OVERVIEW

Between August 1990 and July 1991, approximately 697,000 U.S. active-duty and reserve-component unit personnel served in the Persian Gulf theater in Operations Desert Shield and Desert Storm. For a significant portion of these individuals, the Gulf War experience—before, during, and after deployment—was psychologically stressful. In the years following their service in the Gulf, veterans have suffered from a range of health problems.

This study is one of a series of RAND reports that examine evidence relating to the possible link between exposure to a host of conditions and exposures experienced by U.S. military participants in that conflict and Gulf War illnesses.

This paper evaluates the available evidence concerning the link between stress and health problems in general, and the role of stress in the health problems experienced by Gulf War veterans in particular. The general scientific literature indicates that stress can have myriad health consequences, although no single health problem or set of symptoms is distinctively characteristic solely of stress, with the exception of posttraumatic stress disorder.

THE PROBLEM

Given the large scale of the deployment, the war against Iraq was successfully prosecuted with comparatively little injury or loss of life to U.S. forces. Nonetheless, in the months and years following the end of the war, U.S. personnel reported health problems, many of which were attributed by the veterans to their service in the Gulf War. To date, no single cause of these health problems has been identified. Multiple contributing causes have been suggested, including exposure to chemical and biological weapons, depleted uranium, exposure to harsh climatic conditions, smoke from oil well fires, pesticides, insect repellents, reactions to prophylactic drugs (e.g., pyridostigmine
bromide) and vaccines, infectious diseases, and the psychological stresses of warfare.

Health problems can stem from either disease or illness. While disease and illness overlap, they are distinct constructs. Disease refers to constellations of symptoms that define a diagnosable physical or psychiatric disorder; illness refers to the subjective experience of poor health. Illness manifests itself as somatic (bodily) or psychological symptoms, but may stem from multiple sources—including cognitive and social processes—and may or may not reflect the presence of an underlying disease. The relationship of illness to disease is complex. A person may experience ill health with no underlying disease. Conversely, the person may suffer from an underlying disease without perceiving himself or herself as ill.

In certain circumstances and for certain individuals, stressful experiences can contribute to health problems. For the purpose of this review, we define stress as a real or perceived imbalance between environmental demands required for survival and an individual’s capacity to adapt to these requirements. Circumstances that individuals perceive as stressful trigger an integrated series of responses—physiological, behavioral, and psychological—to adapt to the environmental demands. Although these responses may have short-term benefits, over time they may act in concert with other host and environmental risk factors to increase the likelihood of psychological or somatic symptoms.

Physiological mechanisms implicated in illness and disease include the autonomic nervous system and neuroendocrine mediators that influence immune, gastrointestinal, neuromuscular, and cardiovascular reactions. Acute activation of these systems is known to precipitate short-term adaptive changes (e.g., rapid heart rate, increased perspiration, gastrointestinal motility) that may be experienced as symptomatic of ill health. Chronic activation of these systems is believed to enhance vulnerability to cardiovascular, metabolic, immune-related, and other diseases. Behavioral responses to stress can also heighten risk of illness. Individuals under stress are more likely to engage in behaviors with significant ramifications for health, including poor eating and sleeping habits and consumption of alcohol and other substances. Psychological mechanisms have been implicated as influencing health in at least two ways. First, patterns of thinking about oneself and one’s world may place individuals at heightened risk for various forms of psychopathology, including depression and anxiety. Second, under stress, psychological factors may heighten an individual’s perception of himself or herself as sick.
HOW WE STUDIED THE PROBLEM

This study involved a wide-ranging literature review. We identified relevant literature through an extensive examination of the research database, including searches of *Psychological Abstracts*, *MedLine*, and *Defense Technical Information Center*, as well as the PILOTS database compiled by the National Center for Posttraumatic Stress Disorder. We relied on three sources of evidence:

- general—i.e., non-Gulf War-related—scientific literature concerning the link between stress and health problems; we reviewed more than 250 articles, books, and technical reports examining laboratory and field-research studies
- available data concerning stresses faced by personnel deployed to the Persian Gulf; we assessed approximately 55 studies that attempted to measure veterans’ exposure to stress by means of in-theater psychiatric evaluations or surveys conducted in-theater or following the war
- empirical studies bearing directly on the link between stress and health problems experienced by Gulf War veterans; we examined approximately 60 articles and technical reports.

STRESS IN WARTIME

Classic discussions of war-related stress have long recognized that the war zone is full of hardships and danger, many only secondarily related to combat (e.g., Grinker and Spiegel, 1945). More recent research has continued to document that war-zone deployment may be associated with a wide range of potential stressors. These additional stressors include not only combat exposure but also exposure to atrocities (e.g., horrific carnage or body mutilation) and seemingly low-level events such as separation from loved ones and exposure to harsh living conditions (e.g., difficult climatic conditions, lack of privacy, limited opportunity for recreation, or long work hours). War-zone stressors may include any other events or circumstances that foster a sense of personal disheartenment, discomfort, or demoralization.

STRESS IN THE GENERAL SCIENTIFIC LITERATURE

The general scientific literature provides evidence that exposure to stressful events—including combat or war-zone exposure—can contribute to psychological or bodily symptoms. Relatively common symptoms include depression, anxiety, fatigue, impaired memory and concentration, headaches, back and neck aches, gastrointestinal complaints, and breathing difficulty. More severe forms of mental illness, including posttraumatic stress disorder and depression,
also have been linked to stress. Although the onset of symptoms typically begins within days of exposure, a sizable minority of persons may experience either delayed onset or delayed reporting of symptoms. The temporal course of symptoms of stress exposure is highly variable. It is not uncommon for symptoms of psychological and bodily distress to persist for years. But, in many instances, what appears as delayed onset of symptoms may be more aptly characterized as delayed help-seeking.

The general literature indicates that stress may be associated with a range of illnesses and diseases, but evidence of this linkage varies across problems. Little definitive evidence indicates that the stress of combat or war-zone exposure per se contributes to actual physical disease, although a number of epidemiological studies suggest that such exposure is associated with greater prevalence of self-reported chronic health conditions, poorer self-ratings of health, and higher levels of help-seeking behavior.

Members of the military are not alone in self-reporting health complaints in the absence of objectively verifiable disease; the empirical literature reports this as relatively common in the general population. Some evidence suggests that stress exposure and perceived stress may contribute to both medical help-seeking behavior and the experience of oneself as ill, even in the absence of objective evidence of disease.

Finally, evidence in the general literature suggests that virtually no stressful event or set of stressful circumstances produces health problems in every exposed individual. Certain persons may be more vulnerable to the potentially negative health consequences of stress exposure by dint of genetic or biological predisposition, prior life experiences, or personal and social coping resources as well as other factors.

**STRESS IN THE GULF WAR**

Surveys conducted during and after the war suggest that substantial numbers of U.S. military personnel in the Gulf War found the experience to be stressful. Deployment to the Persian Gulf theater exposed combatants and noncombatants to a wide range of stressful circumstances as self-reported by veterans. This stress exposure varied across different phases of the deployment. While the shooting war was brief and brisk, it was preceded by an abrupt, rapid mobilization and a prolonged build-up phase characterized by high levels of stress in anticipation of impending conflict.

Although these exposures were not reported to be stressful by all personnel, large numbers reported experiencing moderate to high levels of perceived stress resulting from various experiences. These findings were consistent
across most studies and over time (e.g., two to three years following the Gulf War). The data were also consistent across male and female veterans, with few differences found in self-reported stress between the two groups.

In comparison to active-duty personnel, members of reserve component units—as a group—appear to have experienced somewhat higher levels of perceived stress, perhaps because of different expectations about military obligations, different levels of preparedness or training, or problems in the way they were utilized (e.g., units split apart and individual reservists assigned to other than their parent organization), among other factors.

What was stressful? As might be expected, actual combat topped the list. Other stressors included witnessing the death or disfigurement of American, coalition, or enemy forces, prolonged anticipation of the risk of serious injury or loss of life due to impending air and ground assaults, as well as to possible chemical-biological warfare and SCUD missile attacks. Iraq’s past use of chemical and biological weapons heightened apprehension about possible attacks and raised concerns regarding the effectiveness of defensive suits. The possible side effects of required prophylactic drugs were also a concern. The media predicted that U.S. forces would suffer 20,000 to 50,000 casualties, further intensifying the pre-battle anticipatory stress. The threat of random SCUD missile attacks was theater-wide.

Low-level stressors came from many sources. Deployment itself was deemed stressful. The unexpected and rapid nature of the deployment created personal and family hardships, especially for members of reserve-component units. Once in theater, military personnel said they confronted a myriad of stress points: crowded or austere living conditions, long work days, a harsh climate, confinement to base camps with little opportunity for customary recreational outlets, separation from loved ones, and nearly total isolation from indigenous populations. Uncertainty about the length and nature of the mission compounded these hardships. Domestic worries, including concerns regarding separation from family and family-related problems, were another important source of stress reported by many Gulf War veterans.

A final source of stress reported by veterans stems from widespread and unrelenting concerns about the possible negative health effects of Gulf War service. Even before the war ended, efforts began to examine potential health problems associated with Gulf War service. Ambiguity concerning the origins of health problems reported by some Gulf War veterans continues to this day, with media accounts and conflicting reports contributing to an on-going, stress-provoking climate of distrust, recrimination, and suspicion of government cover-ups and obstruction.
STRESS IN THE GULF WAR-SPECIFIC SCIENTIFIC LITERATURE

In our review of some 60 Gulf-specific articles, we identified over 30 studies relevant to a possible link between stress exposure in the Gulf War and health problems experienced by returning veterans. Most measured either perceived stress or actual stress exposure, constructs which are not synonymous, in at least one of the following ways: (1) by using self-reports included in interviews or questionnaires, or (2) by identifying soldiers who experienced a potentially very stressful event (e.g., witnessing deaths from friendly fire, handling human remains). Virtually all studies measured health outcomes in terms of self-reported symptoms of psychological or bodily distress.

Gulf War and Posttraumatic Stress Disorder (PTSD). All fifteen studies that evaluated this relationship found evidence of a positive—albeit modest—relationship between stress exposure and PTSD symptoms. However, these studies were methodologically flawed. They relied on self-report measures or retrospective reporting of exposures, they contained little data from representative samples of deployed personnel, and they did not generally attempt to rule out other etiologic factors. As a result, these studies provide evidence—albeit suggestive—of a link between stress exposure and PTSD.

Gulf War and Non-PTSD Mental Health Problems. Ten studies reported on the relationship between stress exposure and other mental health problems. Although differing in numerous respects, including sample sizes and the operational definition of both stress exposure and mental health, most of these studies provided evidence of a relationship between stress exposure and psychological distress. These associations tended to be modest. Like the PTSD studies, nearly all of these studies relied on veterans’ self-reports of symptoms using symptom checklists, rather than diagnostic interviews. They also suffer from the same methodological problems. As a result, drawing definitive conclusions about the role of stress in non-PTSD mental health problems of Gulf War veterans is difficult.

Gulf War and Somatic Health Problems. Few studies were designed or reported in a manner that permit us to draw firm conclusions concerning the relationship between stress exposure and actual physical disease. We identified only four studies that directly report on the relationship between stress and bodily symptoms. These studies yielded mixed findings. In addition, they generally assessed physical symptoms using self-reports, which do not necessarily indicate an underlying organic cause and may merely reflect psychological distress. As a result, we found the Gulf War literature that evaluated a link between stress exposure and physical health to be quite limited.
Summary. In sum, a number of studies have examined the health effects of service in the Gulf War. Although these studies generally show that persons who went to the Gulf report more health problems than those who did not, they do not clarify whether these differences result from stress, other possible exposures, or preexisting conditions. With respect to specific health problems, the studies suggest that stress is associated with PTSD or PTSD-like symptoms, although the studies are hampered by some methodological limitations. A connection to other psychological disorders is also evident. Both PTSD and other psychological health problems show a modest association with stress, with the relationship more pronounced in those who experience high stress. Little evidence connects stress to self-reported physical symptoms.

CONCLUDING OBSERVATION

The scientific study of stress and its impact on health has made enormous advances in recent years. Unfortunately, these scientific strides have generally not been accompanied by an evolution in popularly held misconceptions about stress. The societal stigma associated with stress as an explanation of poor health and disease has contributed greatly to the politicized environment that sometimes characterizes public discourse concerning the health problems suffered by Gulf War veterans.

Although it is inappropriate to rely upon stress exposure as a default explanation for the myriad health problems reported by Gulf War veterans in the absence of a thorough review of research concerning all plausible causes, we think it equally inappropriate to assume that stress played no role. To do so would ignore what the scientific literature shows about the relationship between stress and health.