

Chronic respiratory symptoms observed in US veterans following deployment may not be unique to that population

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Military personnel can be exposed to a variety of occupational and environmental pollutants that places their health at risk. In a recent publication in *Occupational and Environmental Medicine*, Garshick and colleagues characterised the inhalational exposures during deployment of US military personnel to Afghanistan and Southwest Asia and the associations with postdeployment respiratory symptoms.¹ They observed significant associations between burn pit smoke and military job-related vapours, gases, dusts and fumes (VGDF) exposure and chronic respiratory symptoms.

These findings may lead to a further question: what does this mean in a wider perspective? Not only US veterans, but veterans from across the globe may experience such health effects following deployment in these areas. Furthermore, when looking at the characteristics of the working conditions of deployed military personnel, which are quite particular, there are also some similarities with firefighting.

For both military personnel and firefighters occupational exposures are complex and involve a highly heterogeneous mix of chemical, physical, biological and psychosocial hazards.² Such exposures may result from fires, but for example also from activities for training and protecting life and property. Both the military and firefighting workforce can involve various roles, responsibilities and training requirements. Whereas studying one specific group of workers typically makes exposure assessment easier, this is not the case for military service or firefighting. Their work environment changes consistently, and activities are unpredictable, unlike in a fixed factory setting.

The above-described characteristics of work settings highly complicate the exposure assessment, and hence identifying a link with observed chronic health effects, let alone disentangling the possible causing agent. In many epidemiological studies on firefighting, inferences are reliant on

ever-employment or employment duration as the best exposure information available.³ Garshick and colleagues made a good effort to disentangle the effect of different exposures, but were dependent on self-reported exposures. Additionally, emissions from burn pit smoke are unpredictable due to large variation in toxicant concentrations and meteorological conditions.⁴

Another key characteristic that both occupations share is the relatively young and healthy group of professionals. Military personnel have to pass a physical fitness test and persons with ongoing medication-treated asthma are unlikely to be deployed.^{1,5} Firefighters are also screened for physical fitness for duty before hire.² Hence, there is a strong selection into the workforce (ie, the healthy worker hire effect), which may affect observations from epidemiological studies when compared with the general population. Since Garshick and colleagues used internal comparisons, this will not have affected their observations.

Both occupations are traditionally male-dominated professions, which also means that women are typically understudied with regards to health effects following exposures in these occupations due to smaller numbers. Garshick and colleagues described increased odds of self-reported respiratory symptoms (dyspnoea and chronic bronchitis) among female veterans.¹ However, they did not describe what proportion of these women reported exposures to, for example, burn pit smoke or VGDF. Hence it was unclear whether the reported symptoms could be linked with exposures during deployment. Numbers were presumably too small (226 women included, proportion exposed unknown) for informative stratified analyses, so it would be worthwhile to conduct a study focused on female veterans specifically. This could be done by oversampling females or through combining data sources across similar jurisdictions to increase the overall number of women included. Women have been suggested to be more susceptible to the same amount of (tobacco) smoke exposure, with a stronger lung function

decline.^{6,7} In addition to biological differences in susceptibility, other aspects of epidemiological studies into occupational health (including exposure assessment or case ascertainment) may also be affected by differences between men and women.^{6,8}

The US veterans had a median deployment of 11.7 months,¹ which is a different situation than in typical occupational settings where people work for many years or even decades in the same industry. Most occupational or environmental epidemiological studies on respiratory health effects assess associations with such long-term exposures. The exposures that veterans experienced during deployment were for a relatively short term only, but still with increased risk of dyspnoea and chronic bronchitis years later.¹ Similarly, a study in the Netherlands found that persistent respiratory symptoms and bronchial responsiveness were associated with exposure to combustion products of a chemical waste depot fire which occurred more than 6 years earlier.⁹ Exposed persons included both first responders (including firefighters and policemen) and residents of the affected area, who were exposed over a period of a week.⁹ A scoping review on wildland firefighters, who also often work for relatively short periods when hired for the summer fire season, reported that there is a gap in studies on the long-term health effects of exposure to fire smoke.¹⁰ Changes in respiratory health were reported cross-shift or cross-season, but there were no studies exploring the effects on chronic disease endpoints like asthma or Chronic Obstructive Pulmonary Disease (COPD).¹⁰ In addition to respiratory symptoms, such exposures may also lead to other long-term health effects, particularly cardiovascular health for which there are suggestions among firefighters.^{10,11}

Given the potential health risks, it is important to protect any military personnel on future deployment, as well as firefighters and other first responders in similar exposure situations. Focused prevention strategies would be needed, which could include air monitoring at location, development and evaluation of mitigation strategies (primary prevention), preventive medical assessments of the exposed people if there is an indication of exposure limit exceedance (secondary prevention), and additional steps when early health effects are detected (tertiary prevention).⁴

Furthermore, Garshick and colleagues suggest that postdeployment veterans should be assessed for a wide range of occupational and environmental

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exposures and longitudinal follow-up should be made available, for example to detect accelerated lung function decline.^{1 12} Better understanding of the relation between exposures and chronic health effects could help enforce mitigation strategies to prevent future diseases following deployment.¹²

In conclusion, the reported health effects among veterans are remarkable given the healthy selection into this group and their median age of 40.7 years at interview.¹ More studies on chronic health effects due to exposures experienced during military deployment and firefighting are needed, with specific focus on women. Health surveillance programmes for these workers are also warranted.

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