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Deaths from Nonmalignant Respiratory Disease in Styrene-Exposed Workers: Does Obliterative Bronchiolitis Contribute to Mortality?

Randall J. Nett, M.D., M.P.H.,
National Institute for Occupational Safety and Health Morgantown, West Virginia

Nicole T. Edwards, M.S.,
National Institute for Occupational Safety and Health Morgantown, West Virginia

Avima M. Ruder, Ph.D.,
National Institute for Occupational Safety and Health Cincinnati, Ohio

Stephen J. Bertke, Ph.D.,
National Institute for Occupational Safety and Health Cincinnati, Ohio

Isna Keumala, M.S.,
National Institute for Occupational Safety and Health Morgantown, West Virginia

Jean Cox-Ganser, Ph.D., and
National Institute for Occupational Safety and Health Morgantown, West Virginia

Kristin J. Cummings, M.D., M.P.H.
National Institute for Occupational Safety and Health Morgantown, West Virginia

To the Editor:

Since the 1970s, the U.S. National Institute for Occupational Safety and Health has monitored a cohort of 5,204 workers from two reinforced plastic boat–building facilities where exposures to styrene were characterized (1–3). Styrene is a volatile organic compound used during fiberglass production (4). An analysis of this cohort demonstrated that short-tenured workers with high styrene exposures had elevated standardized mortality ratios for nonmalignant respiratory disease (1.99; 95% confidence interval [CI], 1.38–2.79) and chronic obstructive pulmonary disease (COPD) (2.60; 95% CI, 1.70–3.81) (2).

These findings are noteworthy considering that nine cases of obliterative bronchiolitis have been reported after employment in similar industries that use styrene to make reinforced plastics (5). Nontransplantation-associated obliterative bronchiolitis occurs rarely after occupational exposure to inhalational toxins (6). In addition, rodent models have demonstrated damage to the respiratory epithelium after inhalational exposure to high

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concentrations of styrene (7–10). We hypothesized that styrene-related obliterative bronchiolitis contributed to the excess burden of nonmalignant respiratory disease mortality in this cohort but went unrecognized and was incorrectly categorized on death certificates as COPD (11). We therefore aimed to describe any decedents from this cohort who died of nonmalignant respiratory disease and who had possible underlying obliterative bronchiolitis.

Methods

From the cohort, 157 decedents were identified who had a known cause of death as COPD, pneumonia, or other respiratory disease as of December 31, 2011. Medical records were requested from the hospital listed on the death certificate and additional health care facilities identified in the medical records, as needed. Available death certificates and medical records were reviewed and abstracted.

We examined decedents who died at less than 55 years of age, as these deaths were unlikely to be attributable only to tobacco use (12). For example, U.S. death rates from COPD during 1968–2011 were low among persons aged less than 55 years (ranging from fewer than 0.10–0.35, 1–2, and 6–10 deaths per 100,000 population among persons aged 25–34, 35–44, and 45–54 yr, respectively) (13). Industrial hygiene data were used to categorize workers as ever having worked in departments with high styrene exposures (42.5 or 71.7 ppm, 8-h time-weighted averages, depending on company).

Results and Discussion

We obtained 142 death certificates and medical records for 31 decedents. For those with a death certificate, 125 (88%) were male, and the median age at death was 69 years (range, 32–97 yr). One death was attributed to bronchiolitis. Fifteen decedents died at less than 55 years of age, only one of whom had available medical records. Of these younger decedents, median tenure was 0.5 years (range, 0.1–6.8 yr) and respiratory causes of death included COPD (n = 9), pneumonia (2), bronchiolitis (1), bronchiectasis (1), pneumonitis (1), and lung abscesses (1). Eight (53%) younger decedents had high styrene exposures compared with 40% of the entire cohort (3).

Four of the nine younger decedents from COPD had known tobacco exposure and five had unknown tobacco exposure as tobacco use was not assessed on their death certificates; five had high styrene exposures; and seven had known COPD onset (early 30s [n = 1], early 40s [n = 3], and 40s not further specified [n = 3]). Two of these younger decedents had prior tobacco use and exposure to high styrene concentrations, tenure for less than 1 and 1–5 years, and COPD for 10 and 20+ years at the time of death. The only younger decedent with available medical records had high styrene exposure with tenure less than 1 year, unknown tobacco use, pulmonary function testing that demonstrated severe airway obstruction and air trapping, and a cause of death listed as COPD that had been present for “years.”

Limitations of this analysis included difficulty in obtaining medical records as many were destroyed, potentially resulting in an underestimation of possible cases of obliterative bronchiolitis. In addition, this analysis did not assess other occupational and nonoccupational exposures that might have contributed to respiratory mortality.

Multiple boat builders were characterized as having died of COPD before age 55 years and had disease onset in their early 30s to 40s. These findings suggest some of the excess burden of nonmalignant respiratory disease in this cohort could be associated with obliterative bronchiolitis. An estimated 90,000 U.S. workers are likely exposed to styrene (14) and many others are exposed globally. Our data, although preliminary, add to the growing body of literature that suggests respiratory health risks among workers exposed to styrene and support further research in this area (5).

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