

Short report

COPD mortality among workers in the construction industry, by occupation: USA, 2021–2022

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ABSTRACT

Objective Chronic obstructive pulmonary disease (COPD), a progressive lung condition, is a leading cause of disability and death. Cigarette smoking and workplace exposures are important risk factors for COPD. To examine occupations with COPD deaths among decedents with usual lifetime employment in the construction industry.

Method The 2021–2022 National Vital Statistics System public use multiple cause-of-death data (cross-sectional) were analysed.

Results Among 6.7 million decedents, 497 031 (10.3%) were employed in the construction industry during most of their life and of those, 11.7% (n=57 937) had COPD listed on the death certificate as the underlying or contributing cause of death. The highest numbers of COPD deaths were among adults 65 years and older (n=44 550), males (n=55 092), non-Hispanic white persons (n=50 903) and persons with ≤high school education (n=46 621). Construction workers had 1.31 (95% CI 1.30 to 1.32) times the odds of COPD deaths as compared with non-construction workers. Within construction occupation groups, roofers (mortality OR (MOR) 2.31, 95% CI 2.10 to 2.55) drywall installers, ceiling tile installers and tapers (MOR 2.29, 95% CI 3.05 to 2.56); painters, paperhangers, pipelayers, plasterers and stucco masons (MOR 2.09; 95% CI 1.92 to 2.28) and insulation workers (MOR 2.00, 95% CI 1.66 to 2.41) COPD mortality risk was significantly increased and the mortality odds were twice or more as compared with the reference group (office and administrative support workers).

Conclusions Disparities in COPD mortality observed among construction industry workers may be addressed by reducing COPD risk factors, including cigarette smoking and COPD-related workplace exposures, and emphasising the importance of early diagnosis and disease management.

INTRODUCTION

Chronic obstructive pulmonary disease (COPD) is a progressive lung disease and a leading cause of morbidity and mortality.¹ COPD is characterised by persistent respiratory symptoms (such as chronic cough, sputum production and shortness of breath) and non-reversible airflow limitation, which can severely impact daily activities and quality of life.^{1,2} Additionally, the progression of COPD can lead to more severe health complications including respiratory failure and cardiovascular problems.^{1–3} COPD can significantly impact the working population, as workers with COPD often experience productivity

WHAT IS ALREADY KNOWN ON THIS TOPIC

⇒ Cigarette smoking and occupational exposures are important factors placing construction workers at risk for chronic obstructive pulmonary disease (COPD). One in four construction workers is a current cigarette smoker, and an estimated 18% of COPD cases among construction workers may be attributable to occupational exposure.

WHAT THIS STUDY ADDS

⇒ During 2021–2022, 57 937 COPD deaths were observed among workers usually employed in the construction industry. COPD mortality varied between construction occupations.

HOW THIS STUDY MIGHT AFFECT RESEARCH, PRACTICE OR POLICY

⇒ The elevated risk for COPD among construction industry workers underscores the need for reducing COPD-associated workplace exposures, addressing cigarette smoking and promoting smoking cessation efforts. Implementing evidence-based strategies, especially those tailored to specific groups with high COPD mortality rates and early diagnosis and disease management can reduce COPD deaths and improve worker health.

losses, lower employment rates and increased absenteeism compared with those without COPD.^{1,3}

Tobacco smoking is the primary risk factor for COPD and an estimated one in four construction workers is a current cigarette smoker.⁴ Environmental and occupational exposures also play a role in developing COPD,^{3,5–9} and exposures vary by job type.^{3,7–9} Among construction workers, an estimated 18% of COPD cases may be attributable to the vapour, gases, dusts and fume (VGDF) exposure.⁵ Construction workers are exposed to both inorganic and organic dusts like silica, asbestos, wood dust and mould spores.^{3,7–9} Additionally, metals such as beryllium, cadmium and hexavalent chromium are often present in welding, soldering and pipefitter fumes.^{3,7–9} Occupational exposures to these substances are known factors that increase the risk of developing COPD.^{3,8,9}

Disparities in COPD prevalence and mortality among construction workers have been previously reported.^{2,8,10} During 2012–2018, an estimated 3.6 million US construction workers had COPD.² In 2020, approximately 12% of all decedents who



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were usually employed in the construction industry had COPD listed on their death certificate as an underlying or contributing cause of death.¹⁰ Dement *et al* reported construction trade workers enrolled in the Building Trades National Medical Screening Programme had a 30% greater risk of developing COPD when compared with non-construction workers, and specific trades including cement masons/brick masons/plasterers (OR=2.9) and roofers (OR=2.6) had the highest risk for incident COPD.¹¹ Given the high cigarette smoking prevalence⁴ and the reported workplace exposures among construction workers,^{5 7-9} identifying construction occupations with higher COPD mortality could inform targeted interventions to improve worker health. This study aims to (1) describe COPD mortality risk among US residents aged ≥ 15 years with usual lifetime employment in the construction industry and (2) identify specific occupations within the construction industry that are at higher risk for COPD mortality.

METHODS

The 2021–2022 National Vital Statistics System (NVSS) public use, multiple cause-of-death data for 6.7 million decedents aged ≥ 15 years, with information on their usual industry and occupation (the industry or occupation where the decedent worked the most during their life), were analysed. The NVSS data include two-digit industry recodes based on the 2012 North American Industry Classification System and detailed four-digit occupation recodes based on the 2010 Standard Occupational Classification. Decedents employed (worked during most of their life or for the longest time) in the construction industry were identified using the two-digit industry code 04. The detailed occupations within the construction industry were then examined. Occupations were regrouped into 30 categories based on the job type. Occupations with less than 100 COPD deaths were categorised into ‘All other occupations, in construction’. Decedents with COPD were those whose death certificates listed the International Classification of Diseases, 10th Revision codes J40–J44 as the underlying or contributing cause of death. Details on data are available at: https://www.cdc.gov/nchs/nvss/mortality_public_use_data.htm. This activity was reviewed by the Centers for Disease Control and Prevention (CDC), deemed research not involving human subjects and was conducted consistent with applicable federal law and CDC policy, (45 C.F.R. part 46, 21 C.F.R. part 56; 42 U.S.C. §241(d); 5 U.S.C. §552a; 44 U.S.C. §3501 *et seq.*).

Mortality ORs (MORs) adjusted for age, race/ethnicity and sex were calculated (1) to assess the odds of COPD mortality in construction workers compared with non-construction industry workers and (2) to examine the odds of COPD mortality within specific construction occupations, selecting office and administrative support workers in the construction occupation as a referent group. Previous reports indicated lower COPD prevalence among office workers as their work often occurs in indoor work environments and involves office-based tasks with less respiratory exposures to hazards than are encountered by construction workers.⁹ MORs were adjusted for age, race, ethnicity and sex. Analyses were conducted using SAS software (V9.4, SAS Institute).

RESULTS

During 2021–2022, of the 6.7 million deaths, 497 031 occurred among workers employed in the construction industry. Of those, 57 937 (11.7%) had COPD listed as the underlying or contributing cause of death. The highest proportion of COPD deaths

was among adults 65 years and older (77%, 44 550), males (95%, 55 092), non-Hispanic white persons (87%, 50 903) and persons with less than high school education (80%, 46 621).

The odds of COPD mortality were significantly higher for workers who had ever been employed in the construction industry compared with those in all other non-construction industries (MOR=1.31) (table 1). Analyses by occupation revealed that construction workers in 24 occupation groups had significantly higher odds of COPD deaths when compared with those in office and administrative support workers in the construction occupations (table 1). Roofers (MOR=2.31); drywall installers, ceiling tile installers and tapers (MOR=2.29); painters, paperhangers, pipelayers, plasterers and stucco masons (MOR=2.09) and insulation workers (MOR=2.00) had twice or more the odds of COPD mortality (table 1).

DISCUSSION

During 2021–2022, decedents aged ≥ 15 years, who were employed (during most of their life or for the longest time) in the construction industry, had significantly higher odds of COPD mortality than non-construction workers. In addition, similar to previous findings, COPD deaths varied by demographic characteristics and job types.¹¹ Workplace hazards and levels of exposure vary depending on a worker's job tasks and work environment. Construction workers face a variety of hazards due to the nature of their work.¹¹ Lack of adequate ventilation and use of heavy machinery and tools increases the risk of inhaling harmful substances.¹² Construction workers exposed to dust have higher COPD risk than workers who are not regularly exposed.^{3 6 9} Findings from the current study indicate that roofers, drywall installers, ceiling tile installers and tapers, painters, paperhangers, pipelayers, plasterers and stucco masons, and insulation workers had greater than twice the odds of COPD death when compared with office workers. Work in these occupations is associated with exposures to respirable crystalline silica generated during cutting and grinding procedures, asbestos fibres during remediation work, hexavalent chromium when cutting or grinding stainless steel, joint compounds, adhesives, solvents and paint fumes, all of which have been associated with COPD and other lung diseases.^{7-9 11-13}

Approximately, one in four workers in the construction industry is cigarette smokers and is often exposed to secondhand smoke.⁴ The combined effects of prolonged occupational exposure to hazardous VGDFs and cigarette smoke increase the risk for incident COPD^{3 6-9 11} and may increase the risk for COPD-associated mortality. The high smoking prevalence and elevated risk for COPD deaths in construction workers underscore the importance of identifying and addressing workplace exposure, and smoking cessation programmes, diagnosing disease early and managing disease.^{1 9 12} Prevention of occupational respiratory diseases focuses on eliminating or reducing exposures through a well-established hierarchy of controls applied in the following order (1) elimination of hazardous materials; (2) substitution of less hazardous materials; (3) engineering controls, (4) administrative and work practice controls and (5) use of personal protective equipment (<https://www.cdc.gov/niosh/hierarchy-of-controls/about/index.html>).

Strengths and limitations

The major strength of this study is the use of NVSS multiple cause-of-death national data with coded industry and occupation information. Also, results are derived from the most recent data available. However, the findings in this report

Table 1 Number and percentage of COPD deaths* and mortality OR† among persons aged ≥15 years, by occupation‡–construction industry§ 2021–2022

Construction occupations	Deaths from all causes¶ (N)	COPD deaths (underlying or contributing)	
		N (%)	Mortality OR** (95% CI)
Total	497 031	57 937 (11.66)	1.31 (1.30 to 1.32)
Roofers	11 260	1470 (2.54)	2.31 (2.10 to 2.55)
Drywall installers, ceiling tile installers and tapers	5024	803 (1.39)	2.29 (2.05 to 2.56)
Painters, paperhangers, pipelayers, plasterers and stucco masons	24 487	3443 (5.94)	2.09 (1.92 to 2.28)
Insulation workers	1117	166 (0.29)	2.00 (1.66 to 2.41)
Carpet floor and tile installers and finishers	6993	898 (1.55)	1.91 (1.72 to 2.12)
Construction labourers	110 512	11 059 (19.09)	1.90 (1.75 to 2.06)
Carpenters	65 563	8936 (15.42)	1.85 (1.71 to 2.01)
Cement masons, concrete finishers and terrazzo workers	4323	514 (0.89)	1.83 (1.62 to 2.07)
Structural iron and steel workers	4890	695 (1.20)	1.78 (1.59 to 1.99)
Operating engineers and other construction equipment operators	21 190	2978 (5.14)	1.75 (1.60 to 1.91)
Brick masons, block masons and stone masons	13 309	1709 (2.95)	1.74 (1.58 to 1.91)
Highway maintenance workers	5096	707 (1.22)	1.69 (1.51 to 1.89)
Drivers/sales workers and truck drivers	5316	707 (1.22)	1.68 (1.50 to 1.87)
Building and ground cleaning and maintenance	1226	115 (0.20)	1.67 (1.35 to 2.06)
Sheet metal workers	2753	371 (0.64)	1.65 (1.44 to 1.89)
Pipelayers, plumbers, pipefitters and steamfitters	23 177	2848 (12.3)	1.60 (1.47 to 1.75)
Heating, air conditioning and refrigeration mechanics	11 941	1290 (2.23)	1.59 (1.44 to 1.75)
Glaziers	1241	141 (0.24)	1.58 (1.30 to 1.92)
Electricians	29 826	3322 (5.73)	1.44 (1.32 to 1.57)
First line supervisors of construction trades and extraction	40 322	4485 (7.74)	1.36 (1.25 to 1.48)
Boilermakers	721	84 (0.14)	1.30 (1.02 to 1.66)
Helpers, construction trades and other construction-related work	3855	379 (0.65)	1.23 (1.08 to 1.40)
Construction managers	44 877	4615 (7.97)	1.15 (1.06 to 1.25)
Business and financial specialists	3019	311 (0.54)	1.07 (0.93 to 1.23)
Architecture and engineering	3265	296 (0.51)	0.97 (0.84 to 1.12)
Sales and related	2419	210 (0.36)	0.96 (0.81 to 1.12)
All other management within construction	6046	502 (0.87)	0.87 (0.77 to 0.97)
Civil engineers	5332	444 (0.77)	0.87 (0.77 to 0.98)
All other construction	27 914	3311 (5.81)	1.63 (1.50 to 1.77)
Office and administrative support	10 017	1128 (1.95)	Ref

Source: National Vital Statistics System public use multiple cause files 2020. https://www.cdc.gov/nchs/data_access/vitalstatsonline.htm#Mortality_Multiple

*Decedents with COPD (ICD-10 codes J40–J44) listed as the underlying or contributing cause of death.

†Reference group is decedents employed in the office and administrative support occupations during most of their life or for the longest time.

‡Occupation the decedent worked in 'during most of his or her life, or for the longest time' and is the two-digit simple occupation recode based on the 2010 Standard Occupation Classification-informed codes obtained from the US Census Bureau. <https://www.cdc.gov/nchs/data/dvs/Industry-and-Occupation-data-mortality-2020.pdf>

§Decedent aged ≥15 years who were employed in the construction industry during most of their life or for the longest time.

¶All causes of death among usually employed persons in the construction industry by job type.

**Mortality ORs were adjusted for age, race and sex.

COPD, chronic obstructive pulmonary disease; ICD-10, International Classification of Diseases, 10th Revision; misc, miscellaneous.

are subject to some limitations. COPD-related deaths were not validated using medical records. In addition, no information on workplace exposures and other known causal factors such as smoking status of decedents or secondhand smoke exposure is available on death certificates. The associations between workplace exposures and the COPD deaths could not be assessed. Moreover, the history of employment in the construction industry was not validated and could have missed persons who were employed in construction at the time they developed COPD but who had a different (usual) industry listed on the death certificate. Finally, occupations identified as those placing workers at risk for COPD might not be the actual occupations where exposures might have occurred; full work histories are not recorded on the death certificate.

CONCLUSIONS

Elevated COPD deaths were observed among workers employed in the construction industry and the mortality risk varied by job type. Findings underscore the importance of identifying and addressing COPD-related risk factors, including cigarette smoking and workplace exposures, and implementing targeted interventions to prevent COPD.^{1 12} Continued surveillance, including collection of detailed industry and occupational history, can help to track progress in preventing COPD and to guide interventions and policies to improve workers' health.

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