Chronic obstructive pulmonary disease (COPD), a chronic, progressive lung disease, affects an estimated 15.5 million US adults (1). It is a leading cause of death and imposes a high human and financial toll in terms of hospital visits and related charges (2,3). Work in certain industries and occupations is associated with COPD, and workplace exposure accounts for 10% to 15% of the disease burden (4–6). However, employment may enhance health and well-being for people with COPD (7). Our objective was to examine COPD and employment among Massachusetts adults, including occupation, and compare workers with and without COPD to inform interventions that support health and the ability to work.

Objective

Chronic obstructive pulmonary disease (COPD), a chronic, progressive lung disease, affects an estimated 15.5 million US adults (1). It is a leading cause of death and imposes a high human and financial toll in terms of hospital visits and related charges (2,3). Work in certain industries and occupations is associated with COPD, and workplace exposure accounts for 10% to 15% of the disease burden (4–6). However, employment may enhance health and well-being for people with COPD (7). Our objective was to examine COPD and employment among Massachusetts adults, including occupation, and compare workers with and without COPD to inform interventions that support health and the ability to work.
Nearly 40% of workers in our study with COPD continued to improve health and prolong careers of workers with COPD, raising questions about how occupation-related factors may influence respiratory health would inform efforts.

In conclusion, our findings suggest that interventions that support continued employment may confer health advantages, beyond income, including health insurance–related benefits (eg, influenza vaccinations, smoking cessation programs) and psychosocial support (7). A healthy workplace, devoid of secondhand smoke, dusts, fumes, gases, and vapors may prevent COPD onset and exacerbations (6,9).

Poor physical or mental health among workers with COPD, further affected by comorbidities like asthma, may affect their capacity to work or prompt a job change (10). Continued employment may be dependent on job type, demands, and flexibility of the employer (11). Findings by occupation suggest differences in the distribution by age among workers with COPD that are not seen in those without. This may indicate a shift to jobs that are less hazardous or labor intensive or that enable disease management (eg, flexible work schedule). It may also indicate that workers in certain high-risk occupations leave the workforce at younger ages as exposures become less tolerable or as their disease progresses (11).

Our study had limitations. First, the COPD measure was based on self-report and not medically validated. However, previous research found self-report to be consistent with objective evidence of COPD (12). Next, the proportion of workers with COPD may have been underestimated because of underdiagnosis, especially in nonsmokers. Next, the Massachusetts BRFSS is limited to noninstitutionalized adults who speak English, Spanish, or Portuguese. Lastly, we cannot infer causality about COPD and employment because the BRFSS is cross-sectional.

In conclusion, our findings suggest that interventions that support and retain workers with COPD may be needed. Further research into workplace conditions and organizational factors that best promote respiratory health would inform efforts.

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### Tables

#### Table 1. Characteristics of Massachusetts Adults and Workers with COPD, Massachusetts BRFSS, 2011–2017

| Characteristic          | With COPD | Without COPD | P Value |
|-------------------------|-----------|---------------|---------|
|                         | No. Responding | % (95% CI) | No. Responding | % (95% CI) |        |
| All Adults, N = 56,052  | 4,623 | NA | 51,429 | NA | <.001 |
| Employment status       |          |               |          |               |         |
| Unable to work          | 33.3 (31.0–35.6) | 7.4 (7.0–7.7) |        |               |         |
| Retired                 | 18.2 (16.5–19.9) | 12.2 (11.8–12.6) |        |               |         |
| Out of work for ≥ 1 year| 6.2 (4.8–7.5) | 3.8 (3.6–4.1) |        |               |         |
| Other (Student, homemaker) | 2.9 (2.1–3.8) | 4.6 (4.3–4.9) |        |               |         |
| Employed, past year²    | 39.4 (37.0–41.8) | 72.1 (71.5–72.6) |        |               |         |
| Workers, n = 35,906     |          |               |          |               |         |
| Age, y                  |          |               |          |               |         |
| 40–50                   | 28.5 (24.8–32.2) | 45.2 (44.5–46.0) |        |               | <.001 |
| 51–60                   | 44.9 (40.9–48.9) | 38.7 (37.9–39.4) |        |               |         |
| 61–70                   | 26.6 (23.4–29.9) | 16.1 (15.6–16.6) |        |               |         |
| Female                  | 58.0 (54.0–62.0) | 48.6 (47.9–49.4) |        |               | <.001 |
| Race/ethnicity          |          |               |          |               | .07    |
| White, non-Hispanic     | 87.2 (84.0–90.4) | 82.6 (81.9–83.3) |        |               |         |
| Hispanic                | 4.1 (2.4–5.7) | 6.5 (6.0–6.9) |        |               |         |
| Black, non-Hispanic     | 3.5 (1.6–5.5) | 5.4 (5.0–5.7) |        |               |         |
| Other, non-Hispanic     | 5.2 (2.9–7.5) | 5.6 (5.2–6.1) |        |               |         |
| Education               |          |               |          |               | <.001 |
| ≤High school graduate   | 48.0 (44.0–52.1) | 29.3 (28.5–30.1) |        |               |         |
| >High school graduate   | 52.0 (47.9–56.0) | 70.7 (69.9–71.5) |        |               |         |

### Asthma

Abbreviations: BRFSS, Behavioral Risk Factor Surveillance System; COPD, chronic obstructive pulmonary disease; NA, not applicable.

² Employed for wages, self-employed, or out of work for less than 1 year.

b “Yes” (with COPD) or “no” (without COPD) response to the question: “Has a doctor, nurse, or other health professional ever told you that you had chronic obstructive pulmonary disease or COPD, emphysema, or chronic bronchitis?”

c Unweighted number of respondents who answered the corresponding question(s). The numbers might not total the full study group because not all respondents answered each question.

d Weighted percentage. Percentages may not add to 100% because of rounding.

e P value from \( \chi^2 \) test of independence comparing weighted distributions between those with and without COPD.

f “Yes” response to the question: “Have you ever been told by a doctor or other health professional that you have asthma?”

g “Yes” responses to the questions: “Have you ever been told by a doctor or other health professional that you have asthma?” and “Do you still have asthma?”

h Responded “fair” or “poor” when asked to describe his/her overall health as excellent, very good, good, fair, or poor.

i Responded 15 days or more when asked the number of days in the past month that his/her mental health, which includes stress, depression, and problems with emotions, had not been good.

j Responded 15 days or more when asked the number of days in the past month that his/her physical health, which includes physical illness and injury, had not been good.

k Current = smoked at least 100 cigarettes in his/her lifetime and currently smokes either some days or every day; former = smoked at least 100 cigarettes in his/her lifetime but no longer smokes.

l Responded 1 or more hours when asked the number of hours exposed to other people’s tobacco smoke when at work in the past 7 days.

(continued on next page)
Table 1. Characteristics of Massachusetts Adults and Workers\textsuperscript{a} Aged 40 to 70, by COPD Status\textsuperscript{b}, Massachusetts BRFSS, 2011–2017

| Characteristic                          | With COPD | Without COPD | P Value\textsuperscript{a} |
|----------------------------------------|-----------|--------------|-----------------------------|
|                                        | No. Responding\textsuperscript{c} | % (95% CI)\textsuperscript{d} | No. Responding\textsuperscript{c} | % (95% CI)\textsuperscript{d} |
| Ever diagnosed with asthma\textsuperscript{f} | 1,503     | 45.2 (41.2–49.1) | 34,326        | 11.5 (11.0–12.0)       | <.001          |
| Current asthma\textsuperscript{g}        | 1,491     | 38.0 (34.1–41.9) | 34,233        | 8.1 (7.6–8.5)          | <.001          |
| Physical health                         |           |              |                             |                           |                |
| Fair or poor\textsuperscript{h}         | 1,513     | 27.9 (24.5–31.4) | 34,338        | 7.0 (6.6–7.4)          | <.001          |
| Poor, ≥15 days past month\textsuperscript{i} | 1,486     | 20.6 (17.5–23.8) | 33,992        | 5.5 (5.2–5.9)          | <.001          |
| Poor mental health, ≥15 days past month\textsuperscript{j} | 1,483     | 19.9 (16.7–23.2) | 33,913        | 6.8 (6.4–7.2)          | <.001          |
| Influenza vaccination, past year        | 1,412     | 48.4 (44.2–52.5) | 31,911        | 43.9 (43.1–44.7)       | .04            |
| Smoking status\textsuperscript{k}       | 1,476     | NA           | 33,244        | NA                      | <.001          |
| Current                                |           |              |                             |                           |                |
| Former                                 |           |              |                             |                           |                |
| Never                                  |           |              |                             |                           |                |
| Secondhand smoke exposure at work, past week\textsuperscript{l} | 971       | 18.1 (13.9–22.4) | 22,942        | 10.0 (9.3–10.7)        | <.001          |
| Among nonsmokers                        | 606       | 15.8 (10.9–20.6) | 20,193        | 8.8 (8.1–9.4)          | <.001          |

Abbreviations: BRFSS, Behavioral Risk Factor Surveillance System; COPD, chronic obstructive pulmonary disease; NA, not applicable.

\textsuperscript{a} Employed for wages, self-employed, or out of work for less than 1 year.

\textsuperscript{b} "Yes" (with COPD) or "no" (without COPD) response to the question: "Has a doctor, nurse, or other health professional ever told you that you had chronic obstructive pulmonary disease or COPD, emphysema, or chronic bronchitis?"

\textsuperscript{c} Unweighted number of respondents who answered the corresponding question(s). The numbers might not total the full study group because not all respondents answered each question.

\textsuperscript{d} Weighted percentage. Percentages may not add to 100% because of rounding.

\textsuperscript{e} P value from χ\textsuperscript{2} test of independence comparing weighted distributions between those with and without COPD.

\textsuperscript{f} "Yes" response to the question: “Have you ever been told by a doctor or other health professional that you have asthma?”

\textsuperscript{g} "Yes" responses to the questions: “Have you ever been told by a doctor or other health professional that you have asthma?” and “Do you still have asthma?”

\textsuperscript{h} Responded “fair” or “poor” when asked to describe his/her overall health as excellent, very good, good, fair, or poor.

\textsuperscript{i} Responded 15 days or more when asked the number days in the past month that his/her physical health, which includes physical illness and injury, had not been good.

\textsuperscript{j} Responded 15 days or more when asked the number of days in the past month that his/her mental health, which includes stress, depression, and problems with emotions, had not been good.

\textsuperscript{k} Current = smoked at least 100 cigarettes in his/her lifetime and currently smokes either some days or every day; former = smoked at least 100 cigarettes in his/her lifetime but no longer smokes.

\textsuperscript{l} Responded 1 or more hours when asked the number of hours exposed to other people’s tobacco smoke when at work in the past 7 days.
Table 2. Massachusetts Workers\textsuperscript{a} n = 35,906 Aged 40 to 70, by Occupation\textsuperscript{b}, COPD Status\textsuperscript{c}, and Age Group, Massachusetts BRFSS, 2011–2017

| Census Occupation (Code) | Age, y\textsuperscript{d} | Overall\textsuperscript{e} |
|-------------------------|--------------------------|--------------------------|
|                         | 40–50                    | 51–60                    | 61–70        |     |
| With COPD               |                          |                          |              |     |
| All groups, no.\textsuperscript{f} | 290                      | 591                      | 459          | 1,340|
| Management, Business and Financial Operations (COC 0010–0950) | 10.8 (5.9–15.7) | 13.9 (9.4–18.4) | 12.1 (6.9–17.3) | 12.5 (9.7–15.4) |
| Professional and Related (1000–3540) | 18.1 (12.3–23.9) | 23.3 (18.1–28.5) | 24.0 (18.6–29.4) | 22.0 (18.8–25.2) |
| Service (3600–4650) | 26.9 (19.8–34.0) | 16.1 (10.7–21.6) | 16.4 (10.9–21.9) | 19.3 (15.8–22.8) |
| Sales and Related (4700–4960) | 8.4 (3.8–12.9) | 7.0 (4.0–10.1) | 13.7 (8.5–19.0) | 9.2 (6.8–11.6) |
| Office and Administrative Support (5000–5930) | 14.8 (8.5–21.0) | 18.7 (13.8–23.6) | 16.2 (10.8–21.5) | 16.9 (13.8–20.1) |
| Transportation and Material Moving (9000–9750) | 6.4 (2.2–10.6) | 4.4 (2.4–6.5) | 6.9 (3.4–10.4) | 5.7 (3.9–7.4) |
| Other | 14.6 (8.0–21.2) | 16.5 (10.9–22.0) | 10.6 (6.5–14.7) | 14.4 (11.0–17.7) |
| Without COPD            |                          |                          |              |     |
| All groups, no.\textsuperscript{f} | 10,865                   | 12,228                   | 6,722        | 29,815|
| Management, Business and Financial Operations (COC 0010–0950) | 17.8 (16.8–18.8) | 16.4 (15.5–17.4) | 16.0 (14.8–17.2) | 17.0 (16.4–17.6) |
| Professional and Related (1000–3540) | 34.6 (33.4–35.9) | 35.5 (34.3–36.7) | 37.4 (35.8–39.0) | 35.4 (34.7–36.2) |
| Service (3600–4650) | 12.7 (11.8–13.7) | 11.4 (10.6–12.3) | 10.9 (9.8–12.1) | 11.9 (11.4–12.5) |
| Sales and Related (4700–4960) | 7.7 (7.0–8.4) | 7.8 (7.1–8.4) | 9.3 (8.3–10.4) | 8.0 (7.6–8.4) |
| Office and Administrative Support (5000–5930) | 9.6 (8.8–10.4) | 11.1 (10.3–11.9) | 11.3 (10.2–12.4) | 10.5 (10.0–11.0) |
| Transportation and Material Moving (9000–9750) | 3.8 (3.2–4.4) | 4.2 (3.6–4.8) | 3.6 (2.8–4.3) | 3.9 (3.5–4.3) |
| Other | 13.7 (12.7–14.7) | 13.5 (12.5–14.5) | 11.4 (10.1–12.8) | 13.3 (12.6–13.9) |

Abbreviations: BRFSS, Behavioral Risk Factor Surveillance System; COPD, chronic obstructive pulmonary disease.

\textsuperscript{a} Employed for wages, self-employed, or out of work for less than 1 year.

\textsuperscript{b} Response to the following question categorized using 2002 Census Occupation Codes: “What kind of work did you do? For example, registered nurse, janitor, cashier, auto mechanic.”

\textsuperscript{c} “Yes” (with COPD) or “no” (without COPD) response to the question: “Has a doctor, nurse, or other health professional ever told you that you had chronic obstructive pulmonary disease or COPD, emphysema, or chronic bronchitis?”

\textsuperscript{d} Values are percentage (95% CI) unless otherwise indicated. Percentages are weighted and may not total 100% because of rounding.

\textsuperscript{e} P < .001 from the \( \chi^2 \) test of independence comparing the occupation distribution overall between those with and without COPD.

\textsuperscript{f} Unweighted number of respondents who answered the corresponding question(s). Those with missing or noncodable responses to the occupation question (n = 4,751) were excluded from analyses of occupation group.