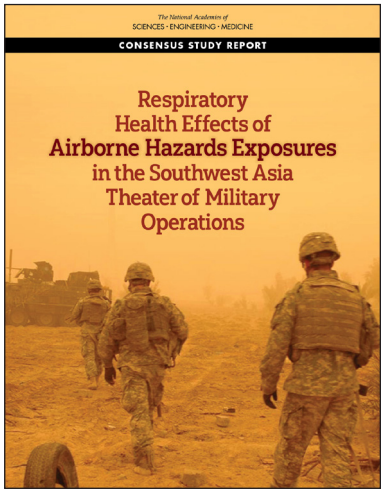
Consensus Study Report
HIGHLIGHTS
September 2020

Respiratory Health Effects of Airborne Hazards Exposures in the Southwest Asia Theater of Military Operations



More than 3.7 million U.S. service members have participated in operations in Iraq, Kuwait, Saudi Arabia, Bahrain, the Gulf of Aden, the Gulf of Oman, Oman, Qatar, the United Arab Emirates—a region known collectively as the Southwest Asia Theater of Military Operations—and Afghanistan since 1990. Individuals who served in this region were likely to have been exposed to a number of airborne hazards, including oil-well fire smoke, emissions from open burn pits, dust and sand suspended in the air, pollution from local industries, and exhaust from diesel vehicles.

During and after the 1990–1991 Persian Gulf War, veterans began reporting a variety of respiratory health problems. In response to the concerns raised, the U.S. Congress passed laws, including the Persian Gulf War Veterans Act and the Veterans Programs Enhancement Act, mandating the study of health outcomes in Southwest Asia theater veterans. The Department of Defense (DoD) and the Department of Veterans Affairs (VA) have also undertaken their own initiatives to address questions that remain unanswered. As part of this work, in September 2018, VA requested that the National Academies of Sciences, Engineering, and Medicine form an ad hoc expert committee to study the evidence regarding respiratory health outcomes in veterans of the Southwest Asia theater conflicts. The resulting Committee on the Respiratory Health Effects of Airborne Hazards Exposure in the Southwest Asia Theater of Military Operations was also asked to identify gaps in this evidence, potential research opportunities to address outstanding questions and generate answers, newly emerging technologies that could aid in these efforts, and organizations that VA might collaborate with to accomplish this work.

AIRBORNE HAZARDS ENCOUNTERED IN THE SOUTHWEST ASIA THEATER

As part of their service in the Southwest Asia theater, veterans may be exposed to a broad range of potentially hazardous airborne agents. These include:

- Dust and sand
- Emissions from burning oil wells and open burn pits
- Exhaust from vehicles and aircraft
- Air pollution from local industry, power generation, and agriculture
- Vapors, gases, dusts, and fumes from chemical agents used in military job tasks

One of these exposures, exposure to particulate matter, has received special attention because a growing body of literature suggests that it is associated with adverse respiratory and other health effects.

Exposures differ by conflict and vary by location and over time. For example, 1990–1991 Gulf War veterans were potentially exposed to smoke from oil-well fires set by retreating Iraqi forces, while veterans of post-9/11 conflicts were likely to have been exposed to emissions from open burn pits. The health effects of these airborne hazards were likely enhanced by factors common to military operations in Southwest Asia, such as temperature extremes, psychosocial stress, sleep deprivation, and noise.

ASSOCIATIONS BETWEEN SERVICE IN THE SOUTHWEST ASIA THEATER AND RESPIRATORY HEALTH EFFECTS

The committee developed a list of respiratory health outcomes that might be associated with exposure to airborne hazards encountered in the Southwest Asia theater based on its review of the scientific literature, including those identified by VA as of great concern to veterans (listed in Box 1). Of these outcomes, none met the committee's criteria for sufficient evidence of an association. The evidence for respiratory symptoms—defined as chronic persistent cough, shortness of breath (dyspnea), and/or wheezing—met the committee's criteria for limited or suggestive evidence of an association for veterans of both the 1990–1991 Gulf War and the post-9/11 conflicts.

Research studies that have been considered in previous National Academies reports consistently reported associations between deployment and more prevalent self-reported respiratory symptoms in Southwest Asia theater veterans, and results from more recent studies agree with those findings. However, many of the studies considered were limited by self-selection bias on the part of their participants—individuals may have been more likely to participate if they had respiratory symptoms than if they did not. Many of these studies also did not account for the role of cigarette smoking, which is known to exacerbate symptoms. These concerns, while serious, were consistent with a classification in the limited or suggestive category.

Consistent with prior National Academies reports, the committee concluded that there was limited or suggestive evidence of no association between in-theater exposures and changes in lung function in 1990–1991 Gulf War veterans. Factors such as the lack of good exposure information led them to conclude that there was inadequate or insufficient information to evaluate the association between service in the Southwest Asia theater and all of the other respiratory health outcomes examined. The committee emphasized that these findings do not mean that there is no association

BOX 1 RESPIRATORY HEALTH OUTCOMES ADDRESSED IN THE REPORT

NON-CANCER RESPIRATORY DISORDERS

Upper Airway Disorders
- rhinitis
- sinusitis
- sleep apnea
- vocal cord dysfunction

Non-Infectious Lower Airway
- asthma
- chronic bronchitis
- chronic obstructive pulmonary disease
- constrictive bronchiolitis
- emphysema

Interstitial Lung Diseases
- acute eosinophilic pneumonia
- hypersensitivity pneumonitis
- idiopathic interstitial pneumonia
- idiopathic pulmonary fibrosis
- pulmonary alveolar proteinosis
- sarcoidosis

Infectious Lower Airway
- acute bronchitis
- pneumonia
- tuberculosis

Respiratory Symptoms
- chronic persistent cough
- shortness of breath (dyspnea)
- wheeze

RESPIRATORY CANCERS

- esophageal cancer
- laryngeal cancer
- lung cancer
- oral, nasal, and pharyngeal cancers

OTHER OUTCOMES

- changes in lung function
- mortality due to diseases of the respiratory system

between service in the Southwest Asia theater and the conditions, but instead that the available evidence does not allow a definitive determination to be made about any potential association. Taken together, their findings indicate that there is a great need to generate knowledge to address information gaps.

ADVANCING KNOWLEDGE OF RESPIRATORY HEALTH ISSUES IN SOUTHWEST ASIA THEATER VETERANS

A key component of the committee's task was to identify existing knowledge gaps, potential research that may inform the field and generate answers, and newly emerging technologies that could aid in research efforts. The committee identified a large number of gaps in the current information base regarding respiratory health outcomes in the population of veterans who served in the Southwest Asia theater. These can be grouped as gaps in knowledge concerning adverse respiratory health outcomes in theater veterans, in-theater airborne exposures, and the biological and toxicological effects of in-theater airborne exposures.

Based on its review, the committee developed three recommendations regarding knowledge gaps:

- **The committee recommends that VA establish an expert panel to advise it on issues related to the diagnosis of constrictive bronchiolitis in veterans and its possible relationship to military service.**
- **The committee recommends that an updated analysis of mortality in Southwest Asia theater veterans be conducted.**
- **The committee recommends that VA and DoD explicitly integrate research access considerations into their planning as they refine the implementation of their new interoperable electronic health record system.**

ORGANIZATIONS THAT VA MIGHT PARTNER WITH TO ADDRESS KNOWLEDGE GAPS

The committee was also asked to identify organizations that VA might partner with to advance its understanding of respiratory health effects in Southwest Asia theater veterans. A number of federal agencies, investigators in the United States and abroad, and other governmental and private-sector organizations are currently conducting research relevant to theater veterans' health or else have information that could improve the conduct of such work.

Based on its already extensive relationship with VA on issues related to occupational and environmental exposures for veterans, the committee made one recommendation regarding VA's relationship with DoD:

- **The committee recommends that VA continue and expand its partnership with DoD on environmental health issues, focusing on the free flow of information on exposures encountered during military service and on the health of personnel before, during, and after deployment and after transition to veteran status. This should include cooperation on identifying which respiratory health status information should be gathered during active duty for later use as baseline data in evaluating veterans' health for treatment, benefits, and research purposes.**

FUTURE DIRECTIONS

To more fully understand any existing associations between service in the Southwest Asia theater and respiratory health effects, the committee emphasized that researchers should take a new approach that will allow them to better answer these questions. It is possible today to conduct high-quality research on this topic by better accounting for influences such as smoking habits, combining and analyzing existing data in innovative ways, standardizing the way outcomes are determined to make it easier to compare results, and improving exposure assessment.

While burn pit–related research will certainly be a part of this work, it will likely be challenging to attribute specific effects to only this exposure. The more important question is whether deployment to the Southwest Asia theater—with all of the hazardous airborne exposures it entailed—may be responsible for adverse respiratory outcomes. This report addresses not only existing knowledge gaps but also suggests actions that VA and its partners can take to better understand the health problems that veterans face and provide them with the information they need.

Committee on the Respiratory Health Effects of Airborne Hazards Exposure in the Southwest Asia Theater of Military Operations

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To read the full report, please visit
nationalacademies.org/gulf-airborne-hazards

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