

## War Syndromes and Their Evaluation: From the U.S. Civil War to the Persian Gulf War

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**Purpose:** To better understand the health problems of veterans of the Persian Gulf War by analyzing previous war-related illnesses and identifying possible unifying factors.

**Data Source:** English-language articles and books on war-related illnesses published since 1863 that were located primarily through a manual search of bibliographies.

**Data Extraction:** Publications were assessed for information on the clinical characteristics of war-related illnesses and the research methods used to evaluate such illnesses.

**Data Synthesis:** Poorly understood war syndromes have been associated with armed conflicts at least since the U.S. Civil War. Although these syndromes have been characterized by similar symptoms (fatigue, shortness of breath, headache, sleep disturbance, forgetfulness, and impaired concentration), no single recurring illness that is unrelated to psychological stress is apparent. However, many types of illness were found among evaluated veterans, including well-defined medical and psychiatric conditions, acute combat stress reaction, post-traumatic stress disorder, and possibly the chronic fatigue syndrome. No single disease is apparent, but one unifying factor stands out: A unique population was intensely scrutinized after experiencing an exceptional, life-threatening set of exposures. As a result, research efforts to date have been unable to conclusively show causality, have been subject to reporting bias, and have lacked similar control populations. In addition to research limitations, war syndromes have involved fundamental, unanswered questions about the importance of chronic somatic symptoms and the factors that create a personal sense of ill health.

**Conclusion:** Until we can better understand what constitutes health and illness in all adult populations, we risk repeated occurrences of unexplained symptoms among veterans after each war.

After returning home in 1991, some veterans of the Persian Gulf War began reporting diverse symptoms that have been collectively called a mystery illness or the Gulf War syndrome (1). Extensive programs have been initiated by the governments of the United States, Great Britain, and Canada to provide medical care for veterans of the Persian Gulf War, to define any new syndrome, and to determine the causes of the veterans' illnesses (2-4). In the search for the cause of a previously uncharacterized complex of signs and symptoms (or syndrome), the question arises whether a similar illness occurred during or after previous wars. If an analogous illness affected veterans of other wars, its cause may be related to common wartime experiences rather than to a unique event during the Persian Gulf War. In this historical review, war-related syndromes from the U.S. Civil War to the Persian Gulf War were analyzed to identify possible unifying factors.

### War Syndromes

#### U.S. Civil War

During the U.S. Civil War, Da Costa (5) did one of the first studies of a war syndrome. Da Costa evaluated 300 soldiers referred to him for a syndrome that he called irritable heart; this syndrome was principally characterized by shortness of breath, palpitations, and sharp or burning chest pain, particularly on exertion. Other symptoms included fatigability, headache, diarrhea, dizziness, and disturbed sleep (Table 1). There was no consistent sign of physiologic disease, and most patients appeared to be in fair overall health.

Symptoms of the irritable heart syndrome were not restricted to soldiers who had been in combat, and Da Costa believed that the condition occurred in civilian populations. Because many of the patients had had a recent episode of diarrhea, upper respiratory infection, or febrile disease, Da Costa concluded that an infectious disease was the cause in 48% of patients. Thirty-five percent of cases were attributed to strenuous military duties and 18% to miscellaneous causes. Da Costa reported that 38%

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**Table 1. Somatic Symptoms Commonly Associated with War-Related Medical and Psychological Illnesses\***

Symptom	War and Illness					
	U.S. Civil War, Da Costa Syndrome	World War I, Effort Syndrome	World War II, Combat Stress Reaction	Vietnam, Agent Orange Exposure	Vietnam and Other Conflicts, Post-Traumatic Stress Disorder	Persian Gulf, Unexplained Illnesses
Fatigue or exhaustion	+	+	+	+	+	+
Shortness of breath	+	+	+		+	+
Palpitations and tachycardia	+	+	+		+	
Precordial pain	+	+			+	+
Headache	+	+	+	+	+	+
Muscle or joint pain				+	+	+
Diarrhea	+		+	+	+	+
Excessive sweating	+	+	+		+	
Dizziness	+	+	+	+	+	
Fainting	+	+				
Disturbed sleep	+	+	+	+	+	+
Forgetfulness		+	+	+	+	+
Difficulty concentrating		+	+	+	+	+

\* A plus sign indicates a commonly reported symptom.

of patients recovered from the disorder and that administration of several drugs, including digitalis, may have had a beneficial effect.

On the basis of Da Costa's clinical descriptions, it is difficult to confidently determine specific diagnoses; however, various illnesses could have caused the symptoms in these patients (6, 7). Few patients had conclusive evidence of heart disease. Many patients were debilitated from malnutrition, lack of exercise, infectious diseases (including malaria and typhoid), and other adverse medical conditions. Some patients had symptoms of a psychological illness or stress reaction (8). In addition to the irritable heart syndrome, a war-related illness attributed primarily to psychological factors was reported during the U.S. Civil War. Young soldiers with obsessive thoughts of home received a diagnosis of a severe form of homesickness called "nostalgia," which was characteristically accompanied by extreme apathy, loss of appetite, diarrhea, and sometimes fever (9, 10).

### World War I

A syndrome similar to the one described by Da Costa became a major problem during World War I: Soldiers had to be evacuated to England because of shortness of breath, palpitations, and chest pain (11). Affected soldiers also commonly reported fatigue, headache, dizziness, confusion, concentration problems, forgetfulness, and nightmares (Table 1) (12–14). This complex of symptoms became known as soldier's heart or the effort syndrome because symptoms were exacerbated by effort. It was also called the Da Costa syndrome, disordered action of the heart, and, in the United States, neurocirculatory asthenia (15).

At the beginning of World War I, the effort syndrome was frequently attributed to cardiac hypertrophy caused by heavy marching packs com-

pressing the chest (16, 17). However, as the war progressed, the effort syndrome was believed to encompass a mixed group of illnesses and causes, including constitutional nervous weakness and physical weakness; an infectious disease or debility from previous infections; exhaustion from lack of sleep and exertion in the trenches; the effects of poison gas; malingering; and, rarely, heart disease (12–14, 18–23). In some cases, onset of symptoms was also associated with acute stress resulting from combat or burial duties (12, 22). Digitalis and other drugs did not benefit patients with the effort syndrome, but a structured rehabilitation program with a graduated exercise regimen and encouragement from a supervising medical staff were effective (12, 22). It was also found that if symptoms of the effort syndrome were attributed to heart disease, recovery and return to duty were hindered (12, 13). As a result, physicians were advised not to tell soldiers that they had a heart condition so that the soldiers would not think of themselves as patients who required evacuation from the front (12, 21, 22, 24).

A concerted clinical and research program was developed during World War I to determine the causes and most effective treatment of the effort syndrome (11). This program involved clinical care and empirical observations in two specialized hospitals in England (12) and a specialized referral center in the United States (7, 17). After the war, the Medical Research Council continued to oversee clinical evaluation and additional studies for the British government (11). Further investigations were given high priority because the effort syndrome was the third most common reason for disability and compensation assessment in England; 44 000 veterans eventually received pensions for this condition (11, 14, 25).

Although clinical studies published at the end of the war (26–28) indicated that the effort syndrome

was caused by psychological factors, there was little agreement on what specific symptoms constituted the effort syndrome, whether it was primarily a physiologic or psychological illness, and even what the official name of the condition should be (29). However, there was a consensus that the effort syndrome was not caused exclusively by unique wartime exposures, because many soldiers reported having had similar symptoms before the war (12, 19, 22).

Each year for 5 years after World War I, a survey was mailed to 601 British veterans who had received a diagnosis of the effort syndrome and who had received pensions (30). Data from this survey and available medical records identified 52 veterans who had developed various defined illnesses, including 22 cases of pulmonary tuberculosis and 6 confirmed cases of cardiac disease. The health of most other veterans had remained stable, and mortality did not increase. In addition to the effort syndrome, an acute illness attributed to combat stress (which was called shell shock or trench neurosis) was investigated during World War I. This acute combat stress reaction was first attributed to a strange new disease, possibly caused by concussion from modern weapons; however, a psychological cause was soon determined (31, 32). Typical manifestations of acute combat stress reaction included breakdown in battle, dazed or detached manner, exaggerated startle response, and severe anxiety (32, 33).

During World War I, it was determined that soldiers with shell shock could be rapidly rehabilitated if they were cared for near the front, expecting a quick recovery (32). After soldiers with shell shock were taken away from their comrades and treated as patients in a hospital, they were much less likely to return to combat. Also, the British used the nonspecific term "not yet diagnosed, nervous (NYD)" for the initial designation of possible victims of shell shock; this designation prevented soldiers from concluding that they had a medical condition that required hospitalization (32, 33).

## World War II

At the beginning of World War II, the effort syndrome again became an important medical consideration for the British military (14). Whether the effort syndrome was predominantly a physiologic or psychological illness had not been resolved (14, 34). However, after Wood's influential clinical studies of 200 patients (35–37), the effort syndrome was generally considered to be a psychoneurosis and not a medical disease (7).

Acute combat stress reaction (which was known as battle fatigue, combat exhaustion, or operational fatigue among aviation personnel during World War II) also became better understood at this time (33, 38). Studies of combat personnel determined that

acute combat stress reaction frequently manifested as somatic symptoms, including fatigue, palpitations, diarrhea, headache, impaired concentration, forgetfulness, and disturbed sleep (Table 1) (39).

As in World War I, soldiers with acute combat stress reaction were more likely to return to duty if they were treated quickly and near their combat units and received a diagnosis of a normal response to extreme stress rather than an abnormal condition. Consequently, use of such diagnostic labels as "war neurosis" was discouraged because they connoted that soldiers were sick and should be treated as patients (33, 39, 40).

## Korean Conflict

Possibly because the effort syndrome had been attributed to psychological causes during World War II, it was not reported as a major medical problem during the Korean Conflict (7). Since the 1940s, the effort syndrome has been identified less frequently as a unique disease entity (41–43), but the lineages of many illnesses not related to war have been traced back through the effort syndrome to the Da Costa syndrome. Such illnesses include anxiety neurosis and manic–depressive conditions (44), panic disorders (45), the mitral valve prolapse syndrome (17, 46), the hyperventilation syndrome (47), and the chronic fatigue syndrome (48).

As in World War I and World War II, acute combat stress reaction was an important clinical problem during the Korean Conflict (33, 38).

## Vietnam War

The most prominent illness related to the Vietnam War was post-traumatic stress disorder (49), which was initially called post-Vietnam syndrome (50, 51). Whereas acute combat stress reaction is the immediate consequence of psychological trauma, post-traumatic stress disorder more often refers to the long-term consequences of extreme psychological stress (52). Post-traumatic stress disorder has also been recognized as a problem in veterans of both the Korean Conflict and World War II (53), especially former prisoners of war (54, 55), and has been found in civilians exposed to extreme trauma not related to war (51).

No other prominent, poorly understood war syndrome was associated with the Vietnam War (56–58), although controversy about the role of Agent Orange (dioxin) exposure in the development of various medical problems and birth defects continues (59). Chronic somatic symptoms have generally not been linked to the effects of herbicide exposure in Vietnam. However, it is noteworthy that the somatic symptoms frequently described by Vietnam veterans who may have been exposed to Agent Orange (56, 58, 60) are similar to the symptoms commonly

associated with other war-related illnesses (61), including acute combat stress reaction (39) and post-traumatic stress disorder (62–68) (Table 1).

### Persian Gulf War

After Iraq invaded Kuwait in August 1990, 697 000 soldiers from the United States, 45 000 soldiers from Great Britain, and 4500 soldiers from Canada were deployed to the Persian Gulf during a 5-month buildup period; this period was followed by a 39-day air war and a 4-day ground war in February 1991. Far fewer casualties than anticipated occurred among coalition forces, and morbidity rates were low compared with those in previous wars (69, 70).

After the war ended, troops returned home, and veterans from diverse military units of the United States, Great Britain, and Canada began reporting various chronic symptoms, often referred to as the Gulf War syndrome (71–77). Fatigue, headache, muscle and joint pain, diarrhea, skin rashes, shortness of breath, and chest pain have been common symptoms (Table 1) (2, 78–80). Various neuropsychological symptoms also have been common—particularly sleep disturbances, impaired concentration, forgetfulness, irritability, and depression. Currently, no characteristic physical sign or laboratory abnormality has been identified (2, 80, 81).

No medical reports of similar unexplained illnesses among other coalition troops or among persons indigenous to the Persian Gulf have been published. During World War II, no similar unexplained illnesses were seen among the British and U.S. forces stationed in the Persian Gulf (82).

Personal accounts of family members developing symptoms similar to those of relatives who served in the Persian Gulf War and increased birth defects among children born after the war have been reported (2, 83). Other recent war-related conditions have been associated with medical and psychological problems among family members (59, 84), but accounts of health problems among family members of veterans who received a diagnosis of a war-related illness did not increase during World War I or World War II.

The health problems experienced by veterans after service in the Persian Gulf War have been considered a serious matter by the involved governments, a response similar to that seen for the effort syndrome in World War I. A tri-agency coordinating board has been established in the United States to supervise a comprehensive clinical and research program (85–87), and compensation is being provided to disabled war veterans who have unexplained illnesses (U.S. Public Law 103-446, 2 November 1994). In addition, the U.S. Department of Veterans Affairs, the U.S. Department of Defense,

and the governments of Great Britain and Canada have established self-referred health registries and specialized centers that provide comprehensive clinical examinations and medical care (2–4).

Clinical evaluation of more than 80 000 veterans and initial epidemiologic surveys have identified a broad range of health problems (2, 80, 88, 89), including symptoms of post-traumatic stress disorder in 5% to 15% of some veteran populations (90–94); however, a new or unique syndrome has not yet been identified (80). Preliminary results of epidemiologic studies of veterans of the Persian Gulf War show no overall increase in hospitalization rates (95), birth defects (96), or mortality due to medical causes (97).

Available information on the nature and cause of illnesses among veterans of the Persian Gulf War has been evaluated by five independent panels in the United States (70, 98–101). These panels did not identify a new illness (70, 98, 100) or establish a case definition of a unique syndrome (70, 98, 99, 101); they concluded that veterans of the Persian Gulf War had numerous illnesses that resulted from various causes (70, 98). However, one advisory committee concluded that a rare or mild illness could be missed by large case series, such as the Persian Gulf health registries, which have examined approximately 10% of all U.S. veterans of the Persian Gulf War (100).

### Comparison of War Syndromes

Since the U.S. Civil War, two general categories of war-related illnesses have been recognized: one poorly understood group thought to be associated with physiologic disease and another group of psychological illnesses attributed to wartime stress (Table 2). Although there have been two general types of war-related illnesses, war syndromes have not been consistently defined or identified by a pathognomonic physical sign or laboratory abnormality. As a result, the diagnosis of a physiologic or psychological illness in individual patients has been imprecise and has depended on self-reported symptoms and the impression of the examining physician (8, 13, 34, 61, 98).

The war syndromes thought to be associated with organic pathology have been characterized by two similarities that could indicate a related disease. From the Da Costa syndrome to the more recent Gulf War syndrome, the first common feature has been the similarity of reported symptoms. Shared symptoms include fatigue, shortness of breath, headache, sleep disturbances, impaired concentration, and forgetfulness (Table 1). Common symptoms alone, however, do not show that veterans of

**Table 2. Comparison between Categories of War-Related Illnesses**

War	Category of Illness	
	Physiologically Attributed	Psychologically Attributed
U.S. Civil War	Da Costa syndrome (irritable heart)	Nostalgia
World War I	Effort syndrome (soldier's heart, neurocirculatory asthenia)	Shell shock (trench neurosis)
World War II	Effort syndrome	Battle fatigue, combat exhaustion, operational fatigue
Korean Conflict		Battle fatigue, combat exhaustion
Vietnam War	Agent Orange exposure	Post-traumatic stress disorder (Post-Vietnam syndrome)
Persian Gulf War	Gulf War syndrome	Post-traumatic stress disorder

various wars had a related disease process, because such symptoms are nonspecific and are frequently found in all adult populations (102–106), particularly among persons with psychological stress (39, 56, 107) and post-traumatic stress disorder (62, 63, 108).

A second possible unifying factor has been the high frequency of reported diarrhea and other infectious diseases preceding the onset of these syndromes (5, 13, 19, 109). The significance of this factor is unclear because crowded populations of military personnel, particularly troops sent to tropical and developing regions, have an inevitably high rate of infectious disease (58, 82). However, no unique, deployment-related syndrome has been reported after large peacetime military exercises. In addition, infectious diseases have not been proven to cause chronic somatic symptoms in the absence of measurable signs of disease (110), except possibly among persons prone to depression (111, 112). Nevertheless, convalescence can be prolonged after many infections (113), and the chronic fatigue syndrome, although not associated with characteristic signs of disease, is suspected of having an infectious origin (114).

Other than these two similarities, there is little additional evidence of a single, unique war syndrome that is unrelated to psychological stress. However, 19th-century and early 20th-century clinical characterizations are difficult to compare with modern data, and the psychological aspects of illness were not as well appreciated and reported in the past. Furthermore, because of the general improvement in health and nutrition during this century, it is difficult to compare the illnesses of military populations of different eras.

Although historical data are difficult to compare, ample evidence shows that numerous complex factors were responsible for the health problems of war veterans, as in any population, and that many illnesses were described after successive wars. A substantial proportion of veterans with chronic somatic symptoms were found to have various physiologic and psychological illnesses (13, 30, 80, 89). In addition, veterans of each war had high rates of acute combat stress reaction and post-traumatic stress dis-

order (33). Still other veterans had illnesses that meet the recently suggested criteria for a diagnosis of the chronic fatigue syndrome (48, 70, 89, 115). Although no single, recurring war-related disease has been identified, many aspects of the process used during the past 130 years to evaluate the health problems of veterans have been repeated with each war. The most important and consistent factor is that this process has involved medical evaluation after the critical event, thereby precluding a definitive demonstration of causality. Consequently, numerous illnesses that occur after a war may be attributable to wartime exposure, and epidemiologic studies, regardless of their size or design, cannot conclusively resolve medical, legal, and political questions about the causes of post-war health problems (116). In addition to the problems of interpreting the results of retrospective studies, it has been difficult to identify similar control populations because of the exceptional nature of wartime experiences and the unique characteristics of military populations.

Because studies of war-related illnesses have been done after exposure and without similar control groups, research efforts have frequently been limited to the evaluation of a series of clinical cases. Research efforts have been further hampered because war syndromes have not been associated with characteristic and measurable signs of disease that would allow for the development of specific case definitions (8, 98). In addition to these research limitations, the problem of diagnostic labeling has played a critical role in the evaluation of war syndromes. The naming of a syndrome has repeatedly exerted a powerful effect on the medical approach toward, official recognition of, and patient perception of these poorly understood conditions (11, 33). A medically recognized diagnosis fundamentally alters the lives of active-duty military personnel and veterans, influencing everything from type and location of duty assignment to medical treatment, expectations of recovery, and eligibility for compensation (13, 37). The influence of a medical classification has also been found to be substantial among nonmilitary populations (117–119).

## Conclusions

Despite enormous progress in medical science, poorly understood war syndromes have recurred at least since the U.S. Civil War. No single, previously uncharacterized illness or underlying cause that is unrelated to psychological stress is apparent from the available reports. However, many illnesses have been found among war veterans evaluated for these syndromes. As expected in any large adult population exposed to complex environmental and psychological conditions, various health problems have developed.

Although no unique war-related disease is evident, one unifying factor has been prominent in the evaluation of these syndromes: A unique population was intensely scrutinized after experiencing an exceptional, life-threatening set of exposures. The process by which these syndromes were evaluated and defined is the most evident similarity.

Designing studies to evaluate the health of war veterans inevitably presents several serious methodologic problems (116). For example, it is difficult to obtain accurate health and risk factor data after a potentially harmful experience, particularly if there has been extensive or sensational media coverage, because of reporting bias (120–122). During wartime conditions, it is not feasible for the military to collect comprehensive exposure data among combat troops because the primary focus must be to fight and win the war.

An apparent solution to these methodologic problems is to gather more extensive baseline medical and exposure data and to design large prospective studies before any future conflict. As a result of numerous recent overseas deployments, the U.S. Department of Defense is developing a greatly enhanced surveillance system. For military operations in Bosnia, which began in 1995, environmental and infectious disease surveillance teams have been deployed; U.S. troops are being provided extensive health guidance before, during, and after the operation; medical and psychological screening will occur before and after deployment; and a repository for serum collected before and after deployment is being established (123).

Intensive surveillance will substantially aid in the evaluation of veterans' health. However, it will be difficult to design prospective studies to answer all post-war health questions because the location and nature of each war varies too greatly to predict every health risk. In addition, studies of military populations alone will not sufficiently explain war-related syndromes because these syndromes involve fundamental, unanswered questions about health and illness. To more fully understand the health of any population, military or civilian, research efforts

will have to be done to answer two basic questions: 1) What is the relation between chronic, non-specific symptoms and physiologic and psychological illness (124–127)? 2) What factors—medical, environmental, psychological, or social—create a personal sense of ill health (128–131)?

Evaluating fundamental questions of health in large populations is always extraordinarily difficult, but is particularly so after traumatic and complex wartime events. Nevertheless, unless these difficult questions are answered, we risk repeated occurrences of unexplained symptoms among veterans after each war.

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