Prevalence of Chronic Obstructive Pulmonary Disease Among US Working Adults Aged 40 to 70 Years

National Health Interview Survey Data 2004 to 2011

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Objective: To estimate the prevalence and prevalence odds ratios of chronic obstructive pulmonary disease (COPD) among US workers by major occupational groups. **Methods:** The 2004 to 2011 National Health Interview Survey data for working adults 40 to 70 years old was analyzed to estimate the prevalence of COPD by major occupational groups. Logistic regression models were used to evaluate the associations between COPD (chronic bronchitis or emphysema) and occupations. **Results:** The estimated overall COPD prevalence was 4.2% (95% CI, 4.0 to 4.3). The odds of COPD were highest among workers in health care support occupations (prevalence odds ratio, 1.64; 95% CI, 1.25 to 2.14) followed by food preparation and serving-related occupations (prevalence odds ratio, 1.57; 95% CI, 1.20 to 2.06). **Conclusions:** Prevalence varied by occupations, suggesting workplace exposures may contribute to COPD. Preventive measures such as interventions to reduce smoking may reduce the prevalence of COPD.

Chronic obstructive pulmonary disease (COPD) is a primary cause of morbidity and mortality globally.[1] In the United States, COPD ranks third in causes of mortality with 100,000 deaths annually. An estimated 15 million people had health care provider diagnosed COPD in 2010, and an estimated 12 million potential cases remain undiagnosed.[2–4] The estimated total annual cost of COPD for 2010 was $49.9 billion.[5] The probability of being employed is reduced by 8.6% with COPD associated disability.[4]

Chronic obstructive pulmonary disease is a chronic disease, mostly affecting older adults.[6,7] Balmes et al[8] concluded that 15% of COPD is attributable to occupational exposure. Furthermore, according to Bang et al,[9] certain occupation groups have higher prevalence of COPD, especially among service occupations. Therefore, for this study we analyzed data for working adults aged 40 to 70 years by occupation. This study is based on National Health Interview Survey (NHIS) data (2004 to 2011) for COPD by occupation, representing a large sample of US working adults. The aim of this study was to (1) estimate the prevalence of COPD among older working adults in the United States by major occupational groups, and (2) provide prevalence odds ratios (PORs) of COPD by major occupational groups.

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METHODS

The NHIS is an annual cross-sectional survey of the noninstitutionalized US population conducted by the National Center for Health Statistics.[10] The NHIS samples are selected through a complex, multistage, probability design, and the data are collected through personal interviews of participants aged 18 years or more. Informed consent was obtained from all participants, and the National Center for Health Statistics Research Ethics Review Board approved the protocol. For this study, we included data from 2004 to 2011. Eight years of data were combined to improve the precision and reliability of the estimates. The survey response rate for the NHIS adults sampled ranged from 72.5% in 2004 to 66.3% in 2011. Questionnaires, documentation, and data sets are publicly available at ftp://ftp.cdc.gov/pub/Health_Statistics/NCHS/Dataset_Documentation/NHIS/2011/srvydesc.pdf.

During years 2004 to 2011, of the 141 million estimated US working adults 18 years and older, an estimated 73.8 million were 40 to 70 years of age. Currently working adults were defined as those who were employed during the week before their interview. We defined COPD on the basis of a positive response to one or both questions:

1. Have you *ever* been told by a doctor or other health professional that you had . . . emphysema?
2. *During the past 12 months*, have you been told by a doctor or other health professional that you had . . . chronic bronchitis?

Demographic data were collected during the interview including self-reported age, sex, smoking status, and race; race was categorized as white, black, and other. Information on each participant's current employment by industry and occupation was gathered and recoded by the National Center for Health Statistics for confidentiality reasons. This study included the recoded 23 major occupation groups, which were based on Census Occupation Codes as reported by Standard Occupation Classification codes. Participants with unknown and missing information for COPD were excluded from the analysis. The occupation codes before 2004 are not directly comparable with the more recent data because of the changes in coding in 2004. Therefore, we analyzed 2004 to 2011 NHIS data.[11]

Data Analysis

We estimated annual average COPD prevalence for individuals aged 40 to 70 years during 2004 to 2011, by demographic characteristics, smoking status, and current occupation. SAS® 9.3 (SAS Institute Inc., Cary, NC).[12] PROC SURVEYFREQ and PROC SURVEYLOGISTIC procedures were used to analyze data and calculate estimated frequencies, standard errors, and prevalence rates with 95% confidence intervals (CIs). We used a logistic regression model to estimate PORs by occupation. The multivariate regression models were adjusted for smoking status (current, former, and never), age, sex, race, and pack-years of cigarette smoking (available for current smokers only). Separate models were also stratified by

smoking status and never-smoker estimates were presented. Workers in management occupations were used as a reference because we perceived that they had low likelihood of occupational exposure to agents that could contribute to COPD and because they were previously reported to have minimal risk of COPD.[9]

RESULTS

Overall COPD Prevalence and Prevalence by Occupational Categories

The overall COPD prevalence estimates, by sex, race, and education level, are provided in Table 1. The estimated overall COPD prevalence for working adults aged 40 to 70 years was 4.18% (95% CI, 4.01 to 4.34). Prevalence of COPD was higher among females (5.40%; 95% CI, 5.12 to 5.67) and whites (4.40%; 95% CI, 4.22 to 4.59).

Among major occupational groups, the estimated prevalence of COPD was highest in health care support occupations (7.11%; 95% CI, 5.64 to 8.57), especially among females (7.70%; 95% CI, 6.08 to 9.33) and whites (8.42%; 95% CI, 6.43 to 10.41) (Table 2). Food preparation and serving-related occupations had the next highest COPD prevalence overall (6.46%; 95% CI, 5.12 to 7.80), again primarily among females (8.41%; 95% CI, 6.52 to 10.31) and whites (7.31%; 95% CI, 5.59 to 9.03). Increased COPD prevalence among personal care and service occupations (5.28%; 95% CI, 4.14 to 6.42) was also observed with higher prevalence among females (5.67%; 95% CI, 4.39 to 6.94), whites (5.67%; 95% CI, 4.25 to 7.09), and blacks (5.62%; 95% CI, 3.06 to 8.18).

COPD PORs by Occupational Categories as Compared With Management Occupations

Workers in occupations that had significantly elevated odds ratios for COPD as compared with workers in management occupations included health care support (POR, 1.64; 95% CI, 1.25 to 2.14); food preparation and serving (POR, 1.57; 95% CI, 1.20 to 2.06); installation, maintenance, and repair (POR, 1.52; 95% CI, 1.16 to 1.98); protective service (POR, 1.5; 95% CI, 1.07 to 2.11); building and grounds cleaning and maintenance support (POR, 1.4; 95% CI, 1.08 to 1.81); and office and administrative support (POR, 1.25; 95% CI, 1.04 to 1.51) (Table 3). After excluding adults with current asthma, seven occupations had significantly elevated odds ratios for COPD (data not shown): health care support (POR, 1.69; 95% CI, 1.21 to 2.36); food preparation and serving-related (POR, 1.62; 95% CI, 1.15 to 2.28); building and grounds cleaning and maintenance (POR, 1.42; 95% CI, 1.02 to 1.97); office and administrative support (POR, 1.29; 95% CI, 1.01 to 1.64); construction and extraction (POR, 1.40; 95% CI, 1.02 to 1.94); installation, maintenance, and repair (POR, 1.61; 95% CI, 1.16 to 2.22); production (POR, 1.43; 95% CI, 1.09 to 1.88); and transportation and material moving (POR, 1.49; 95% CI, 1.08 to 2.04) .

Among never smokers, occupations associated with increased odds of COPD included food preparation and serving (POR, 2.34; 95% CI, 1.52 to 3.60); protective service (POR, 2.11; 95% CI, 1.27 to 3.49); office and administrative support (POR, 1.51; 95% CI, 1.11 to 2.07); and education, training, and library (POR, 1.44; 95% CI, 1.05 to 1.98).

Sex differences in COPD were observed by occupational categories. In females, the elevated PORs were among workers in protective services (POR, 2.12; 95% CI, 1.31 to 3.42); food preparation and serving (POR, 1.72; 95% CI, 1.25 to 2.37); health care support (POR, 1.70; 95% CI, 1.24 to 2.33); and office and administrative support (POR, 1.34; 95% CI, 1.06 to 1.70). In contrast, among males the only significant PORs were in education, training, and library (POR, 1.79; 95% CI, 1.17 to 2.75); building and grounds cleaning and maintenance (POR, 1.68; 95% CI, 1.17 to 2.42); and installation, maintenance, and repair (POR, 1.41; 95% CI, 1.04 to 1.93) occupations.

Results from the race-specific analyses identified whites as the subgroup with higher risk of COPD. Table 3 shows the POR overall, sex-specific, and for whites. For whites, there were significantly elevated PORs for COPD among workers in health care support (POR, 1.80; 95% CI, 1.33 to 2.44); food preparation and serving (POR, 1.61; 95% CI, 1.20 to 2.18); protective service (POR, 1.57; 95% CI, 1.08 to 2.30); installation, maintenance, and repair (POR, 1.53; 95% CI, 1.14 to 2.03); building and grounds cleaning and maintenance support (POR, 1.41; 95% CI, 1.07 to 1.85); transportation and material moving (POR, 1.36; 95% CI, 1.01 to 1.84); construction and extraction (POR, 1.35; 95% CI, 1.00 to 1.81); office and administrative support (POR, 1.31; 95% CI, 1.07 to 1.60); and education training and library (POR, 1.28; 95% CI, 1.01 to 1.62) occupations.

A separate analysis was done for self-reported physician diagnoses of emphysema and chronic bronchitis, and the results are presented in Table 4. The results with significant PORs for COPD, emphysema, or chronic bronchitis are presented separately by occupational categories. The odds of overall COPD, emphysema, and bronchitis varied by occupation. Certain occupations such as health care support had the highest POR for chronic bronchitis (POR, 1.72; 95% CI, 1.30 to 2.27), followed by protective service (POR, 1.60; 95% CI, 1.11 to 2.29); construction and extraction (POR, 1.37; 95% CI, 1.00 to 1.88); and office and administrative support (POR, 1.25; 95% CI, 1.02 to 1.52). Occupations with higher odds ratios for emphysema included personal care and service (POR, 2.64; 95% CI, 1.49 to 4.67); building and grounds cleaning and maintenance (POR, 2.41; 95% CI, 1.40 to 4.13); installation, maintenance, and repair (POR, 2.25; 95% CI, 1.36 to 3.73); and transportation and material moving (POR, 2.02; 95% CI, 1.25 to 3.24). Food preparation and serving-related occupation was the only category that had significant PORs for both emphysema and chronic bronchitis.

TABLE 1. Estimated Number of US Working Adults (40 to 70 Years) and Prevalence of Self-Reported Physician Diagnosed COPD by Selected Characteristics, 2004 to 2011

Characteristic	*N**	COPD P† (95% CI)
Age, yrs		
40–54	50,825	3.75 (3.54–3.95)
55–70	22,974	5.13 (4.76–5.49)
Sex		
Male	38,739	3.07 (2.85–3.28)
Female	35,060	5.40 (5.12–5.67)
Race		
White	61,952	4.40 (4.22–4.59)
Black	7,762	3.41 (2.98–3.83)
Other	4,086	2.15 (1.65–2.66)
Smoking status	73,799	
Current	14,220	7.47 (6.96–7.97)
Former	17,933	4.92 (4.50–5.33)
Never	41,024	2.74 (2.54–2.94)
Unknown/missing	622	‡
Total	73,799	4.18 (4.01–4.34)

*Annual average estimates are per 1000 population.
†Prevalence estimates.
‡Prevalence estimates not calculated for missing or unknown values.
CI, confidence interval; COPD, chronic obstructive pulmonary disease.

TABLE 2. Estimated Prevalence of COPD, by Occupation, Sex, and Race—US Working Adults 40 to 70 Years, 2004 to 2011

	Overall		Males		Females		Whites		Blacks	
Occupation	***N****	**COPD P† (95% CI)**	***N***	**COPD P (95% CI)**	***N***	**COPD P (95% CI)**	***N***	**COPD P (95% CI)**	***N***	**COPD P (95% CI)**
Management	8,440	3.22 (2.75–3.68)	5,465	2.64 (2.08–3.19)	2,975	4.29 (3.45–5.13)	7,548	3.22 (2.74–3.71)	489	4.43 (2.15–6.71)
Business and financial operations	3,358	3.58 (2.82–4.35)	1,575	1.83 (0.95–2.71)	1,782	5.13 (3.92–6.34)	2,837	3.61 (2.77–4.45)	308	4.38 (1.98–6.77)
Computer and mathematical	1,742	2.61 (1.68–3.54)	1,215	2.51 (1.39–3.63)	527	2.84 (1.29–4.38)	1,460	2.68 (1.64–3.73)	130	‡
Architecture and engineering	1,546	1.88 (1.05–2.72)	1,368	1.50 (0.72–2.28)	178	‡	1,355	1.98 (1.04–2.91)	51	‡
Life, physical, and social science	730	3.03 (1.59–4.47)	407	‡	323	4.78 (2.26–7.31)	632	3.18 (1.57–4.80)	32	‡
Community and social services	1,294	3.97 (2.87–5.06)	533	3.52 (1.45–5.58)	761	4.28 (2.89–5.67)	999	4.11 (2.83–5.39)	235	‡
Legal	958	3.65 (2.34–4.96)	510	‡	448	4.73 (2.62–6.84)	866	3.62 (2.21–5.02)	62	‡
Education, training, and library	4,887	4.50 (3.79–5.22)	1,175	4.14 (2.71–5.57)	3,712	4.62 (3.78–5.46)	4,302	4.66 (3.86–5.45)	436	3.96 (2.11–5.81)
Arts, design, entertainment, sports, and media	1,282	3.95 (2.59–5.31)	648	3.71 (1.83–5.59)	634	4.19 (2.23–6.15)	1,160	3.54 (2.18–4.90)	67	‡
Health care practitioners and technical	4,067	3.82 (3.10–4.54)	1,056	2.82 (1.59–4.06)	3,011	4.17 (3.32–5.02)	3,334	4.11 (3.29–4.94)	423	3.46 (1.37–5.54)
Health care support	1,442	7.11 (5.64–8.57)	170	‡	1,272	7.70 (6.08–9.33)	994	8.42 (6.43–10.41)	367	4.47 (2.65–6.29)
Protective service	1,345	4.45 (3.18–5.71)	1,056	3.18 (1.91–4.46)	289	9.05 (5.63–12.48)	1,047	4.86 (3.29–6.43)	249	3.06 (1.48–4.63)
Food preparation and serving related	2,221	6.46 (5.12–7.80)	718	2.39 (1.23–3.54)	1,502	8.41 (6.52–10.31)	1,652	7.31 (5.59–9.03)	370	4.56 (2.50–6.62)
Building and grounds cleaning and maintenance	3,069	4.86 (4.01–5.72)	1,699	4.32 (3.15–5.50)	1,369	5.53 (4.10–6.97)	2,424	5.23 (4.23–6.24)	488	3.43 (1.95–4.91)
Personal care and service	2,088	5.28 (4.14–6.42)	368	‡	1,719	5.67 (4.39–6.94)	1,590	5.67 (4.25–7.09)	311	5.62 (3.06–8.18)
Sales and related	6,916	3.93 (3.36–4.50)	3,694	2.98 (2.21–3.75)	3,222	5.02 (4.20–5.84)	6,076	4.26 (3.62–4.90)	442	‡
Office and administrative support	9,690	5.32 (4.76–5.89)	2,131	2.96 (1.99–3.93)	7,559	5.99 (5.32–6.65)	8,160	5.66 (5.01–6.31)	1,093	4.16 (2.87–5.46)
Farming, fishing, and forestry	428	3.43 (1.51–5.34)	320	‡	108	‡	369	3.44 (1.37–5.52)	28	‡
Construction and extraction	3,822	3.91 (3.08–4.73)	3,701	3.81 (2.97–4.64)	121	‡	3,394	4.20 (3.29–5.12)	315	‡
Installation, maintenance, and repair	2,830	4.31 (3.42–5.20)	2,714	3.98 (3.09–4.87)	116	‡	2,457	4.46 (3.45–5.48)	240	‡
Production	5,032	4.01 (3.40–4.62)	3,421	3.00 (2.31–3.70)	1,611	6.15 (94.82–7.48)	4,112	4.41 (3.67–5.15)	591	3.07 (1.76–4.39)
Transportation and material moving	4,306	4.41 (3.54–5.28)	3,501	3.75 (2.91–4.59)	805	7.25 (4.37–10.13)	3,439	4.88 (3.80–5.97)	685	1.78 (0.82–2.73)
Military	85	‡	51	‡	35	‡	60	‡	16	‡
Refused, not ascertained, do not know	2,222	1.79 (1.21–2.37)	1,242	1.01 (0.43–1.59)	980	2.78 (1.68–3.88)	1,686	1.81 (1.12–2.49)	334	‡
Total	73,799	4.18 (4.01–4.34)	38,739	3.07 (2.85–3.28)	35,060	5.40 (.12–5.67)	61,952	4.40 (4.22–4.59)	7,762	3.406 (2.98–3.83)

*Estimated annual average per 1000 working population.

†Prevalence estimates.

‡Relative standard errors greater than 30%, estimates unreliable.

CI, confidence interval; COPD, chronic obstructive pulmonary disease.

TABLE 3. Adjusted Prevalence Odds Ratios for COPD, by Occupational Category—US Working Adults 40 to 70 Years, 2004 to 2011

Occupation	Overall POR (95% CI)	Never Smokers POR (95% CI)	Males POR (95% CI)	Females POR (95% CI)	Whites POR (95% CI)
Management	1.00	1.00	1.00	1.00	1.00
Business and financial operations	1.01 (0.77–1.33)	1.25 (0.83–1.89)	0.72 (0.42–1.22)	1.21 (0.87–1.67)	1.00 (0.74–1.34)
Computer and mathematical	0.95 (0.63–1.44)	0.95 (0.57–1.59)	1.11 (0.67–1.84)	0.73 (0.39–1.35)	0.96 (0.61–1.50)
Architecture and engineering	0.70 (0.43–1.14)	*	0.57 (0.32–1.02)	*	0.72 (0.43–1.21)
Life, physical, and social science	0.91 (0.54–1.53)	*	*	1.16 (0.63–2.11)	0.93 (0.53–1.64)
Community and social services	1.15 (0.82–1.59)	1.35 (0.79–2.30)	1.59 (0.83–3.06)	1.02 (0.69–1.51)	1.15 (0.80–1.66)
Legal	1.13 (0.76–1.66)	1.10 (0.60–2.01)	*	1.13 (0.69–1.86)	1.12 (0.73–1.71)
Education, training, and library	1.23 (0.98–1.54)	1.44 (1.05–1.98)	1.79 (1.17–2.75)	1.18 (0.89–1.56)	1.28 (1.01–1.62)
Arts, design, entertainment, sports, and media	1.13 (0.77–1.66)	1.11 (0.59–2.07)	1.46 (0.82–2.58)	0.97 (0.57–1.65)	1.01 (0.66–1.54)
Health care practitioners and technical	1.02 (0.79–1.32)	1.34 (0.92–1.96)	1.27 (0.76–2.11)	1.03 (0.76–1.39)	1.07 (0.82–1.41)
Health care support	1.64 (1.25–2.14)	1.57 (0.98–2.49)	*	1.70 (1.24–2.33)	1.80 (1.33–2.44)
Protective service	1.50 (1.07–2.11)	2.11 (1.27–3.49)	1.21 (0.76–1.93)	2.12 (1.31–3.42)	1.57 (1.08–2.30)
Food preparation and serving related	1.57 (1.20–2.06)	2.34 (1.52–3.60)	1.08 (0.62–1.87)	1.72 (1.25–2.37)	1.61 (1.20–2.18)
Building and grounds cleaning and maintenance	1.40 (1.08–1.81)	1.55 (0.99–2.43)	1.68 (1.17–2.42)	1.19 (0.82–1.72)	1.41 (1.07–1.85)
Personal care and service	1.25 (0.94–1.66)	0.96 (0.61–1.52)	1.41 (0.57–3.49)	1.26 (0.91–1.73)	1.24 (0.90–1.70)
Sales and related	1.05 (0.84–1.33)	1.41 (0.97–2.04)	1.07 (0.74–1.55)	1.06 (0.80–1.40)	1.13 (0.89–1.44)
Office and administrative support	1.25 (1.04–1.51)	1.51 (1.11–2.07)	1.08 (0.72–1.62)	1.34 (1.06–1.70)	1.31 (1.07–1.60)
Farming, fishing, and forestry	1.17 (0.64–2.13)	*	*	*	1.09 (0.58–2.08)
Construction and extraction	1.29 (0.97–1.71)	*	1.29 (0.93–1.79)	*	1.35 (1.00–1.81)
Installation, maintenance, and repair	1.52 (1.16–1.98)	1.34 (0.74–2.43)	1.41 (1.04–1.93)	*	1.53 (1.14–2.03)
Production	1.17 (0.94–1.46)	1.21 (0.84–1.74)	1.05 (0.77–1.42)	1.32 (0.96–1.81)	1.22 (0.97–1.55)
Transportation and material moving	1.30 (0.99–1.71)	1.53 (0.90–2.62)	1.26 (0.90–1.77)	1.48 (0.90–2.42)	1.36 (1.01–1.84)

*Relative standard errors are greater than 30%, estimates unreliable.
Overall adjusted for age, sex, race, smoking status, and pack-years.
Never smokers adjusted for age, sex, and race.
Sex adjusted for age, race, smoking status, and pack-years.
Whites adjusted for age, sex, smoking status, and pack-years.
CI, confidence interval; COPD, chronic obstructive pulmonary disease; POR, prevalence odds ratio.

TABLE 4. Adjusted Prevalence Odds Ratios for COPD, Emphysema, and Chronic Bronchitis, by Occupational Categories—US Working Adults Aged 40 to 70 Years, 2004 to 2011

Occupation	*N**	Overall COPD POR (95% CI)	*N*	Emphysema POR (95% CI)	*N*	Chronic Bronchitis POR (95% CI)
Management	271	1.00	54	1.00†	232	1.00
Health care support	102	1.64 (1.25–2.14)	†	†	99	1.72 (1.30–2.27)
Food preparation and serving related	143	1.57 (1.20–2.06)	30	1.93 (1.08–3.44)	126	1.54 (1.15–2.06)
Installation, maintenance, and repair	122	1.52 (1.16–1.98)	49	2.25 (1.36–3.73)	79	1.24 (0.90–1.71)
Protective service	60	1.50 (1.07–2.11)	†	†	52	1.60 (1.11–2.29)
Building and grounds cleaning and maintenance	149	1.40 (1.08–1.81)	49	2.41 (1.40–4.13)	115	1.22 (0.93–1.62)
Transportation and material moving	190	1.30 (0.99–1.71)	77	2.02 (1.25–3.24)	133	1.14 (0.84–1.55)
Construction and extraction	149	1.29 (0.97–1.71)	40	1.22 (0.70–2.13)	122	1.37 (1.00–1.88)
Personal care and service	110	1.25 (0.94–1.66)	34	2.64 (1.49–4.67)	88	1.09 (0.81–1.47)
Office and administrative support	515	1.25 (1.04–1.51)	76	1.19 (0.75–1.90)	463	1.25 (1.02–1.52)
Total	3078		676		2603	

*Estimated annual average of the condition (COPD, emphysema, or chronic bronchitis) per 1000 working population; the total number includes all the estimates, even if the POR for occupations that were not significant and are not shown.
†Relative standard errors are greater than 30%, estimates unreliable.
Overall COPD, emphysema, and chronic bronchitis adjusted for age, sex, race, smoking status, and pack-years.
CI, confidence interval; COPD, chronic obstructive pulmonary disease; POR, prevalence odds ratio.

DISCUSSION

During 2004 to 2011, the overall estimated annual average prevalence of self-reported doctor-diagnosed COPD among working adults aged 40 to 70 years was 4.18% and increased with age from 3.75% for adults 40 to 54 years old to 5.13% for adults 55 to 70 years old. COPD prevalence was higher among females, whites, and current smokers. The results are consistent with previous findings from the Behavioral Risk Factor Surveillance System study, which showed that the prevalence of self-reported doctor-diagnosed COPD (or chronic bronchitis or emphysema), among all US adults in 2011, increased with age from 6.6% for adults aged 45 to 54 years to 9.2% for adults aged 55 to 64 years, to 12.1% for adults aged 65 to 74 years.[2] Nevertheless, overall prevalence of COPD in this study among working adults was lower than the Behavioral Risk Factor Surveillance System estimates, which included both working and nonworking adults with COPD.

The COPD prevalence estimates varied by occupation with workers in service occupations, including health care support, food preparation and serving, and personal care and service occupations having high prevalence of COPD, which was similar to the study by Bang et al[9] (COPD outcome defined as self-reported doctor-diagnosed chronic bronchitis or emphysema using 1997 to 2004 NHIS data). Various risk factors have been associated with COPD and smoking is one of the most important factors.[2,13,14] Estimated smoking prevalence among the above listed service occupations was 20% or higher and exceeded the Healthy People 2020 goal of 12% or less.[13,15] Smoking and occupational exposures have been shown to have an interactive effect on an additive scale.[14] In this study, as compared with never smokers, the prevalence of COPD among current smokers was greater than 2.5 times among workers in personal care and service, health care support occupations, and protective service occupations. The overall prevalence of COPD among currently working adults aged 40 to 70 who smoked was 7.47% versus 2.74% among never smokers.

It has been estimated that 15% of COPD is attributable to occupational exposure.[8] Vapors, gas, dust, and fume exposures have been shown to be associated with COPD among workers in various occupations and industries.[9,16–20] Exposure to organic, inorganic dust, and sensitizing agents in agricultural and food workers shows higher prevalences of respiratory conditions including COPD morbidity and mortality.[21,22] Chronic exposure to coal and silica dust increases risk of COPD among miners.[8,23] The current results show that the COPD prevalence among workers in construction and extraction (includes mining), and farming, fishing and forestry occupations was not as high as the overall working population, probably a result of a younger workforce and healthy worker effect. Workers greater than 55 years of age had higher prevalence of COPD in this study.

Prevalence estimates of COPD also varied by sex. Overall, females had a higher prevalence than males, which is consistent with findings reported by Ford et al.[24] Various factors have been associated with higher COPD among women, some of which are environmental tobacco smoke, biological differences, occupational exposure, or a combination of all these factors.[25,26] In this study, females employed in protective service, food preparation and serving, production, and transportation and material moving had prevalence estimates of COPD that were two to four times higher than males. This is consistent with a previous study by Bang et al[9] and a review publication by Varkey.[27]

As compared with management occupations, after adjusting for age, race, sex, and smoking, the odds of having COPD were significantly higher among workers in health care support; protective service; food preparation and serving related; building and grounds cleaning and maintenance; and installation, maintenance, and repair occupations even after adjustment, which is consistent with studies by Bang et al.[9] and Hnizdo et al.[28] Additional analysis were done to assess whether higher odds ratios of COPD in certain occupations were a result of chronic bronchitis or emphysema. The odds ratios of chronic bronchitis or emphysema varied by occupation. Higher odds of chronic bronchitis were found in certain occupations, for example in health care support, protective service, construction and extraction, and office and administrative support occupations. In a study among office workers, exposure to paper dust has been associated with increased chronic bronchitis and breathlessness.[29] The prevalence of smoking was 30% during 2004 to 2010 among construction and extraction workers[13] and the prevalence of overall COPD was elevated, but not significant in this study. Nevertheless, among construction and extraction workers, the odds of having chronic bronchitis were 1.4 times that of workers in management occupations, indicating that there are factors associated with construction and extraction work. Ahman et al[30] reported that exposure to lacquers, wood dust, solvent-based products, and glues was associated with a higher prevalence of chronic bronchitis. Results show that workers in installation, maintenance, and repair; transportation and material moving; and personal care and service had higher odds ratios of emphysema. Previous research shows that occupational exposure to coal dust, silica, endotoxin, and cadmium was associated with emphysema.[31,32]

This study has some limitations. Disease classification and subsequent prevalence rates were based on self-reports of health care professional-diagnosed emphysema and/or chronic bronchitis. It is unknown whether the diagnosis of emphysema was based on radiology, lung function, or some other methods. Respondents may have been unfamiliar with the terms, and this may have led to under- or overestimation of the prevalence estimates. Furthermore, spirometry information was not collected in the NHIS study. Self-report of COPD is prone to recall bias. Chronic bronchitis may be confused with acute bronchitis, and this may have resulted in misclassification.[33] Furthermore, this study definition of COPD was based on self-reported physician diagnosis of chronic bronchitis and emphysema and did not exclude those who reported asthma. Previous research has shown that there are overlapping features of asthma and COPD among older people, which may be a result of accelerated decline in lung function.[34] Additional analysis shows that 32.5% of workers with COPD also reported current asthma, and there is a possible overlap between chronic bronchitis and asthma. Sensitivity analysis calculating the prevalence of COPD, after excluding adults with current asthma, shows that COPD PORs became significant among working adults in construction and extraction (POR, 1.40; 95% CI, 1.02 to 1.94), production (POR, 1.43; 95% CI, 1.09 to 1.88), and transportation and material moving (POR, 1.49; 95% CI, 1.08 to 2.04). In addition, females had a higher prevalence of COPD as compared with males, and this may be due to higher likelihood of females visiting a doctor. In our analysis, we adjusted for smoking status (current, former smoker, and never smoker) and for pack-years of cigarette smoking among current smokers. Nevertheless, the data did not contain information to allow us to adjust for pack-years among former smokers. In addition, the cross-sectional study design has limitations for determining causality, the current job may not be the one that contributed to COPD, and may be affected by the presence of disease, and the management reference group may be populated with individuals who had previous, higher exposure jobs.

Information detailing occupational history and on the type of jobs held was not collected and was limited to employment in the week before the interview, considering latency, the job with causal exposure may not be reflected in the analysis. Nevertheless Gomez-Marin et al[35] concluded that for many occupational subgroups, the current occupation may represent the longest-held job. No information on occupational exposures was collected. We restricted this study to those aged 40 to 70 years to estimate COPD in the older age groups when the onset of COPD is more likely to occur. The cutoff of 70 years was used with the assumption that workers could have changed to a job with less exposure.

CONCLUSIONS

This study conducted from 2004 to 2011 represents the most recently available data on COPD prevalence in the US working population. The estimated odds ratios varied by occupational category indicating that, in addition to smoking, workplace exposures contribute to the increased risk of COPD in the US population.

In an occupational setting, preventive measures such as interventions to reduce smoking may reduce the risk of COPD in workers.[14,36] Future intervention studies are needed to identify methods to reduce COPD risk. Health care providers should continue screening and surveillance for work-related COPD, and epidemiologic studies are needed to monitor changes in COPD prevalence among workers in at-risk occupations and industries.

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