Harm from Workplace Vapors, Gases, Dust and Fumes Extends into Retirement

Longitudinal decline in lung function among older construction workers

John M. Dement, Laura S. Welch, Knut Ringen, Kim Cranford, and Patricia Quinn. Occupational and Environmental Medicine, 2017.

Overview

High occupational exposures to vapors, gases, dust and fumes (VGDF) are common in many construction tasks and trades. Cross-sectional studies have linked occupational VGDF exposures to declines in lung function and increased risk of COPD. Using data from the Building Trades Medical Screening Program (BTMed), which screens workers and former workers at certain Department of Energy construction sites, researchers constructed a longitudinal study to measure this association. The authors gathered work history information, chest X-ray results and spirometry test results from a population of 3150 construction workers who received at least one follow-up examination after initial intake.

Key Findings

- Workers with a history of high or intermediate VGDF exposures on the job had poorer lung function at their initial screening than those with a history of low VGDF exposures.
- In the years following the initial screening, lung function declined more quickly in workers with a history of high or intermediate VGDF exposures than those with a history of low VGDF exposures.
- Pleural plaque, even in the absence of Diffuse Pleural Thickening, was associated with a decline in lung function.

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See abstract:
http://bit.ly/2qGfhft

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ORIGINAL ARTICLE

Longitudinal decline in lung function among older construction workers

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ABSTRACT

Background Occupational exposures to vapours, gasses, dusts and fumes (VGDF) and chest X-ray abnormalities by the International Labour Office (ILO) classification system are associated with reduced lung function, with the majority of published studies being cross-sectional. We examined the effects of VGDF exposures, as well as ILO parenchymal changes, pleural plaque and diffuse pleural thickening (DPT) on reduction in lung function in a longitudinal study.

Methods Chest radiographs and spirometry for 3150 ageing construction workers enrolled in a medical screening programme with a baseline and at least one follow-up examination were studied. Indices for VGDF exposure, parenchymal changes, pleural plaque and DPT severity were developed and used in longitudinal mixed models of lung function.

Results Smoking and VGDF exposure were associated with decreased FEV_1 and FVC at baseline as well as accelerated rates of annual decline. High VGDF exposure was associated with a yearly decline of −19.5 mL for FEV_1 and −15.7 mL for FVC. Parenchymal abnormalities, pleural plaque and DPT were more strongly associated with reduced FVC. An increase of one unit in the pleural plaque severity index resulted in approximately −5.3 mL loss of FVC and −3.3 mL loss of FEV_1, with a possible non-linear effect of plaque on FEV_1.

Conclusions Increasing pleural plaque severity was associated with progressively greater loss of FVC and FEV_1, supporting a causal association. VGDF exposures were associated with reduced FVC and FEV_1 at baseline as well as accelerated annual loss of lung function.

What this paper adds

- Mixed occupational vapours, gasses, dusts and fumes exposures are associated with accelerated declines in both FEV_1 and FVC.
- Pleural plaque is associated with declines in lung function with a stronger effect on FVC.

INTRODUCTION

Occupational exposures to agents such as silica and asbestos or complex mixtures such as coal mine dust, welding and cutting gases and fumes, and diesel exhausts increase the risk of chronic obstructive pulmonary disease (COPD).[1–3] Furthermore, there is increasing evidence that exposures to mixtures of various vapours, gases, dusts and fumes (VGDF) cause COPD.[4–6] The VGDF exposure metric is a qualitative summary measure of exposures to vapours and gases as well as particles (dusts and fumes), including low toxicity dusts which are largely insoluble and make up a significant component of all VGDF exposures in many workplaces. These low toxicity dusts are sometimes referred to as 'particulates not otherwise regulated' and include all mineral and inorganic dusts without specific individual US Occupational Safety and Health Administration Permissible Exposure Limits.[7]

Many of the individual exposures that contribute to VGDF have known effects on lung function. For example, asbestos, one of the components of occupational VGDF exposures, has long been known to cause cancer at many sites as well as pulmonary fibrosis (asbestosis), pleural plaque, diffuse pleural thickening (DPT) and pleural calcification.[8] While pulmonary fibrosis and DPT are well accepted causes of restrictive findings on spirometry, the impact of pleural plaque alone on lung function has been debated.[9 10]

Most studies of effects of occupational exposures and pleural plaque on lung function have been cross-sectional rather than longitudinal. Using longitudinal rather than cross-sectional analysis, the objectives of this study were twofold: (1) to assess the effects of occupational exposures to mixed VGDF exposures on lung function and (2) to assess the contributory effect of chest radiograph parenchymal and pleural changes on lung function among workers with VGDF exposures.

METHODS

This study assessed the impact of VGDF exposures and chest X-ray changes on lung function using longitudinal data among construction and trade workers employed at US Department of Energy (DOE) sites and participating in the Building Trades National Medical Screening Program (BTMed) (https://www.BTMed.org). BTMed participants include many different trades doing new construction, renovationand maintenance of DOE facilities across the USA as described elsewhere.[4 11–14]

Prior publications provide details of the BTMed surveillance programme including the work history and medical components.[12–14] In brief, in 1993, the US Congress called on the US DOE to determine whether workers within the US nuclear weapons facilities were at significant risk for work-related illnesses and if so, to provide them with medical surveillance. Initial surveillance programmes for construction workers were established at the Hanford Nuclear Reservation in Richland, Washington; the Oak Ridge Reservation in Oak Ridge,

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