	0.8–1.0
>3 times	33.8	32.2–35.4	38.4	36.0–40.8	44.7	40.2–49.3	**1.9**	1.7–2.1	**1.2**	1.1–1.4	**2.0**	1.8–2.2
Emergency department visits												
Zero	72.8	71.5–74.2	64.9	63.0–66.8	57.3	53.7–60.9	0.7	0.6–0.8	0.8	0.7–0.9	0.7	0.7–0.8
1–3 times	23.8	22.5–25.1	29.5	27.8–31.3	34.9	31.5–38.4	**2.2**	2.0–2.4	**1.3**	1.1–1.5	**2.3**	2.1–2.6
>3 times	3.4	2.9–4.0	5.6	4.5–6.6	7.8	5.8–9.9	**5.7**	43–7.5	**1.7**	1.2–2.4	**7.2**	5.5–9.5
Lost workdays												
Zero	46.5	44.8–48.2	44.0	41.9–46.1	41.7	37.8–45.5	0.8	0.7–0.8	0.9	0.9–1.1	0.7	0.7–0.8
1–7 days	42.1	40.4–43.8	37.8	35.7–39.8	38.7	35.1–42.2	**1.1**	1.0–1.2	1.0	0.9–1.1	**1.1**	1.0–1.3
>7 days	11.4	10.5–12.4	18.3	16.7–19.8	19.7	16.8–22.6	**2.4**	2.1–2.8	**1.1**	0.9–1.3	**2.6**	2.3–3.1
No. of bed days												
Zero	52.4	50.8–54.1	48.1	45.9–50.3	46.5	42.5–50.4	0.8	0.7–0.8	1.0	0.9–1.1	0.7	0.7–0.8
1–3 days	37.6	36.1–39.2	37.1	35.0–39.2	35.3	31.6–39.0	**1.2**	1.1–1.3	1.0	0.8–1.0	**1.2**	1.1–1.3
>3	9.9	9.0–10.9	14.8	13.3–16.3	18.2	15.3–21.1	**3.4**	2.9–4.0	**1.3**	1.1–1.6	**3.9**	33–4.6
Body Mass Index (BMI)												
Underweight	1.2	0.8–1.5	1.3	0.9–1.7	1.0	0.4–1.5	0.7	0.4–1.3	0.6	0.3–1.2	0.7	0.4–1.2
Healthy	27.3	25.9–28.7	25.1	23.2–27.0	19.5	16.4–22.5	0.6	0.5–0.7	0.7	0.6–0.9	0.6	0.5–0.7
Overweight/obese	71.5	70.1–72.9	73.6	71.6–75.6	79.6	76.5–82.6	**1.2**	1.2–1.3	**1.1**	1.1–1.2	**1.2**	1.2–13
Health status												
Poor/fair physical health	12.2	11.2–13.2	20.1	18.5–21.8	23.0	20.1–26.0	**3.0**	2.6–3.4	**1.3**	1.1–1.5	3.4	2.9–3.9
Poor/fair mental health	63.2	60.8–65.6	62.7	59.8–65.7	64.5	59.3–69.7	**1.1**	1.0–1.2	1.0	0.9–1.1	1.1	1.0–1.2
Co-morbidity												
Heart Disease	8.0	7.1–8.9	12.6	10.8–14.4	15.5	12.9–18.0	**2.4**	2.0–2.9	**1.2**	1.0–1.5	**2.7**	2.2–3.2
Hay fever	18.8	17.5–20.2	11.9	10.4–13.3	29.9	26.5–33.2	**3.7**	3.3–42	**2.4**	2.0–2.8	**4.3**	3.8–4.9

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Characteristics	Asthma alone		COPD alone		ACO		ACO vs. asthma alone		ACO vs. COPD alone		ACO vs. workers with no disease[d]	
	%	95% CI	%	95% CI	%	95% CI	PR[b]	95% CI	PR[c]	95% CI	PR[c]	95% CI
Any cancer	6.5	57–7.2	10.8	9.4–12.3	12.8	10.4–15.1	**1.5**	1.2–1.8	**1.2**	1.0–1.5	**1.5**	13–1.9
Diabetes	7.1	6.2–8.0	11.4	10.0–12.8	13.9	11.0–16.9	**1.8**	1.4–2.2	**1.3**	1.0–1.6	**1.8**	1.5–23
High cholesterol	15.7	14.5–17.0	27.8	25.7–29.9	26.9	23.5–30.3	**1.4**	1.3–1.6	1.0	0.9–1.2	**1.5**	13–1.7
Hypertension	18.8	17.4–20.1	32.5	30.2–34.7	36.2	32.5–39.9	**1.7**	1.5–1.9	**1.2**	1.0–1.3	**1.8**	1.6–2.0

Abbreviations: COPD = chronic obstructive pulmonary disease; ACO = asthma-COPD overlap; CI = confidence interval; PR= prevalence ratio.

Boldface indicates statistical significance ($p < 0.05$).

[a]Adults who reported “working at a job or business”; “with a job or business but not at work”; or “working, but not for pay at a family-owned job or business” during the week before the survey interview.

[b]Adjusted for age, sex, race and smoking status. Reference group includes workers with asthma alone.

[c]Adjusted for age, sex, race and smoking status. Reference group includes workers with COPD alone.

[d]Adjusted for age, sex, and smoking status. Reference group (no disease group) includes workers with no asthma, no COPD, and no ACO.

Note: The data were weighted to provide national annual average estimates. The estimated number of workers with asthma alone n = 9.9 million, COPD alone n = 4.2 million and asthma-COPD overlap n = 1.7 million.