

Combined Analysis of the VA and DoD Gulf War Clinical Evaluation Programs

*A Study of the Clinical Findings from Systematic Medical Examinations
of 100,339 U.S. Gulf War Veterans*



**Department of Veterans Affairs,
Veterans Health Administration**



**Department of Defense,
Office of the Assistant Secretary of Defense, Health Affairs**

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Background

In response to Iraq's invasion of Kuwait on August 2, 1990, the United States began deploying troops to the Arabian Gulf five days later in Operation Desert Shield.¹ A total of 40 Coalition countries eventually deployed military forces to the Gulf region, including troops from the U.S., the United Kingdom, France, and Canada. On January 17, 1991, the air war against Iraq began (Operation Desert Storm), which was followed by a four-day ground war starting on February 24, 1991.¹

By the end of active hostilities on February 28, 1991, the U.S. had deployed 697,000 troops to the theater of operations. The British deployed approximately 53,000 military personnel, the French 25,000, and the Canadians 4,500. In contrast to previous conflicts, a larger proportion of U.S. troops were from the Reserves/National Guard (17%) and were women (7%).^{2,3} Along with a rapid buildup of Coalition combat forces, an extensive medical care infrastructure and preventive medicine effort was established in the theater of operations.^{4,5}

Despite the harsh environment and intense preparations for war,⁶ morbidity rates among U.S. troops were lower than in previous major conflicts.^{7,8} In addition, mortality rates were much lower than anticipated. There was a total of 372 U.S. military fatalities during the first 12 months of deployment to the Arabian Gulf: 40% from combat, 52% from accidents (primarily related to training and motor vehicle accidents), and 8% from illness.⁹

By May 1991, just 10 months after the initial deployment, most U.S. troops had left the theater of operations. Gulf War veterans who remained on active duty after the war received health care through the Military Health System, which provides medical care to all active duty personnel and eligible Department of Defense (DoD) beneficiaries. For the first year after the war, veterans who left active duty -- either to re-enter the inactive Reserves/National Guard or to become civilians -- were ineligible for no-cost health care from the Department of Veterans Affairs (VA) unless they could demonstrate a service related health problem or financial need. With the passage of Public Law (PL) 103-210 in 1992, Gulf War veterans were granted special eligibility for health care within the VA for any illness possibly related to wartime service.

During the 10 years since the end of the Gulf War, some veterans of Operations Desert Shield and Desert Storm have presented with a diversity of difficult-to-explain physical symptoms. The most commonly reported symptoms include: fatigue, headaches, joint pains, skin rash, shortness of breath, sleep disturbances, difficulty concentrating, and forgetfulness.¹⁰⁻¹² There also have been reports of similar symptoms among British, Canadian, Australian, and most recently French Gulf War veterans.¹³⁻²⁰

In addition to unexplained somatic symptoms, there have been reports of possible increased rates of various medical and psychological illnesses among Gulf War veterans.¹² For medical diseases, attention has focused on neurological diseases like amyotrophic lateral sclerosis (ALS), various malignant cancers, connective tissue diseases, and immunologic abnormalities.²¹⁻²³ There also has been concern about possible increased rates of birth defects among children born after the war to both male and female Gulf War veterans.²⁴ More recently, there have been news

media reports of possible increased numbers of birth defects and cancer in the civilian population of southern Iraq.²⁵

Because of concerns about the health of Gulf War veterans, the U.S. Departments of Veterans Affairs and Defense established clinical evaluation programs to assess veterans' health problems. The findings from "registry" examinations have been used to generate research hypotheses about the health effects of Gulf War service. Additionally, the clinical registries have been utilized extensively in outreach and education efforts.²⁶

The purpose of the following report is to summarize the findings from over 100,000 systematic medical examinations conducted in the VA and DoD Gulf War clinical evaluation programs. Further information can be obtained on the VA and DoD internet sites at <http://www.va.gov> and <http://www.gulflink.osd.mil>.

Potential Health Hazards During the Gulf War

Diverse factors related to the Gulf War experience have been postulated as causes of chronic health problems.²⁷ Potential health hazards include:

1. *Infectious diseases*

Infectious diseases were one of the first health threats confronted by Coalition troops deployed to the Arabian desert in August 1990. Based on experiences in WW II, the major endemic infectious disease risks were thought to be sandfly fever, cutaneous leishmaniasis, diarrheal disease, and malaria.²⁸ However, only acute diarrheal disease and mild upper respiratory infections were a common problem for deployed Gulf War troops.

One unique infectious disease has been linked to the Gulf War deployment: viscerotropic leishmaniasis.²⁹ This infectious disease has been found in 12 U.S. veterans but none of the other Coalition military personnel.⁸ There have been no new cases of this infectious disease during the last nine years. Viscerotropic leishmaniasis is a relatively mild form of systemic leishmanial infection caused by *Leishmania tropica* -- a single-celled parasite that typically causes skin disease. Prior to the deployment of U.S. troops, viscerotropic leishmaniasis had not been identified in Saudi Arabia, Kuwait, or Iraq among local populations or foreign guest workers.

2. *Biological warfare (BW)*

Exposure to BW agents during the Gulf War has been hypothesized.³⁰ However, there has been no confirmation that a biological warfare agent affected the health of Gulf War troops. In addition, most BW agents, like anthrax spores and botulinum toxin, are designed to be deadly in minute quantities, but there were no fatalities during the Gulf War consistent with exposure to highly lethal biological or chemical weapons.

3. *Chemical warfare (CW)*

Although there is no indication that CW agents were used offensively by Iraq during the Gulf War,¹ exposure of veterans to low levels of CW agents has been a concern. Two possible sources of low level exposure have been evaluated: 1) bombing of Iraqi CW production and storage facilities during the air and ground war, and 2) the destruction shortly after the war of an ammunition storage facility at Khamisiyah, southern Iraq, where munitions containing sarin and cyclosarin were identified eight months later by a United Nations inspection team. The possibility that Coalition troops were harmed by CW agents is the focus of substantial government-funded research.³¹ Thorough investigations of possible CW and BW exposures also have been conducted by several U.S. government panels^{32,33} and DoD's *Special Assistant for Gulf War Illnesses, Medical Readiness, and Military Deployments*.³⁴⁻⁷⁶

4. *Pesticides and insect repellents*

Gulf War troops were primarily exposed to DEET, organophosphate pesticides, and permethrin.¹² These chemical compounds are routinely used during deployments of U.S. military personnel to developing and tropical regions to prevent infectious disease transmission and also are commonly used in agriculture and for individual protection in the general population. Pesticides and repellents have been hypothesized to cause both unexplained symptoms and neurological disease among veterans, either by acting alone or in combination with other chemical substances and stress.⁷⁷⁻⁸¹

5. *Pyridostigmine bromide (PB)*

PB pills were provided to some Coalition military personnel for self-administration as pre-treatment against chemical warfare nerve agents. U.S. troops were given twenty-one 30 mg PB tablets and instructed to take one tablet every eight hours whenever the threat of a CW attack was considered high during the air and ground war. DoD estimates that approximately 250,000 U.S. military personnel took at least one 30 mg tablet of PB. PB has been postulated to cause long-term health problems by directly acting on the central nervous system and by synergistic toxicity from interactions with CW agents, pesticides, and stress.^{27,78,82} Since the mid 1950's, PB has been used in very high doses over prolonged periods of time to treat myasthenia gravis without apparent long-term health effects. PB also has been used in general surgery to treat patients without myasthenia gravis.⁸³

6. *Oil well fire smoke*

In February 1991, the retreating Iraqi army ignited over 600 oil wells, which burned until November 1991, producing massive clouds of smoke. Environmental monitoring conducted after the war indicated that exposure to airborne pollutants had not been great for Coalition troops and that long-term health effects were unlikely.^{84,85} Measured levels of pollutant gases and polycyclic aromatic hydrocarbons (PAHs) were comparable to concentrations in large, urban U.S. cities. Nevertheless, smoke clouds sometimes drifted to ground level, which increased exposure for combat troops. On the basis of self-completed questionnaires, U.S. troops deployed to Kuwait reported a higher incidence of eye and upper respiratory tract irritation, shortness of breath, cough, rashes, and fatigue than unexposed troops.⁸⁶

7. *Anthrax and botulinum vaccinations*

Two non-live vaccines given to U.S. troops during this deployment have been hypothesized to cause long-term health effects: About 150,000 U.S. troops received one to two doses of an FDA-approved anthrax vaccine and 8000 troops (1.1% of deployed U.S. forces) received an investigational botulinum vaccine.¹² These vaccines had been used for several decades, alone and in combination, without apparent long-term health effects.⁸⁷ Other vaccinations were administered during the Gulf deployment, for example, influenza vaccine and routine booster doses of standard vaccines, like typhoid and tetanus.

The British also gave their troops varied vaccines, including a novel pertussis adjuvant for vaccination of troops against anthrax. The possibility has been raised that combinations of these vaccines -- given over a short period of time during a stressful deployment -- may be responsible for long-term health problems.⁸⁸⁻⁹¹ However, in an epidemiological study conducted after the war, no difference was found in the prevalence of post-deployment health complaints among groups of Canadian veterans who received the same vaccinations as British personnel compared to Canadians who received different combinations of vaccines.¹⁷ In another post-war study, the anthrax vaccine given to U.S. forces was found not to be contaminated with bacteria, as had been hypothesized.⁹² Lastly, the Institute of Medicine evaluated the current anthrax vaccine and concluded that it is safe.⁹³

8. *Depleted uranium (DU)*

In this war, U.S. military forces used DU for both armor on tanks and for munitions (kinetic penetrators) because of DU's enhanced armor-piercing capability.²⁷ Due to its biological effects as a heavy metal and as a source of radiation, DU presents a potential health risk when it enters the body as shrapnel or is inhaled following aerosolization from impact and combustion. In the VA *Depleted Uranium Follow-up Program* at the Baltimore, Maryland, VA Medical Center, 60 U.S. veterans who may retain DU shrapnel from friendly-fire incidents are being evaluated. To date, these veterans have not experienced health problems that can be related to the effects of radiation exposure or heavy metal intoxication.⁹⁴⁻⁹⁷

9. *Physical and psychological stress*

Stress has been hypothesized to be a cause of chronic symptoms and illnesses among some Gulf War veterans. As true of all wars, the Gulf War deployment was associated with extreme physical and psychological stress from life-threatening combat, harsh living conditions, loss of privacy, and separation from family. Stress can lead to psychological illnesses, which manifest with physical symptoms and has been theorized to play a substantive role in the development of organic disease.^{98,99} Numerous studies have shown increased levels of stress-related symptomatology among Gulf War veterans.¹⁰⁰⁻¹⁰⁴

10. *Sand and less common exposures*

Some troops may have been exposed to a number of other potential health hazards,¹⁰⁵⁻¹⁰⁹ including:

- a. Airborne sand, allergens, and irritants;
- b. Microwaves;
- c. Chemical agent-resistant coating (CARC) paint fumes containing isocyanate;
- d. Various petroleum products, like leaded gasoline, diesel fumes, and JP4 fuel used in tent heaters and on the ground to keep sand from blowing; and,
- e. Decontamination solution 2, which contains propylene glycol, monomethyl ether, and ethylene glycol.

11. *Combinations of exposures*

As noted, combinations of diverse environmental exposures, along with physical and psychological stress, have been hypothesized to cause both well-recognized illnesses and unexplained symptoms among Gulf War veterans.²⁷ For example, an initial study indicated that stress might increase the effects of pyridostigmine bromide in the central nervous system,¹¹⁰ but several follow-up studies did not confirm this finding.¹¹¹⁻¹¹⁴

As this list of potential health risks demonstrates, Gulf War veterans were subjected to complex environmental and psychological exposures. Like prior military conflicts, veterans had to contend with a multitude of health hazards due to the chaotic, life-threatening nature of warfare.¹¹⁵

Research and Evaluation

An extensive research program has been initiated by VA, DoD, and the Department of Health and Human Services (HHS) to investigate Gulf War health questions.³¹ Over 200 million dollars has been allocated for this research effort in the U.S. A total of 224 federally-funded Gulf War related research studies have been authorized to date. As of January 2002, 140 projects had been completed and 88 were still in progress. The British, Canadian, and Australian governments also mounted an extensive clinical and research effort to evaluate and care for their populations of Gulf War veterans.^{17,18,116} Further information on U.S. sponsored Gulf War research can be obtained at www.va.gov/gulfwar and www.va.gov/resdev/prt/gulf_war_2001.

In epidemiological surveys of diverse populations of Gulf War troops, veterans consistently have reported higher rates of elicited symptoms and illnesses compared to non-deployed control groups.^{17,91,117-122} However, large-scale epidemiological studies based on DoD hospitalization records found no overall increase in hospitalization rates among Gulf War veterans,¹²³ no increase in specific diseases like systemic lupus erythematosus²² or testicular cancer,²¹ and no indication of a new syndrome.^{124,125} Also, two large epidemiological studies that utilized DoD and civilian State medical records found no increase in the overall rate of birth defects among children born after the war to Gulf War veterans.^{126,127}

A comprehensive study of the U.S. Gulf War veteran population based on death certificate records found the mortality rate in this population to be comparable to non-deployed era veterans for the first 7 years after the war with Iraq.^{128,129} As observed among veterans of WWII, Korea, and Vietnam, a slightly increased death rate from external causes, principally motor vehicle accidents, was found among Gulf War veterans for the first few years after the war. However, Gulf war veterans are now no more likely to die of external causes than other military personnel.¹²⁹ In addition, compared to the demographically similar civilian community, the mortality rate of Gulf War veterans has been less than one-half the rate observed in the general population during the decade since the war with Iraq.¹²⁹

For psychological illnesses, clinical and epidemiological studies have found indications of increased rates of depression, post-traumatic stress disorder (PTSD), and stress-related symptomatology among Gulf War veterans compared to non-deployed military personnel.^{117,119,130,131}

A series of fourteen expert panels in the USA have evaluated available clinical and research data on Gulf War health issues but did not identify a unique war-related syndrome."¹³²⁻¹³⁹ Additionally, none of the postulated exposure risks has been demonstrated or ruled-out as a cause of illness among widespread groups of Gulf War veterans. The Presidential Advisory Committee on Gulf War Veterans' Illnesses concluded in 1996 that stress is likely to be an important "contributing factor" in the development of the broad range of illnesses experienced by Gulf War veterans.¹³⁷

A recent Institute of Medicine (IOM) committee evaluated peer-reviewed research on the potential exposures of greatest concern to representatives of Gulf War veterans' organizations: sarin, pyridostigmine bromide (PB), depleted uranium, and the vaccines used to prevent anthrax

and botulism. The current scientific literature was evaluated for any evidence of a link between these exposures and long-term health effects. Unfortunately, the IOM committee concluded: “Because little information exists on actual exposure levels -- a critical factor when assessing health effects -- the committee emphasized that it could not draw specific conclusions about the health problems of Gulf War veterans.”^{140,141}

Another recent IOM committee came to the following conclusion:

“Several expert committees were asked to examine those various risk factors and to determine whether a ‘unique’ Gulf War illness with a known cause could be established. Each of these panels concluded that there was no evidence consistent with the existence of a unique illness and that no single cause could be established. That remains the case, despite a vigorous research portfolio examining multiple hypotheses put forward as possible explanations for the medically unexplained physical symptoms experienced by these sick veterans. This continuing controversy highlights, in a very visible way, the tensions that exist between expectations and realities, between science and politics, and between policy and execution.”¹⁴²

Since the question arose about a possible “Gulf War syndrome,” a number of similar conditions have been reported among war veterans and military peacekeepers, including a Balkan syndrome,^{143,144} Cambodia syndrome,¹⁴⁵ and Chechnya syndrome.¹⁴⁶ The repeated occurrence of difficult to explain symptoms among combat troops and military peacekeepers indicate that these health problems are an inherent aspect of hazardous military deployments.¹⁴⁷

Gulf War Clinical Evaluation Programs

VA Gulf War Registry Health Examination Program

Before the end of the Gulf War, VA officials became concerned about the long-term health of combat troops because of the large clouds of smoke from oil well fires. Consequently, a proposal was developed in early 1991 to create a clinical registry of war veterans to determine whether health problems were caused by wartime exposures and to provide optimal health care for returning troops through focused education and outreach. This proposal led to the establishment of the *VA Gulf War Registry Health Examination Program*, which was authorized on November 4, 1992, by PL 102-585 (Title VII), the "Persian Gulf War Veterans Health Status Act."¹⁴⁸ This clinical evaluation program was patterned after the VA's Agent Orange registry, which has aided VA in caring for Vietnam veterans.

The *VA Gulf War Registry Health Examination Program* offers to every Gulf War veteran a complete physical examination with basic laboratory studies. Additionally, a thorough medical history is obtained and documented in the veteran's medical record. Registry examinations are available at VA treatment facilities nationwide. All veterans who are eligible for VA health care (Reserve, National Guard, and former active duty military personnel) are encouraged to participate in the health examination program, if they have any health concerns related to serving in the Gulf War theater of operations, even if they are feeling well.

The VA clinical evaluation program has been widely publicized and an extensive outreach effort has been implemented to ensure that Gulf War veterans with health concerns are informed about the registry. Varied means have been utilized to contact Gulf War veterans, including:

1. A national toll-free information helpline that continues in operation: 1-800-PGW-VETS
2. A quarterly Gulf War veterans newsletter: *Gulf War Review Newsletter*
3. Other VA publications: *Gulf War Research Report to Veterans*, and *Gulf War Veterans Illness Questions and Answers* brochure
4. Outreach programs of veterans service organizations
5. Posters and other printed materials
6. The news media

As of September 30, 1999, 70,385 Gulf War veterans had responded to VA's outreach program and completed a free examination (Figures 1); 2,583 veterans who served in the Gulf region after the war (from July 31, 1991 until 1999) also have been evaluated. In addition to standardized registry examinations, by October 2000 the VA had seen 263,782 unique Gulf War veterans on an outpatient basis and 28,738 unique Gulf War veterans as inpatients.

A centralized mailing lists of registry participants is maintained by VA to inform veterans about new clinical and research findings. This clinical database allows VA to communicate with Gulf War veterans and provides a mechanism to catalogue prominent symptoms, reported exposures, and diagnoses. Each VA medical center has an assigned *Registry Coordinator* and a *Registry Physician* for this comprehensive health program.

The standard VA registry clinical examination protocol consists of the laboratory tests and consultations that physicians use to evaluate the symptoms reported by Gulf War veterans during their initial clinical examination.^{26,148} This baseline examination protocol elicits information about symptoms and exposures, and directs initial laboratory studies, including a blood count, urinalysis and a set of blood chemistry tests. In addition to core laboratory screening, physicians order additional tests and specialty consultations as clinically indicated to arrive at a diagnosis for every participating veteran.

In 1995, the VA expanded this standard protocol as more experience was gained about the health problems of Gulf War veterans. A greater number of symptoms and diagnoses are captured in the revised registry database. Additionally, if a Gulf War veteran's symptoms remain unexplained after initial examination, the revised VA registry provides an expanded assessment protocol, which is a set of clinical guidelines for use in evaluating ill-defined or unexplained illnesses. For this purpose, an "unexplained illness" is characterized as one or more symptoms that do not conform to a characteristic clinical presentation, allowing for a specific diagnosis, but which appear to be causing a decline in the veteran's functional status or quality of life.

This set of extended clinical guidelines -- the *Uniform Case Assessment Protocol* -- suggests 22 additional tests and auxiliary specialty consultations, and outlines supplementary diagnostic procedures based on the specific symptoms of the veteran and the clinical judgment of the registry physician. The *Uniform Case Assessment Protocol* was first developed in 1993 by the VA and is now used in both VA and the DoD Gulf War clinical evaluation programs.

In the VA registry, veterans receive a diagnosis based on the International Classification of Diseases, 9th Edition, Clinical Modification (ICD-9-CM).¹⁴⁹ However, ICD-9-CM does not provide specific codes to track all symptoms and diagnoses. To address this limitation, three additional coding designations were created for the revised VA registry:

1. 990.01 -- for sleep apnea
2. 990.02 -- for chronic fatigue syndrome (CFS)
3. 990.03 -- for fibromyalgia.

Prior analysis of VA registry data indicated that many participants are healthy when evaluated.^{26,148} Thirty-two percent of evaluated veterans reported very good health, 41% report good health, and 26% report poor/very poor health. In decreasing frequency, the most common symptoms reported were:

1. fatigue
2. skin rash
3. headache
4. muscle and joint pain
5. loss of memory and other general symptoms
6. shortness of breath
7. sleep disturbances
8. diarrhea and other gastrointestinal symptoms

The most common primary diagnoses were diverse and usually were related to the following: 1) musculoskeletal and connective tissue conditions, 2) mental disorders, 3) respiratory illnesses, 4) skin and subcutaneous conditions, and 5) digestive disorders.²⁶

The health problems of a majority of veterans evaluated in the VA clinical evaluation program have been diagnosed. For Gulf War veterans with debilitating symptoms that remain unexplained after completing the *Uniform Case Assessment Protocol*, the local VA physician initially could refer them to one of VA's four regional Gulf War Referral Centers in: 1) Washington, DC; 2) Houston, Texas; 3) West Los Angeles, California; and 4) Birmingham, Alabama. The decision to send a veteran to a referral center was made by the local medical center physician in consultation with a referral center physician. More than seven hundred veterans were evaluated at the referral centers. With more extensive assessment permitted by hospitalization, most of these veterans were diagnosed as having well-recognized illnesses.

The referral centers recently have been superseded by new VA clinical programs. Gulf War veterans requiring more extensive clinical evaluation are now seen in one of two new *War Related Illness and Injury Study Centers*, located in East Orange, NJ, and Washington, DC. In May 2001, VA announced the selection and funding of these deployment health research centers, which specialize in studying the treatment of war-related illnesses among active duty troops and veterans. A competitive, scientific peer-review process was used to select the two sites. VA recognized the need for these new centers based on experience treating Gulf War and Vietnam veterans. VA concluded that combat casualties do not always result in visible wounds, and inevitably some veterans return with health problems that while difficult to diagnose are no less disabling. DoD also has established three deployment health research centers.

On April 1, 1996, VA initiated a special program to support health examinations for some spouses and children of participants in the *VA Gulf War Registry Health Examination Program* (authorized by PL 103-446). The results of these examinations, which are conducted under contract by non-VA physicians in non-VA medical facilities, are included in the VA registry database. Examinations can be provided to individuals who are a spouse or child of a veteran listed in the VA Gulf War registry, who may be suffering from an illness that cannot be disassociated from the veteran's service in Southwest Asia, or who have been granted permission by the VA to be evaluated. The clinical evaluation protocol includes a detailed medical history, physical examination, and laboratory testing as clinically required. Up to October 2001, more than 1100 spouses and children of Gulf War veterans have been evaluated.

In July 1998, VA significantly expanded the Registry Examination to include a new 7-page depleted uranium (DU) questionnaire. Furthermore, a 24-hour urine collection was offered to measure uranium levels of any Gulf War veteran who is concerned about possible DU exposure.

Department of Defense Comprehensive Clinical Evaluation Program (CCEP)

In response to the health concerns of Gulf War veterans, DoD's Office of the Assistant Secretary of Defense for Health Affairs, instituted the *Comprehensive Clinical Evaluation Program* (CCEP) on June 7, 1994.¹⁵⁰ The CCEP was a continuation of prior DoD medical care of active duty Gulf War veterans and screening for unusual illnesses but provided a more systematic evaluation strategy modeled after the VA *Gulf War Registry Health Examination Program*. As of September 30, 1999, there were 32,876 military personnel evaluated in the CCEP (Figure 1). In addition, some active duty personnel have been evaluated in the CCEP following deployments to the Gulf region after the war with Iraq, and following hazardous deployments to Somalia, Haiti, and Bosnia.

The CCEP was developed to provide a systematic and uniform medical evaluation at 184 military health care facilities located in 39 states, eight foreign countries, and two territories. To institute the CCEP, organizational meetings were held with senior medical officials from all military services; health care officials of the VA were consulted to ensure that the CCEP and the VA *Gulf War Registry* collected comparable data; and, four instructional meetings were held with military health care personnel on CCEP procedures and to provide clinical and research information related to Gulf War health questions. A special committee of the Institute of Medicine (IOM) reviewed and monitored the CCEP process, including the design and implementation of the program and interpretation of initial findings.^{135,151-153}

Through concerted outreach efforts, the 285,000 Gulf War veterans still on active duty in 1994 when the CCEP was begun were encouraged to enroll if they had any health questions or concerns; a current health problem was not necessary for participation. Also eligible were veterans of the Gulf deployment who were military retirees, Reserve/National Guard personnel on full-time active duty or on special orders, and civilian DoD employees. Family members of qualified Gulf War veterans also could receive a CCEP evaluation. Finally, active duty troops who had participated in more recent deployments outside of the USA could be evaluated in the CCEP.

Military personnel enrolled in the CCEP either by calling a toll-free telephone number or by contacting their nearest military medical treatment facility (MTF). Veterans not eligible for a CCEP examination were referred to the VA's *Gulf War Registry Health Examination Program*. For the less than 100,000 Gulf War veterans who currently remain on active duty, CCEP examinations are still offered. Veterans of service in the Gulf from August 1990 to the present, who are eligible for care in DoD (active duty, retirees, Reserves/National Guard on active duty) and who wish a CCEP examination, can call 1-800-796-9699 to schedule an evaluation in the CCEP. Their family members are also eligible for evaluation.

The CCEP consists of an initial two-phase clinical evaluation supervised by a board-certified physician in either family practice or internal medicine. All CCEP participants are provided a Phase I examination, which is conducted at the local MTF and consisted of a thorough clinical examination and a standardized provider-administered questionnaire.¹⁵⁴ All participants are asked about: 1) medical and family histories; 2) symptoms; 3) number of days of work lost due to illness during the 90 days prior to examination; and, 4) self-perceived exposures in the Arabian Gulf to among the following: petroleum products, pyridostigmine bromide pills, oil

well fire smoke, insect repellents, anthrax and botulinum vaccinations, combat casualties, and actual combat. In addition, the following laboratory tests are performed: a complete blood count, urinalysis, and blood chemistries for electrolytes, glucose, creatinine, blood urea nitrogen, and transaminase levels.

For CCEP participants without current medical problems or who had health problems that could be satisfactorily dealt with after the Phase I evaluation, no additional evaluation was conducted. Other CCEP participants proceed to Phase II examination at one of 14 DoD Regional Medical Centers.¹⁵⁴ The Phase II CCEP examination is comparable to the VA's *Uniform Case Assessment Protocol*. Phase II participants are administered the Structured Clinical Interview for DSMIII-R (SCID)¹⁵⁵ and the Clinician Administered PTSD Scale (CAPS).¹⁵⁶ Additionally, Phase II participants have a PPD skin test and chest x-ray, and a blood sample is analyzed for the following: sedimentation rate, C-reactive protein, rheumatoid factor, fluorescent ANA, thyroid function, B12 and folate levels, creatine phosphokinase level, HIV-I antibody, and hepatitis B surface antigen.¹³⁵

At the conclusion of the CCEP evaluation process, examining physicians provide a primary diagnosis and additional secondary diagnoses based on clinical importance. After review by accredited medical record coders, up to seven diagnoses were coded using ICD-9-CM and entered into the database.¹⁴⁹ A quality control process was instituted when the CCEP was established to ensure uniform evaluation, accurate data collection, and database validity.¹³⁵

There have been a series of reports and publications dealing with the data collected from the CCEP.¹⁵⁷⁻¹⁶⁰ Analysis of the first 20,000 Gulf War veterans showed that the types of primary and secondary diagnoses varied widely.¹⁶⁰ A total of 1,263 separate ICD-9-CM codes were needed to categorize primary diagnoses. Of the 1,263 separate codes used, 41% were applicable to only a single CCEP participant. Relatively frequent primary diagnoses found among 25 or more veterans were distributed among 114 different ICD-9-CM codes. For broad ICD-9-CM classifications, the three most common primary diagnoses were: 1) "Diseases of the Musculoskeletal System and Connective Tissue" (19% of diagnoses), 2) "Mental Disorders" (18%), and 3) "Symptoms, Signs, and Ill-Defined Conditions" (18%). Nine percent of participants were found not to have a clinically significant new illness.

Among the first 20,000 CCEP participants, there were: 74 (0.4%) veterans with connective tissue disease; 52 (0.3%) with non-cutaneous malignancies; 42 (0.2%) with peripheral neuropathy; 14 (0.07%) with interstitial pulmonary fibrosis; 12 (0.06%) with renal insufficiency; and, no new case of viscerotropic leishmaniasis.¹⁶⁰ For the 3558 veterans with a primary ICD-9-CM diagnosis of "Symptoms, Signs, and Ill-Defined Conditions," no single subcategory of illness predominated, and no characteristic physical sign or laboratory abnormality was identified. Fifty-one percent of veterans in this diagnostic category reported that symptoms began more than six months after returning from the Gulf region.

In summary, no clinical indication of a new or unique illness was found, and the types of physiologic disease that could result from postulated hazardous exposures were uncommon in this self-referred population of 20,000 Gulf War veterans.¹⁶⁰ Additionally, severe disability -- measured in terms of reported lost work days -- was not a major characteristic of evaluated

military veterans who remained on active duty: 80% of active duty personnel had not missed work because of illness or injury during the 90 days prior to their initial registry evaluation.¹⁵⁹ Lastly, there was no association between broad ICD-9-CM diagnostic categories and self-reported exposures to potential health hazards.^{159,160}

In a more recent study of 21,579 CCEP participants, the diagnosis of "Symptoms, Signs, and Ill-Defined Conditions" was not found to be associated with particular self-reported exposures or demographic characteristics.¹⁶¹ Also, more definitive and often psychological diagnoses could be found among veterans of the Gulf deployment by increasing the intensity of the evaluation and by multidisciplinary clinical assessment.

In addition to Phase I and Phase II examinations in the CCEP, a Specialized Care Center (SCC) was opened at Walter Reed Army Medical Center (WRAMC) in March 1995 for intensive evaluation and treatment of symptomatic Gulf War veterans.^{162,163} Referrals are considered from all DoD clinicians who have evaluated veterans in the CCEP. Clinicians can refer motivated individuals who are suffering from persistent symptoms that interfere with their ability to perform routine military duties or to meet physical fitness and retention standards. Patients come to the SCC for three-week treatment periods in groups of four to six, and reside on the grounds of the medical center as outpatients. They receive treatment from a multidisciplinary team that includes fitness trainers, nutritionists, occupational and physical therapists, art and recreation therapists, internists, social workers, psychiatrists, and psychologists.

By January 2002, about 350 Veterans have been intensely evaluated and treated in the SCC. Initial analysis and follow-up indicate that most veterans have benefited from the program, with improved functional ability following a treatment regimen that utilizes a multidisciplinary team approach.

On September 30, 1999, the Assistant Secretary of Defense for Health Affairs (NHRC) established a DoD Center for Deployment Health Research at the Naval Health Research Center in San Diego, CA. The Center's mission includes conducting epidemiological studies to investigate the longitudinal health experience of previously deployed military personnel, and the development and evaluation of appropriate health surveillance strategies. A key study in fulfilling this mission is the Millennium Cohort Study.¹⁶⁴ The Millennium Cohort study is a probability-based, cross-sectional sample of 100,000 U.S. military personnel who will be followed prospectively by postal surveys every 3 years over a 21-year period. The 100,000 subjects will be comprised of 50,000 veterans who have been deployed to Southwest Asia, Bosnia, or Kosovo since August 1997, and 50,000 veterans who have not been deployed to these conflicts. There are further plans to add 20,000 new military personnel to this cohort in 2004 and in 2007. A total of 140,000 veterans will be followed until the year 2022.

The primary objective for the Millennium Cohort Study is to determine how the health of US military service members and veterans change over time, and to determine the health impact of military deployments upon the adjusted incidence of chronic disease. Secondary objectives include comparing the adjusted change in health status between the cohorts as reflected by standardized questionnaires. This study will serve as a foundation upon which other routinely

captured medical and deployment data may be added to answer future questions regarding the health risks of deployment, military occupations, and general military service.

British Medical Assessment Programme (MAP)

In 1993, the British Ministry of Defence established a clinical registry -- the *Medical Assessment Programme* (MAP) -- to assess the health of Gulf War veterans from the United Kingdom. Systematic clinical examinations of an initial 1000 Gulf veterans found a wide range of medical and psychiatric conditions, similar to the VA and DoD clinical registries.¹⁸ At least 19% of veterans had a diagnosis of a psychiatric condition, which in over one-half was due to PTSD. Musculoskeletal and respiratory disorders also were common. Like American veterans, British Gulf War troops reported numerous somatic symptoms. The authors of the report on these 1000 British registry participants noted that "there is no evidence of a single illness, psychological or physical, to explain the pattern of symptoms seen in veterans in the assessment programme."¹⁸

Over 3000 self-selected veterans have now attended the MAP. A report on the second series of 1000 British Gulf War veterans found similar symptom reporting as in the first series.^{165,166} An analysis of all 3000 British MAP participants has just been completed. Eighty percent of veterans who attended the MAP were found to be well and 20 percent were unwell. Among the unwell, a psychiatric condition constituted a major or significant part of their ill-health. Of the psychiatric disorders, PTSD (with or without co-morbidity) was the most frequent diagnosis, even though the trauma of warfare had occurred 10 years previously. The emergence of an unusual pattern of disease or unusual diseases or malignancies was not seen. Like civilians in primary health care, veterans frequently present to the MAP with medically unexplained physical symptoms (MUPS). These symptoms did not necessarily indicate disability. Finally, no evidence to support the existence of a unique "Gulf War syndrome" was found among British veterans attending the MAP.

A study comparing MAP registry participants with a randomized sample of the overall population of British Gulf War veterans found that veterans who underwent a registry evaluation reported more symptoms and health problems than the general population of Gulf veterans.¹⁶⁷ These data suggest that the clinical registries are unlikely to miss a serious cause of health problems among Gulf War veterans.

Canadian Gulf War Registry

In 1995, the Canadian Department of National Defence also established a Gulf War clinical evaluation program.¹⁶ It was not necessary to have a medical problem in order to enroll in this registry, although most participants did have symptoms that concerned them. Veterans were initially evaluated at the local base level. If a diagnosis was reached and the member and examining physician were satisfied, no further workup or referral was done. If however the service member or examining physician requested further assistance, a referral could be made to a single Gulf War Clinic in Ottawa, Canada. The Gulf War Registry ceased recording new entries as of January 1998 after 226 veterans had been enrolled.

The Ottawa Gulf War Clinic saw 104 referred veterans between April 1995 and December 1997 (COL Ken Scott, MD FRCPC, Deputy Chief of Staff Medical Policy, Canadian Forces Medical Group Headquarters, Ottawa, Ontario, Canada). The initial history and physical examination averaged three hours, with a subsequent two-week hospital admission to facilitate other specialist consultations and diagnostic tests. There were, on average, 10 symptoms reported per patient, and 6 ½ specialist consultations were obtained on each veteran. Multiple diagnoses were made, but there was no evidence for a unique or previously undescribed medical condition. Approximately two-thirds of patients seen had either a primary or secondary psychiatric diagnosis. The most common psychiatric diagnoses were major depressive disorders, anxiety disorders, and PTSD.

Approximately 20% of veterans presented with multiple idiopathic physical symptoms that resulted in diagnoses of chronic fatigue syndrome, fibromyalgia, myofascial pain syndrome or soft tissue pain syndrome. These diagnoses were not unique to Gulf War veterans. In January of 1998, multiple “Post-Deployment Clinics” were opened on bases across Canada to which veterans of any Canadian deployment, whether currently serving or not, could be referred. This initiative was undertaken when examining physicians concluded that illnesses among Gulf War veterans were similar to illnesses being seen in Canadian veterans from Somalia, Croatia, Bosnia, Rwanda and Haiti.

Combined Analysis of the VA and DoD Gulf War Clinical Evaluation Programs

As the previous description indicates, in the USA there have been three distinct Gulf War clinical evaluation programs:

1. Initial VA Registry begun in 1992
2. Revised VA Registry initiated in 1995
3. DoD's CCEP begun in 1994

These three clinical evaluation programs were not typical “registries” as this term is generally used in medical care. Clinical registries customarily enroll patients with a specific disease in order to better understand the natural progression of that disease or how well patients respond to different types of treatment. In contrast, the three Gulf War clinical programs accepted all veterans, regardless of their symptoms or even whether they had a health complaint. Through a multifaceted outreach effort, all Gulf War veterans were encouraged to participate in the clinical programs and undergo an examination if they had any health concerns or questions, even if they did not have a current illness. As a consequence, it was possible in these clinical evaluation programs to assist a large number of Gulf War veterans and to assess a wide spectrum of health problems.

There are difficulties comparing data from the three registries because of the differences in how the information was collected and coded. Nevertheless, a combined study of these clinical databases provides more useful information than individual analysis for several reasons. First, combining the registries affords a larger number of evaluated Gulf War veterans for study, which increases the chance of detecting a rare or less clinically obvious abnormality. Combined analysis also provides greater numbers and increased statistical power to conduct subgroup analysis by gender, age, location, and time of Gulf War service. Another value of combined analysis is that it allows for comparison of health problems between different populations of veterans: those who remained on active duty after the war and veterans who left active military service or entered the inactive Reserves/National Guard and became eligible for VA health care. Finally, combined analysis permits longitudinal assessment of illnesses over a multi-year period among veterans who participated in more than one registry.

Combined analysis of registry data is possible because the characteristics of these three clinical evaluation programs are similar. The primary goal of the clinical registries was to arrive at a definitive diagnosis and to code diagnoses accurately using ICD-9-CM. Therefore, veterans in the registries received comparable clinical work-ups and diagnoses for any apparent abnormality or complaint, even though the VA and DoD registries used slightly different diagnostics guidelines. In addition, the revised VA registry and the DoD registry were patterned closely on each other, utilizing a similar two-stage diagnostic work-up that targeted veterans with unexplained symptoms and then referred the most difficult to diagnose and treat patients to specialized hospital centers for more extensive evaluation. Importantly, similar self-reported exposure data was obtained from veterans in the three registries.

There are, however, consequential differences in how symptoms and diagnostic data were coded in these three clinical registries (Table 1). The VA *Gulf War Registry Health Examination*

Program had two separate data formats as a result of a major revision and expansion of the original codesheet in 1995. On the original codesheet, up to three symptoms and three diagnoses could be recorded, but for the revised VA codesheet, up to 10 symptoms and 10 diagnoses were captured. In contrast, the DoD's CCEP database lists, as text, the chief complaint and up to 6 other symptoms, and codes a primary diagnosis and no more than 6 secondary diagnoses. In addition to these differences, the VA registry specifically codes for CFS and fibromyalgia, unlike the CCEP. Lastly, coding of registry participants found to be healthy, without a significant health problem, was done differently in the VA and DoD registries (Table 1).

Even though the three databases contain comparable information, the major limitation of all the registries, whether analyzed together or separately, is that participants are self-selected: veterans voluntarily requested and participated in the clinical evaluations. Because of this selection bias, the patterns of illnesses and participation rates in the registries are not necessarily representative of the entire population of Gulf War veterans. It is suspected that participation in the VA registry is influenced by many factors, including: financial need and lack of health insurance; proximity to a VA medical facility; notification by VA outreach efforts; over 100,000 letters sent by DoD to veterans who were potentially exposed to nerve agents from the Khamisiyah demolitions; and, popular media coverage. Participation in the CCEP may have been both discouraged by career concerns during a period of military downsizing and bolstered because the CCEP provided more rapid access to the military health care system.

In a prior study of the initial 74,653 VA and DoD registry patients,¹⁶⁸ participation in the registries was associated with:

1. service in the Army
2. service in the National Guard
3. service in the Gulf during wartime hostilities (Operation Desert Storm)
4. older age
5. being a construction worker
6. female sex
7. having been hospitalized during the year before the Gulf War

Registry participation was also greatly influenced by media attention. This finding was demonstrated by increased enrollment in the registries during periods of high media interest in Gulf War health issues (Figure 3).¹⁶⁸

Another problem related to the unique aspects of this population is that for purposes of external comparison, there is no similar, large, control group of outpatients who: 1) have been as intensively evaluated as veterans in these three registries, 2) have survived a life-threatening experience, and 3) have been the subject of prolonged, media reporting. The systematic clinical examination of a distinct group of over 100,000 individuals is without parallel.

In conclusion, it is possible to conduct a combined analysis of the three Gulf War clinical registries because of similar methodology and ICD-9-CM coding of diagnoses. However, direct

integration of the three computer databases is not possible for most analyses because of procedural differences among the registries.

The following combined analysis allowed for the assessment of clinical data from comprehensive clinical examinations of over 100,000 veterans, which represents more than 14% of all U.S. forces deployed in the Gulf War. This analysis also provides clinical data on the spouses and children of Gulf War veterans. Due to the self-referred nature of the registry population and the absence of a comparable control group, statistical analysis of this database has to be done with caution. Nevertheless, because such a large proportion of Gulf War veterans have been systematically evaluated over an extended eight year period, the findings of this combined analysis adds to our understanding of the health problems experienced by this population.

Table 1. Unique Characteristics of the VA and DoD Clinical Evaluation Programs

Category	Initial VA Registry (n = 49,079)	Revised VA Registry (n = 21,306)	DoD CCEP (n = 32,876)
<i>Symptoms</i>			
Chief complaint	Not noted	Listed	Listed
Total number recorded	3	10	7*
<i>Diagnoses</i>			
Primary	Not noted	Listed	Listed
Total number recorded	3	10	7
Special ICD-9 codes			
Healthy	None+	None+	V65.5
Sleep apnea	Not coded	990.01	Not coded
Chronic fatigue syndrome	Not coded	990.02	Not coded
Fibromyalgia	Not coded	990.03	Not coded

* The chief complaint and 6 additional symptoms are recorded as text in the CCEP database; there is also a 16 symptom checklist that was utilized by the examining physician.

+ The diagnosis was left blank on the registry form.

Overall Aims of Study

Although not designed as research studies, the VA *Gulf War Registry Health Examination Program* and the CCEP provide valuable clinical information about the health of Gulf War veterans. This study had the following aims:

1. Describe the patterns of illnesses among Gulf War veterans evaluated in the three clinical evaluation programs;
2. Assess changes in health status of veterans as individuals and as a group over time;
3. Describe the patterns of illnesses among the family members of Gulf War veterans; and,
4. Establish a linked database of the three clinical programs, which can be utilized in future research efforts to help understand military and veteran health problems.

Confidentiality

This study utilizes data already collected in three health care programs. All data analyses and reporting of findings was done anonymously. This study was approved by two institutional review boards:

1. Department of Veterans Affairs: Research and Development Human Studies Subcommittee, VA Medical Center, Washington, DC
2. Department of Defense: Uniformed Services University of the Health Sciences Institutional Review Board, Bethesda, MD

Clinical Analysis

Methods – Clinical Analysis

The most important contribution of the registries is that they provide objective clinical data about the health problems experienced by Gulf War veterans. Data from comprehensive clinical examinations can be used to evaluate:

1. Specific illnesses that may have resulted from deployment to the Arabian Gulf
2. The possibility of a new or previously unrecognized syndrome

For this study, military personnel and veterans were eligible if they had been deployed to the Gulf theater of operations between August 1990 and July 1991, and had completed a VA or DoD clinical registry examination by September 30, 1999.

A master file was obtained from the Defense Manpower Data Center, Monterey, CA, which contained a roster by social security number of 696,470 U.S. veterans who served in the Gulf during Operations Desert Shield and Desert Storm. This file was used to select eligible "conflict veterans" in the three registries. Also, this file was used to distinguish troops who served with active duty units and veterans who served in the Reserves or National Guard.

For VA, the first objective of this project was to combine the data from VA and DoD Gulf War registries in a manner such that the identity of the veterans who had participated in either clinical examination program would remain anonymous to both VA and DoD investigators. It was also necessary to develop a system in which additional databases -- such as military and demographic files, hospitalization files, vaccination files, and Gulf War exposure files -- could be linked to the clinical examination data. VA generated a randomized personal identification number (VA PIN) for each Social Security Number (SSN) of the 696,470 veterans who were deployed to the Gulf theater between August 1, 1990, and July 31, 1991. This study limited its analyses to those veterans who served during the first year of the Gulf deployment because of the potential for exposure to various wartime health hazards.

This roster of Gulf War veterans was matched by SSN to the VA and DoD registry databases to identify persons initially eligible for inclusion in this combined registry analysis project and to substitute the VA identification number for each individual's SSN. Participants of this combined registry analysis were further restricted to those veterans who had completed their registry examination by September 30, 1999.

Additional databases were matched to the roster of Gulf War veterans, SSN's were replaced with the corresponding VA PIN, and all other personal identifiers were deleted from each newly created database. The two registry databases, as well as the supplemental data files with only the VA PIN for identification, were distributed to the investigators of this combined registry project. There were 32,876 DoD registrants and 70,385 VA registrants who met all the eligibility requirements as described. This resulted in 100,339 unique Gulf War veterans for evaluation, including 2,922 veterans who were examined in both the VA and DoD registries.

Structural differences in the format of the CCEP and the initial and revised formats of the VA Gulf War clinical examination programs prevented the actual merging of the medical data contained in the various registry databases. The merging of the two VA registry formats and the CCEP with regard to symptom and diagnostic codes is technically possible. However, correct interpretation of the analyses of the merged data would be complicated by the variation in the structures of the three databases. In view of the lack of comparability of the structures of each database, data from the three registry programs have not been physically merged. For this report, data are reported separately by source (initial VA registry, revised VA registry, and CCEP).

In summary, after being reviewed for consistency, the data from the VA registries and CCEP, and related clinical and military databases, were linked by an anonymous VA PIN. VA and DoD then proceeded with a systematic evaluation of the registry data. Analysis of all data was therefore done anonymously.

Analyses included:

1. Assessment of the demographic characteristics of registry participants.
2. Determination of the self-reported health status of registry participants and the frequency of symptoms.
3. Determination of the frequency of diagnoses aggregated into broad ICD-9-CM diagnostic categories.
4. Determination of the most frequent ICD-9-CM diagnoses within each major ICD-9 category.
5. Comparison of the distribution of diagnoses in the VA and DoD registries to determine whether different types of illnesses were experienced by active duty personnel and veterans who had left active military service.
6. Comparison between the types of diagnoses made in the initial VA registry, which evaluated veterans during the first few years after the war, with diagnoses made more recently to determine whether the general nature of veterans' illnesses changed over time.
7. Analysis of patients with more than one diagnosis that included the diagnosis of "Symptoms, Signs, and Ill-Defined Conditions," to determine whether there were well-recognized illnesses associated with unexplained conditions.
8. Evaluation of the symptoms and diagnoses by calendar year of enrollment in the registries to determine whether veterans' health problems changed over time.
9. Assessment of 2,922 veterans evaluated in both the VA and DoD registries to determine if health problems were more severe among veterans seeking continued medical care.
10. Evaluation of the clinical findings from VA registry examinations of family members of Gulf War veterans to characterize health problems experienced by spouses and children of veterans. Prior studies have indicated that the health problems of war veterans may affect the health of other family members.¹⁶⁹

Results of Clinical Analysis

There was a total of 100,339 individual Gulf War veterans eligible for evaluation in this study. Among the three clinical registries, there were 49,079 veterans evaluated in the initial VA clinical evaluation program, 21,306 evaluated in the revised VA registry, and 32,876 military personnel evaluated in DoD's CCEP (Figure 1). In this study population, 2,922 subjects had been evaluated in both the VA and DoD registries.

Figure 2 provides the number of veterans enrolling in the registries by calendar year. Most registry participants had enrolled for a clinical examination by 1996, within five years of the end of active hostilities in the Gulf War. There was an upsurge in registry enrollment in 1997 after over 100,000 Gulf War veterans who may have been exposed to chemical warfare agents shortly after the war were notified and encouraged to undergo a clinical examination in the VA or DoD clinical evaluation programs.

For the analysis of registry data, it is important to compare the demographic characteristics of registry participants with the overall population of 696,470 deployed U.S. troops (Table 2). As of 1991, the average age of registry participants was about two years older (29.8 years) than the total population of Gulf War veterans (28.0 years). A slightly higher percentage of registry participants were women than in the total population of Gulf War veterans (10% vs 7%, respectively). Similar percentages of racial/ethnic groups enrolled in the registries as were deployed to the Arabian Gulf. The level of education among registry participants was comparable to other Gulf War veterans. Reflecting their older age, registry participants were more often married (Table 2).

For military characteristics, there were a number of important differences among the registries and the overall population of deployed U.S. troops (Table 3). Because eligibility for DoD health care is generally restricted to active duty troops, a lower percentage (9%) of CCEP participants were Reserve or National Guard personnel compared to the initial VA registry (43%) and the revised VA registry (24%). Overall, active duty troops were less likely to undergo a registry evaluation than Reserve and National Guard members, who represented ~ 16% of the deployed force. This finding may be due to the fact that Reserve and National Guard personnel are not routinely eligible for either VA or DoD health care when they are not currently on active duty. The VA registry program therefore offered ready access to high quality health care, which many veterans availed themselves of after the war.

Among the military service branches, Army personnel were most likely to participate in the registries. A slightly lower percentage of deployed officers enrolled in the registries (Table 3).

Table 2. Demographic Characteristics of Gulf War Clinical Evaluation Program Participants

Category	Percent of Veterans in Category				
	VA Registry Initial Format (n = 49,079)	VA Registry Revised Format (n = 21,306)	DoD CCEP (n = 32,876)	Combined* Registries (n = 100,339)	All Gulf War+ Veterans (n = 696,470)
<i>Age group (1991)</i>					
< 25	34.9	39.6	23.6	32.7	40.9
25-34	35.4	36.6	50.0	40.4	40.3
35-44	21.9	19.5	23.2	21.5	15.6
45-54	6.6	3.8	2.8	4.7	2.6
55-64	0.8	0.3	0.2	0.5	0.2
>= 65	0.0	0.0	0.0	0.0	0.0
Unknown	0.3	0.3	0.2	0.3	0.4
<i>Sex</i>					
Male	88.7	90.6	89.7	89.8	92.5
Female	10.3	9.4	10.2	10.0	7.2
Unknown			0.1	0.2	0.3
<i>Race/ethnicity</i>					
White	66.8	62.8	56.1	62.7	67.7
Black	24.1	26.6	33.9	27.6	22.6
Hispanic	5.7	6.0	5.2	5.6	5.1
Native American	0.8	0.8	0.5	0.7	0.6
Asian	1.0	1.7	1.6	1.3	2.3
Other	1.4	1.8	2.5	1.8	1.4
Unknown	0.3	0.3	0.2	0.3	0.4
<i>Marriage Status</i>					
Married	54.0	54.1	70.2	58.9	53.5
Single	40.6	41.6	24.9	36.2	43.0
No longer married	5.0	4.1	4.8	4.7	3.2
Unknown	0.3	0.3	0.2	0.3	0.4
<i>Highest Education</i>					
Less than high school	1.3	0.9	0.3	0.9	0.5
Some high school education	0.9	1.3	0.8	1.0	1.6
High school diploma	80.9	84.3	80.7	81.7	80.9
Some college	7.0	5.1	6.5	6.3	4.0
Bachelor degree	8.7	7.4	10.5	9.0	11.8
Other/unknown	1.2	1.0	1.0	1.1	1.3

* 2922 veterans were evaluated in both the VA and DoD registries.

+ All military personnel deployed to the Gulf theater between August 1, 1990 and July 31, 1991.

Table 3. Military Characteristics of Gulf War Clinical Evaluation Program Participants

Category	Percent of Veterans in Category				
	VA Registry Initial Format (n = 49,079)	VA Registry Revised Format (n = 21,306)	DoD CCEP (n = 32,876)	Combined* Registries (n = 100,339)	All Gulf War ⁺ Veterans (n = 696,470)
<i>Military Component</i>					
Active Duty	57.1	76.1	90.7	71.9	83.9
Reserve & National Guard	42.9	23.9	9.3	28.1	16.1
<i>Branch</i>					
Army	73.8	70.7	84.9	76.5	50.4
Air Force	6.1	6.7	6.2	6.2	11.9
Marine Corps	13.0	13.3	5.0	10.7	14.9
Navy	6.8	9.2	3.8	6.4	22.7
Coast Guard	0.3	0.1	0.1	0.2	0.1
<i>Pay Grade</i>					
Enlisted	93.0	93.4	89.3	92.0	89.3
Officer	5.8	5.3	8.1	6.4	9.5
Warrant Officer	1.1	1.2	2.6	1.6	1.2

* 2922 veterans were evaluated in both the VA and DoD registries.

⁺ All military personnel deployed to the Gulf theater between August 1, 1990 and July 31, 1991.

Among veterans evaluated during the first few years after the war in the initial VA registry, 29% reported that their health was poor or very poor (Table 4). A lower percentage (26%) of veterans evaluated after 1994 in the revised VA reported their health to be poor or very poor. Likewise, a lower percentage of CCEP participants (6%) reported their health to be poor. These data suggest that Gulf War veterans self-perception of overall health did not decline over time.

Although registry participants did not indicate a decline in general health over time, they perceived themselves to be less healthy than the general population of Gulf War veterans. Fewer than 6% of VA and DoD registry participants reported their health to be very good or excellent (Table 4). In contrast, in the VA National Survey of Gulf War veterans, which was a random sample of the overall population of U.S. veterans, 16% reported that their health was excellent and 28% reported that it was very good.¹²¹ In an investigation of Gulf War veterans from Iowa, 21% reported that their health was excellent.¹⁷⁰ Another study of British veterans produced similar data,¹⁶⁷ all of which indicates that clinical registry participants are more ill than the overall population of Gulf War veterans.

A wide variety of symptoms were reported by Gulf War veterans (Table 5). Among over 100,000 registry participants, the most common symptoms were muscle and joint pain, fatigue, headache, memory problems, and sleep disturbances. Higher percentages of veterans reported these symptoms in the revised VA registry and the CCEP than in the initial VA registry because a greater number of symptoms could be coded in the latter two registries. These symptoms can be severe and debilitating but are not specific for any particular medical or psychological illness. They are the type of symptoms commonly reported by adults in outpatient clinic populations.

Table 4. Self-reported Health Status of Registry Participants Using Two Related, 5-Point Reporting Scales*

VA Registries			DoD CCEP	
Scale	Initial Format % (number)	Revised Format % (number)	Scale	% (number)
<i>Very good</i>	5.3 (2,559)	5.6 (1,196)	<i>Excellent</i>	5.6 (485)
<i>Good</i>	24.6 (11,935)	26.4 (5,632)	<i>Very good</i>	21.0 (1,833)
<i>Fair</i>	41.6 (20,170)	42.0 (8,957)	<i>Good</i>	41.0 (3,610)
<i>Poor</i>	23.4 (11,327)	20.6 (4,399)	<i>Fair</i>	26.0 (2,261)
<i>Very poor</i>	5.2 (2,501)	5.3 (1,122)	<i>Poor</i>	6.0 (522)

* Data on health status were provided by 99% of VA registry participants but by only 35% of veterans evaluated in the CCEP.

Table 5. The Most Common Symptoms Reported by Registry Participants

Symptoms	Percent of Veterans with Symptom*		
	Initial VA Registry (n = 49,079)	Revised VA Registry (n = 21,306)	DoD CCEP (n = 32,876)
Muscle and joint pain	16.2	39.2	51.8
Fatigue	21.0	24.1	46.6
Headache	18.3	27.9	40.8
Memory problems	14.2	24.1	36.2
Skin Rash	18.5	25.3	30.0
Sleep disturbances	5.6	13.5	35.9
Diarrhea	4.6	14.0	25.5
Shortness of breath	8.0	10.2	23.0
Abdominal pain	2.7	4.6	20.8
No complaint	12.3	8.6	6.4

* The percentage of reported symptoms varied among registries because only 3 symptoms were captured in the initial VA registry compared to 10 symptoms in the revised VA registry and a 16-item symptom checklist in the CCEP.

Frequency Distribution of Major Diagnoses

Table 6 provides the frequency distribution for broad ICD-9 diagnostic categories. The most common diagnoses were:

1. Musculoskeletal Diseases
2. Mental Disorders
3. Respiratory Disorders
4. Skin Conditions

Tables 7 through 20 lists the 20 most frequent, specific diagnoses within broad ICD-9 classifications among the three registries. Data were presented separately for the three clinical programs because there were consequential differences among the registries in terms of the populations evaluated and how the data were collected and coded. *The number of veterans with each diagnosis is provided. For tables 7 through 20, the percentages listed relate to the particular registry and the major ICD-9 diagnostic code; these are not percentage estimates for a particular diagnosis among all 100,339 registry participants.*

The original VA registry provides data from 1992 to 1994, fairly soon after the war, and before the more complex “revised” VA registry and the CCEP were instituted. Additionally, the VA registries more often evaluated veterans who had left active duty or were members of the Reserves and National Guard; whereas, the DoD registry predominately enrolled active duty military personnel. Lastly, the frequency distribution of diagnoses was affected by the fact that the three registries coded different numbers of diagnoses: three in the initial VA registry, 10 in the revised VA registry, and seven in DoD’s CCEP.

Despite these differences, the six most frequent diagnoses among broad ICD-9 classifications were similar among veterans evaluated early in the initial VA registry and veterans evaluated later in the revised registry (Table 6). Also, the most common diagnoses among active duty troops in the CCEP were similar to the VA registries, which evaluated a higher percentage of Reservists and National Guard personnel.

For specific diagnoses within broad ICD-9 categories (Tables 7-20), a wide range of common health problems were diagnosed, as noted in the following discussion. When reviewing the data from these registries, the specific percentages of individual diagnoses within categories cannot be compared, but an assessment of the rank order of these diagnoses provides important information. Again, although there are substantial differences in the databases, the most frequently identified diagnoses were similar in all three registries.

Infectious and Parasitic Diseases (ICD-9 001-139)

Like civilian populations of adults evaluated in outpatient clinics, the most common infectious diseases among Gulf War veterans were: athlete’s foot, common skin discoloration, and superficial infections of the groin and nails (Table 7). There was no cluster of unusual infectious diseases among the 100,339 evaluated Gulf War veterans, and infectious diseases associated with immunosuppression were infrequently diagnosed.

The most widespread infectious disease problems during Operations Desert Shield and Storm were those associated with crowding (acute upper respiratory infections) and reduced levels of sanitation (travelers-type diarrhea). However, respiratory and gastrointestinal infections were not prominent diagnoses after the war among registry participants. Other than the 12 known U.S. Gulf War veterans with visceral Leishmaniasis, no new case of this unique infectious disease was identified among over 100,000 VA and DoD registry participants.

Since the Gulf War, a pattern of infectious diseases has not emerged among patients with chronic unexplained symptoms, who have been hypothesized to have a unique “Gulf War syndrome.” Nor has a characteristic physical sign or laboratory test abnormality been observed that would indicate a chronic infectious process, including a unique skin rash, lymphadenopathy, hepatosplenomegaly, transaminase elevations, or hematological abnormalities.¹⁷¹

Malignant Neoplasms (ICD-9 140-208)

Malignant neoplasms were a rare diagnosis among registry participants. Of the 16 major diagnostic categories, malignant neoplasms ranked last (Table 6). Moreover, diverse kinds of neoplasms were found in this population and not a particular type of tumor (Table 8). The most frequent malignancies observed among registry participants were skin cancers. This observation is consistent with the general civilian population. In the U.S., skin cancers are the leading cause of cancer among adults.¹⁷²

There were 42 cases of testicular cancer, which is one of the most common cancers among young men. Because testicular cancer occurs most frequently in men 20 to 40 years of age, young military populations are at higher risk.¹⁷³ Knoke et al., examined Defense Department postwar hospitalization records for testicular cancer and found no association with Gulf War deployment.²¹

Endocrine, Nutritional, and Metabolic Diseases, and Immunity Disorders (ICD-9 240-279)

In the three clinical programs, endocrine and nutritional disorders ranked 9th and 10th in frequency among broad ICD-9 categories (Table 6). Neither morbidity or mortality studies of Gulf War veterans has to date shown an increased risk of these health problems.^{123,129} No abnormalities were found among symptomatic Gulf War veterans with undefined illnesses in a study of *in vitro* immunological responses.¹⁷⁴

The most common diagnoses within this ICD-9 classification were overweight and laboratory findings of elevated cholesterol (Table 9). As in the general population, diabetes and hypothyroidism also were relatively common diagnoses. A recent study has shown that 20% of Americans are severely overweight, and 6% to 7% of the U.S. population has diabetes.^{175,176} Being overweight, lack of exercise, a poor diet, and cigarette smoking have been associated with an increased risk of diabetes.¹⁷⁷

Diseases of the Blood and Blood-Forming Organs (ICD-9 280-289)

There were relatively few diagnoses in this disease category (Table 6). Anemia and low white blood cell counts (agranulocytosis or neutropenia) were the most common observation on laboratory analysis (Table 10). These are frequent findings in routine laboratory testing of clinic patients in the general population.

The most common cause of significant neutropenia is iatrogenic, the result of drug therapy, particularly antibiotics and immunosuppressive drugs used to treat malignancies and autoimmune diseases.¹⁷⁸ In a study of post-war hospitalizations, anemia among Gulf War veteran women was associated with pregnancy, which is often accompanied by anemia.¹²³

Mental Disorders (ICD-9 290-319)

Mental disorders were common diagnoses in all three registries, ranking 2nd and 3rd most prevalent (Table 6). The most frequently diagnosed specific conditions were the same for both VA and DoD registries: tension headache, prolonged post-traumatic stress disorder, anxiety, and depression (Table 11). A wide variety of other mental disorders also were identified, which is expected in general outpatient populations.

High rates of mental disorders should be anticipated among adult outpatients because this is one of the most common clinical problems in the general population. Based on U.S. population estimates, about 15% of the population 18 years of age and over fulfill criteria for at least one alcohol, drug abuse, or other mental disorder during a one month period.¹⁷⁹ A higher prevalence of most mental disorders has been found among younger adults, except for severe cognitive impairments. Men have been found to have higher levels of substance abuse and antisocial personality, whereas women have had higher rates of affective, anxiety, and somatization disorders.¹⁷⁹

Gulf War service was associated with acute mental reactions to stress after the war among U.S. veterans in a controlled study that utilized hospital records.¹³⁰ Personnel who served in ground war support occupations (men and women) were at greater risk for postwar drug-related disorders. Men who served in ground war combat occupations were at higher risk for alcohol-related disorders. In a clinical case-control study of British Gulf War veterans, the findings suggested that ill Gulf War veterans do not have greater levels of psychiatric disorders typically seen in general psychiatry clinic but do have elevated rates of somatization.¹⁸⁰

Diseases of the Nervous System and Sense Organs (ICD-9 320-389)

The most common diagnoses in this category were similar among the three registries (Table 12). They included: migraine headaches, non-specific hearing loss, buzzing in the ears, and carpal tunnel syndrome. Minor visual problems also were commonly found among registry participants. Exposure to pesticides and chemical warfare agents during the Gulf War have been hypothesized to have caused both central and peripheral neurologic damage among Gulf War veterans.^{181,182} However, diagnoses of these neurological disorders were relatively uncommon

among over 100,000 registry participants: This diagnostic category ranked 5th and 6th most frequent among broad ICD-9 classifications in the three clinical programs (Table 6).

Intensive study of a small group of Gulf War veterans have found indications of possible neurological pathology.^{80,183-187} Other studies of Gulf War veterans have found no evidence of a characteristic disease of either the peripheral or central nervous system.¹⁸⁸⁻¹⁹⁵ Currently, the study of diseases of the nervous system among Gulf War veterans is one of the most important areas of Federally-funded research.³¹

Diseases of the Circulatory System (ICD-9 390-459)

In the three clinical programs, this diagnostic category ranked 8th to 11th among broad ICD-9 classifications (Table 6). The two most common diagnoses within this ICD-9 category were high blood pressure and hemorrhoids (Table 13). Greater than 20% of the adult population may have hypertension, which makes it a highly prevalent disorder in outpatient populations.¹⁹⁶ There was a wide variety of other common heart and vessel disorders among registry participants.

Diseases of the Respiratory System (ICD-9 460-519)

A large number of respiratory illnesses were found among registry participants, which were not directly related to infectious diseases (Table 6). The most common diagnoses were allergic rhinitis (hay fever), asthma, and inflammation of the nose and sinuses (Table 14). These conditions are also prevalent in the general population of adults. Asthma has been estimated to occur in 4% to 5% of the U.S. population.¹⁹⁷ The small number of diagnoses of bronchitis among DoD's CCEP participants may reflect the relative health of young active duty troops.

The initial VA registry was established because of concerns about the health effects of smoke exposure from burning oil well fires. These fires caused a major ecological disaster, which was characterized by the burning of more than 4 million barrels of oil per day and the production of 3400 metric tons of soot.⁸⁶ During the war, deployment to Kuwait near the oil well fires was associated with an increased incidence of eye and upper respiratory tract irritation, shortness of breath, cough, rashes, and fatigue.⁸⁶ However, monitoring of air pollution levels after the war did not indicate that troops were heavily exposed to chemicals from smoke or oil spills.^{84,85} A large epidemiological study of postwar hospitalizations of Gulf War veterans diagnosed with conditions thought most likely to be sequelae from smoke exposure failed to demonstrate a strong statistical association with serious illness.¹⁹⁸

Diseases of the Digestive System (ICD-9 520-579)

Irritable bowel syndrome was the most frequent diagnosis observed in this category (Table 15). Also commonly diagnosed were esophageal reflux, dyspepsia, and noninfectious gastroenteritis. These conditions are all extremely common in the general population.

Irritable bowel syndrome can be defined as the presence of unexplained abdominal discomfort or pain for 12 weeks or longer during the previous 12 months. These symptoms have to be

accompanied by two or more of three characteristics: 1) there is relief of symptoms with defecation, 2) the onset of symptoms was associated with new onset of either diarrhea or constipation, or 3) the onset of symptoms was associated with a change in stool consistency.¹⁹⁹

Irritable bowel syndrome may affect as much as 15% of adults, with women more prone to report symptoms of this syndrome.¹⁹⁹ In the U.S., gastroenterologists diagnose irritable bowel syndrome more frequently than any other condition. Twelve percent of visits to primary care providers may be due to symptoms of irritable bowel syndrome but only a minority of individuals with symptoms visit a doctor for evaluation. Patients seeking health care for this syndrome are more likely to have accompanying psychological problems than individuals who tolerate their symptoms.¹⁹⁹

The cause of irritable bowel syndrome is unknown. A consistent pattern of organic disease has not been found among patients reporting symptoms of this illness. Generally, no abnormalities are detected in the physical examination or laboratory testing of patients. Therefore, the diagnoses of irritable bowel syndrome is based on exclusion of other causes of abnormal bowel symptoms.

Treatment of irritable bowel syndrome is primarily directed at alleviating symptoms. The avoidance of certain foods and the addition of fiber to the diet may be helpful. Finally, drug therapy – analgesics, tricyclic compounds, and antispasmodics – may help relieve symptoms.¹⁹⁹

Diseases of the Genitourinary System (ICD-9 580-629)

Relatively few registry participants had a disease of the genitourinary system. This diagnostic category ranked 11th and 12th most frequent among the three clinical programs (Table 6). The low number of cases probably reflects the fact that women most often developed these types of health problems, but women represented only one out of ten registry participants. A common laboratory finding, hematuria (blood in urine), was the most common diagnosis in all three registries (Table 16).

Diseases of the kidney were very rare among registry participants. This finding is important because exposure to depleted uranium (DU) munitions during the Gulf War has been hypothesized to cause long-term health problems. Since DU is only slightly radioactive, its potential toxicity as a heavy metal is of greater concern. Because heavy metals are nephrotoxic, exposure can cause kidney disease.⁹⁵

Diseases of the Skin and Subcutaneous Tissue (ICD-9 680-709)

Gulf War veterans often were diagnosed with a condition that fell within this diagnostic category, which ranked 3rd through 5th most common among broad ICD-9 classifications in the three registries (Table 6). The most common diagnosis within this category was skin rash due to contact with an irritant -- a condition that usually results from recent skin irritation (Table 17). Typical, male-pattern baldness and acne were also frequent diagnoses in this category.

Skin rashes are one of the most common complaints of all adult populations presenting for non-emergency health care. In a specific study of skin conditions among Gulf War veterans, a unique or unusual skin rash was not identified.²⁰⁰ In addition, military dermatologists did not observe unusual skin diseases during the Gulf War deployment.²⁰¹

Diseases of the Musculoskeletal System and Connective Tissue (ICD-9 710-739)

In all three registries, this was the leading diagnosis (Table 6). Within this ICD-9 classification, back pain and non-specific joint pain were the most common specific diagnoses (Table 18). These are also the most frequent musculoskeletal problems reported by outpatient populations of civilian adults.²⁰² It is estimated that there are 315 million outpatient visits each year in the U.S. for musculoskeletal complaints.²⁰³ Also, 17% of adults report back pain.²⁰² In contrast to musculoskeletal problems, connective tissue diseases were infrequently diagnosed among Gulf war registry participants.

Among military populations, musculoskeletal problems are prevalent because of vigorous training and physical fitness requirements. In particular, combat operations like those in the Gulf are associated with injuries to the musculoskeletal system.^{204,205} Specific studies of Gulf War veterans have demonstrated that veterans are suffering from the same types of musculoskeletal health problems as the general adult population. In a 1998 case-series, Escalante and Fischback tabulated the rheumatic manifestations of 145 VA registry participants who were referred for rheumatological evaluation.²⁰⁶ The investigators noted that the types of conditions Gulf War veterans experienced after the war were not unusual (fibromyalgia, nonspecific arthralgias, osteoarthritis, etc.) and they inferred no suggestion of a new Gulf War-related syndrome. However, these clinicians noted that "...pain is common and widespread in these patients and their health related quality of life is poor."²⁰⁶

Three other teams of researchers studied a total of 698 Gulf War veterans evaluated for possible rheumatological conditions and noted a high prevalence of common health problems, but no indication of a unique Gulf War diagnosis or condition.²⁰⁷⁻²⁰⁹

Symptoms, Signs and Ill-Defined Conditions (ICD-9 780-799)

The diagnostic category, "Symptoms, Signs and Ill-Defined Conditions," includes symptoms, signs, illnesses, and abnormal laboratory results or other investigative abnormalities, which are not coded elsewhere in the IDC-9-CM. It is important to note that the "Symptoms, Signs, and Ill-Defined Conditions" category is not a diagnosis of an unusual or mystery illness. This diagnostic classification encompasses more than 160 sub-categories and primarily consists of common symptoms that do not have a definite cause or isolated laboratory abnormalities.

Among Gulf War veterans evaluated in the initial VA registry, the diagnostic category, "Symptoms, Signs and Ill-Defined Conditions," ranked 13th most common (Table 6). In patients seen later, when a greater number of diagnoses were coded, this diagnostic category was more common, ranking 7th in the VA's revised registry and 2nd in the DoD CCEP. The reason for the different frequency of diagnosis between the revised VA registry and the CCEP was not clear but may be the result of coding preferences in the two clinical programs, because many of the

diagnoses in the “Symptoms, Signs and Ill-Defined Conditions” classification can be coded adequately using ICD codes in other diagnostic categories.

Compared to other diagnostic groups, there was more diversity in ranking among the specific diagnoses within this category. Nevertheless, the most common diagnoses were widely varied and not clearly related to a particular disease (Table 19). Most of the diagnoses represented isolated laboratory test abnormalities or symptoms without accompanying pathology. For the twenty most common primary and secondary diagnosis in this category among the 49,079 patients examined in the initial VA Registry protocol, eight of the top ten were abnormal laboratory results or other investigative abnormalities. Abnormal laboratory results are routinely encountered when performing multiple tests on outpatients. For patients evaluated in the revised VA registry and the DoD CCEP, which coded more diagnoses, non-specific symptoms were tabulated more often than abnormal laboratory results. Five of the top ten diagnoses were the same in the revised VA registry and CCEP, and included the following common symptoms: headache, malaise and fatigue, other general symptoms, rash and nonspecific skin eruption, and other insomnia (Table 19).

These findings are comparable to other outpatient populations and the general civilian population. Physical symptoms, like those classified in “Symptoms, Signs and Ill-Defined Conditions,” are one of the most common reasons for outpatient visits. Published data from ambulatory care surveys found the following self-reported prevalence of symptoms:²¹⁰⁻²¹²

- | | |
|---------------------|------------|
| 1. joint pain | 26% to 59% |
| 2. fatigue | 22% to 58% |
| 3. headaches | 21% to 37% |
| 4. sleep complaints | 15% to 35% |
| 5. dyspnea | 14% to 32% |
| 6. abdominal pains | 11% to 24% |

The high prevalence of these particular symptoms in the general clinic population is also supported by data from the National Ambulatory Medical Care Survey (NAMCS).²¹³ This national sample of clinics in the United States found that in 1989 the number of outpatient visits in the United States for fatigue was estimated to be 7 million; for headaches, 10 million; for joint pains, 17 million; and for skin rash, 14 million. Many patients report more than one of these symptoms at the same time.²¹¹

In adult populations, common symptoms often remain unexplained, despite diagnostic testing. In approximately one-third of patients presenting with a physical symptom, a precise physical cause of the symptom cannot be identified even after medical evaluation.²¹⁰ Symptom-based diagnoses are increasingly recognized as prevalent and persistent problems among civilian populations, in which they are associated with high levels of subjective distress, functional impairment, and extensive use of health care services.²¹⁴ In military populations, unexplained symptom-based conditions have been observed after military conflicts dating back to the U.S. Civil War^{115,215} and have been observed in recent military deployments.¹⁴³⁻¹⁴⁶

Studies of patients with multiple, medically unexplained symptoms have found increased rates of major depression and panic disorder.^{212,216-221} Several mechanisms might account for this association. Physical illness may cause psychosocial distress through a direct biological link or by overwhelming a patient's ability to cope.²²² Distress also may increase unhealthy behaviors that increase the risk of such symptoms.²¹⁶

Many studies also demonstrate that patients with primary anxiety and depressive disorders present with physical symptoms.²²³⁻²²⁵ For example, in a study of more than 1,000 health maintenance organization enrollees, increasing numbers of pain complaints were associated with elevated levels of anxiety, depression, and physical symptoms.²²⁶ Importantly, depression and anxiety are consistently associated with medically unexplained symptoms across many studies that have employed different research methodologies, including cross-sectional,²²⁷ case-control,²²⁸⁻²³¹ and longitudinal designs.^{232,233} In several studies, the percentages of patients with anxiety and depressive disorders increased with increasing numbers of physical symptoms.^{212,225} Katon and colleagues found that the relationship of physical symptoms to common anxiety and depressive disorders is linear: as the number of anxiety and depressive symptoms or lifetime episodes of psychological disorders increases, so does the prevalence and number of physical symptoms.^{223,228}

In a study of 18,495 Gulf War veterans, physical symptoms often did not begin until after the war, with 40% of symptoms having a latency period of greater than one year.²³⁴ Moreover, there was no association between symptoms and self-reported exposures. As in the civilian population, the study found a "dose-response" relationship between physical symptoms and co-existing psychological diagnoses. Like other studies, the more symptoms that Gulf War veterans reported, the more likely they were to have a psychological disorder.^{212,223,225,228}

In another study, an intensive examination was conducted of 21,579 Gulf War veterans who had been evaluated in the CCEP and received a diagnoses of "Symptoms, Signs, and Ill-defined Conditions."¹⁶¹ More definitive, often psychological, diagnoses could be made by increasing the comprehensiveness of the evaluation and by multidisciplinary input. In this study, no evidence of a new or unique syndrome was found, and there was no association between a diagnosis of "Symptoms, Signs, and Ill-Defined Conditions" and wartime exposures. In a third study, more than one-half of U.S. Gulf War veterans with unexplained symptoms had a treatable anxiety or depressive disorder.²³⁵ In a fourth study, PTSD was diagnosed in 50% of veterans with complaints of chronic fatigue.²³⁶ Taken together, these data suggest that multiple, unexplained symptoms are often a marker of psychosocial distress.

It is important to note that the VA and DoD Gulf War health examination registries found that about 18 to 20% of participants have undiagnosed symptoms. In comparison, about 17 percent of Vietnam veterans participating in VA's Agent Orange registry have had undiagnosed symptoms (unpublished data, Dr. Han Kang, Department of Veterans Affairs, Washington, DC). These findings indicate that veterans from prior wars, regardless of the types of exposures, develop similar, difficult-to-explain health problems.

There were three symptom-based conditions that received a unique diagnostic code in the revised VA registry: chronic fatigue syndrome (990.02), sleep apnea (990.01), and fibromyalgia

(990.03). Because these postulated conditions are not specifically coded in ICD-9, they were not tabulated in the initial VA registry or the CCEP. In the revised VA registry, chronic fatigue syndrome was diagnosed in 793 veterans, which is 3.7% of this registry's participants. Two hundred and sixty veterans (1.2%) were diagnosed with sleep apnea and 78 (0.4%) were diagnosed with fibromyalgia.

In table 21, a secondary diagnosis of "Symptoms, Signs and Ill-Defined Conditions" was compared to primary diagnoses grouped by major ICD-9 classifications. As shown for the revised VA registry and CCEP, a secondary diagnosis of "Symptoms, Signs and Ill-Defined Conditions" was found most frequently among veterans who also had this set of conditions as a primary diagnosis. In the revised VA registry, a secondary diagnosis of "Symptoms, Signs and Ill-Defined Conditions" was also associated with a primary diagnosis of endocrine and blood diseases; and in the CCEP, this secondary diagnosis was associated with a primary diagnosis of musculoskeletal and digestive disorders. There is no indication that a secondary diagnosis of "Symptoms, Signs and Ill-Defined Conditions" was a manifestation of an underlying mental or psychiatric disorder.

Injury and Poisoning (ICD-9 800-999)

This diagnostic classification also contains diverse conditions. Among registry participants, various sprains and strains were the most common diagnoses, which is consistent with the fact that musculoskeletal injuries are frequent among military personnel (Table 20).

Table 6. Frequency of Major ICD-9 Diagnostic Categories

<i>ICD-9 Code</i>	<u>VA Registry Initial Format</u> (n = 49079) % (Number)	<u>VA Registry Revised Format</u> (n = 21306) % (Number)	<u>DoD's CCEP</u> (n = 32876) % (Number)
001 -- 139 Infectious and Parasitic Diseases	7.2 (3549)	9.8 (2091)	9.8 (3225)
140 – 208 Malignant Neoplasms	0.4 (206)	0.8 (166)	0.6 (212)
240 – 279 Endocrine, Nutritional, and Metabolic Diseases, and Immunity Disorders	5.8 (2858)	10.5 (2238)	9.3 (3069)
280 – 289 Diseases of the Blood and Blood-Forming Organs	1.6 (775)	2.5 (539)	3.2 (1052)
290 – 319 Mental Disorders	15.0 (7345)	35.7 (7615)	48.4 (15923)
320 – 389 Diseases of the Nervous System and Sense Organs	8.2 (4049)	17.9 (3805)	19.4 (6369)
390 – 459 Diseases of the Circulatory System	7.0 (3429)	11.0 (2336)	9.1 (2989)
460 – 519 Diseases of the Respiratory System	14.2 (6966)	18.4 (3926)	19.0 (6253)
520 – 579 Diseases of the Digestive System	11.3 (5569)	17.7 (3773)	24.0 (7896)
580 – 629 Diseases of the Genitourinary System	3.3 (1631)	5.9 (1264)	5.8 (1902)
680 – 709 Diseases of the Skin and Subcutaneous Tissue	13.4 (6562)	19.6 (4167)	21.4 (7051)
710 – 739 Diseases of the Musculoskeletal System and Connective Tissue	25.1 (12328)	39.4 (8404)	70.0 (23012)
780 – 799 Symptoms, Signs, and Ill-Defined Conditions	3.2 (1552)	16.2 (3451)	63.8 (20982)
800 – 999 Injury and Poisoning	4.6 (2280)	4.9 (1050)	3.6 (1193)
V code* (Factors Influencing Health Status and Contact with Health Service)	6.6 (3249)	4.2 (898)	18.5 (6096)
Other codes infrequently diagnosed among registry participants+	1.8 (886)	3.4 (722)++	4.3 (1418)

* Used for a diagnosis of “healthy” (V65.5) among CCEP participants

+ “Complications of Pregnancy, Childbirth, and the Puerperium,” “Congenital Anomalies,” and “Certain Conditions Originating in the Perinatal Period”

++ Not included in this entry are 1131 individuals evaluated in the revised VA registry who were given a special diagnostic code for a diagnosis of chronic fatigue syndrome, sleep apnea, or fibromyalgia.

Table 7. Twenty Most Common Primary and Secondary Diagnoses of Infectious and Parasitic Diseases (ICD-9 001-139)

Percent of diagnoses (total number of diagnoses) and specific diagnosis in this ICD-9 category by type of registry

<u>VA Registry, initial format (3549 participants)</u>	<u>VA Registry, revised format (2091 participants)</u>	<u>DoD's CCEP (3225 participants)</u>
% (No.) with diagnosis in this category	% (No.) with diagnosis in this category	% (No.) with diagnosis in this category
20.8 (739) Dermatophytosis of foot (athletes foot)	22.9 (479) Dermatophytosis of foot	19.8 (638) Dermatophytosis of foot
13.8 (490) Pityriasis versicolor	12.7 (266) Pityriasis versicolor	14.0 (452) Dermatomycosis, Phityriasis versicolor
10.6 (377) Dermatophytosis of groin	8.3 (174) Dermatophytosis of groin	9.7 (314) Dermatophytosis of groin
5.9 (210) Dermatophytosis of the body	7.8 (163) Dermatophytosis of nail	7.0 (227) Dermatophytosis of nail
5.6 (200) Dermatophytosis of nail	5.6 (118) Dermatophytosis of the body	5.8 (188) Dermatophytosis of the body
4.4 (156) Viral warts, unspecified	2.9 (61) Viral warts, unspecified	4.4 (143) Sarcoidosis
3.5 (123) Dermatophytosis of unspecified site	2.9 (61) Dermatophytosis of unspecified site	3.2 (102) Hepatitis C
3.0 (106) Viral warts	2.5 (53) Dermatomycosis, unspecified	2.9 (92) Viral warts
2.4 (84) Sarcoidosis	2.5 (52) Other specified viral warts	2.1 (69) Dermatophytosis of scalp and beard
2.2 (79) Infectious mononucleosis	2.4 (51) Sarcoidosis	1.8 (59) Chronic hepatitis C
2.1 (74) Other specified viral warts	2.2 (47) Acute or unspecified hepatitis C	1.7 (54) Other specified viral warts
2.1 (74) Dermatomycosis, unspecified	1.9 (40) Viral hepatitis B	1.4 (45) Infectious mononucleosis
1.4 (51) Herpes simplex, no complications	1.5 (32) Dermatophytosis of hand	1.2 (40) Viral hepatitis B
1.4 (49) Viral hepatitis B	1.1 (24) Herpes simplex	1.2 (40) Dermatophytosis, unspecified site
1.3 (45) Acute or unspecified hepatitis C	1.1 (24) Chronic hepatitis C	1.1 (37) Herpes simples
1.3 (45) Dermatophytosis of hand	1.1 (24) Infectious mononucleosis	1.0 (31) Giardiasis
1.1 (40) Dermatophytosis of scalp and beard	1.1 (23) Dermatophytosis of scalp and beard	1.0 (31) Dermatophytosis of hand
1.0 (37) Rule out leishmaniasis	1.1 (22) Genital herpes, unspecified	1.0 (30) Condyloma acuminatum
1.0 (34) Dermatophytosis, other specified sites	1.0 (20) Helicobacter pylori	0.9 (29) Genital herpes, unspecified
0.7 (25) Herpes Zoster	0.8 (17) Dermatophytosis, other specified sties	0.9 (28) Other gram-negative organisms

Table 8. Twenty Most Common Primary and Secondary Diagnoses of Malignant Neoplasms (ICD-9 140-208)

Percent of diagnoses (total number of diagnoses) and specific diagnosis in this ICD-9 category by type of registry

<u>VA Registry, initial format (206 participants)</u>			<u>VA Registry, revised format (166 participants)</u>			<u>DoD's CCEP (212 participants)</u>		
%	(No.)	with diagnosis in this category	%	(No.)	with diagnosis in this category	%	(No.)	with diagnosis in this category
11.2	(23)	Skin, site unspecified	11.4	(19)	Skin, site unspecified	9.9	(21)	Skin, site unspecified
8.7	(18)	Other and unspecified testis	6.6	(11)	Other and unspecified testis	6.6	(14)	Melanoma of skin, site unspecified
5.8	(12)	Skin and other and unspecified parts of face	4.8	(8)	Breast (female) unspecified	6.1	(13)	Skin and other unspecified parts of face
5.3	(11)	Hodgkins disease, unspecified	4.2	(7)	Malignant neoplasm of thyroid	6.1	(13)	Other and unspecified testis
4.4	(9)	Colon, unspecified	3.6	(6)	Bronchus and lung unspecified	6.1	(13)	Hodgkins disease, unspecified
3.9	(8)	Other lymphoma	3.6	(6)	Melanoma of skin, site unspecified	4.7	(10)	Brain, unspecified
2.9	(6)	Melanoma of skin	3.6	(6)	Other lymphomas	4.2	(9)	Breast (female), unspecified
2.9	(6)	Malignant neoplasm of thyroid gland	3.0	(5)	Hodgkins disease, unspecified	3.8	(8)	Other lymphomas
2.4	(5)	Bronchus and lung, unspecified	2.4	(4)	Colon, unspecified	2.4	(5)	Colon, unspecified
2.4	(5)	Breast (female), unspecified	2.4	(4)	Other specified sites of skin	1.9	(4)	Upper lobe, bronchus or lung
1.9	(4)	Cervix uteri, unspecified	1.8	(3)	Parotid gland	1.9	(4)	Malignant neoplasma of prostate
1.9	(4)	Bladder, part unspecified	1.8	(3)	Skin of other and unspecified parts of face	1.9	(4)	Malignant neoplasm of thyroid gland
1.5	(3)	Lower limb, including hip	1.8	(3)	Skin of trunk	1.9	(4)	Myeloid leukemia, chronic
1.5	(3)	Trunk, except scrotum	1.8	(3)	Malignant neoplasm of prostate	1.4	(3)	Rectosigmoid junction
1.5	(3)	Other specified sites of skin	1.8	(3)	Kidney, except pelvis	1.4	(3)	Trunk, except scrotum
1.5	(3)	Skin of upper limb, including shoulder	1.8	(3)	Brain, unspecified	1.4	(3)	Malignant neoplasm without site/other
1.5	(3)	Kidney, except pelvis	1.8	(3)	Myeloid leukemia, acute	1.4	(3)	Lymphoid leukemia, chronic
1.5	(3)	Brain, unspecified	1.2	(2)	Malignant neoplasm of pyriform sinus	1.4	(3)	Myeloid leukemia in remission
1.5	(3)	Head, face, and neck	1.2	(2)	Other specified sites of pancreas	0.9	(2)	Bronchus and lung, unspecified
1.5	(3)	Other lymphomas	1.2	(2)	Connective and other soft tissue / trunk	0.9	(2)	Neoplasm, lower limb

Table 9. Twenty Most Common Primary and Secondary Diagnoses of Endocrine, Nutritional, and Metabolic Diseases, and Immunity Disorders (ICD-9 240-279)

Percent of diagnoses (total number of diagnoses) and specific diagnosis in this ICD-9 category by type of registry

<u>VA Registry, initial format (2858 participants)</u>		<u>VA Registry, revised format (2238 participants)</u>		<u>DoD's CCEP (3069 participants)</u>	
%	(No.) with diagnosis in this category	%	(No.) with diagnosis in this category	%	(No.) with diagnosis in this category
26.5	(757) Pure hypercholesterolemia	23.0	(515) Pure hypercholesterolemia	21.1	(648) Pure hypercholesterolemia
20.7	(593) Obesity	19.8	(444) Obesity, unspecified	12.4	(382) Other and unspecified hyperlipidemia
9.9	(284) Other and unspecified hyperlipidemia	12.2	(274) Other and unspecified hyperlipidemia	8.9	(273) Unspecified hypothyroidism
7.5	(213) Unspecified hypothyroidism	7.8	(175) Diabetes mellitus, Type II	8.0	(244) Intestinal disaccharidase deficiencies
6.5	(187) Diabetes mellitus, Type II	5.4	(120) Unspecified hypothyroidism	5.9	(181) Obesity
2.6	(75) Gout, unspecified	2.9	(64) Obesity	4.0	(122) Diabetes mellitus, Type II
2.4	(70) Intestinal disaccharidase deficiency	2.8	(63) Intestinal disaccharidase deficiency	3.5	(108) Disorders of bilirubin excretion
2.0	(58) Unspecified disorder of lipid metabolism	1.9	(43) Pure hyperglyceridemia	3.1	(94) Gout, unspecified
1.6	(47) Diabetes mellitus, Type I	1.6	(35) Morbid obesity	2.6	(79) Pure hyperglyceridemia
1.5	(42) Pure hyperglyceridemia	1.5	(34) Gout, unspecified	2.5	(76) Unspecified disorder lipid metabolism
1.3	(36) Thyrotoxicosis, no mention of goiter	1.5	(34) Disorders of bilirubin excretion	2.4	(75) Obesity, unspecified
1.3	(36) Disorders of bilirubin excretion	1.5	(33) Diabetes mellitus, Type I/no complications	2.2	(67) Mixed hyperlipidemia
1.1	(32) Disorders of calcium metabolism	1.2	(27) Unspecified disorder of lipid metabolism	1.3	(41) Diabetes mellitus no note complications
1.0	(30) Lipoprotein deficiencies	1.1	(25) Disorders of phosphorus metabolism	1.0	(32) Gouty arthropathy
1.0	(29) Toxic diffuse goiter, no mention storm	0.8	(19) Other disorders of lipid metabolism	1.0	(30) Toxic diffuse goiter, no mention storm
1.0	(28) Gouty arthropathy	0.8	(19) Disorders of calcium metabolism	1.0	(30) Other B complex deficiency
0.9	(27) Goiter, unspecified	0.8	(18) Thyrotoxicosis	1.0	(29) Thyrotoxicosis, no mention goiter
0.9	(27) Hypoglycemia, unspecified	0.8	(18) Gouty arthropathy	0.9	(27) Thyrotoxicosis, no mention of storm
0.9	(25) Obesity, unspecified	0.7	(15) Other B complex deficiencies	0.8	(25) Chronic lymphocytic thyroiditis
0.7	(20) Disorders of phosphorus metabolism	0.7	(15) Other disorders of plasma protein metabolism	0.7	(22) Goiter, unspecified

Table 10. Twenty Most Common Primary and Secondary Diagnoses of Diseases of the Blood and Blood-Forming Organs (ICD-9 280-289)

Percent of diagnoses (total number of diagnoses) and specific diagnosis in this ICD-9 category by type of registry

<u>VA Registry, initial format (775 participants)</u>		<u>VA Registry, revised format (539 participants)</u>		<u>DoD's CCEP (1052 participants)</u>	
%	(No.) with diagnosis in this category	%	(No.) with diagnosis in this category	%	(No.) with diagnosis in this category
36.1	(280) Anemia, unspecified	27.3	(147) Anemia, unspecified	27.2	(286) Anemia, unspecified
20.2	(157) Agranulocytosis	22.6	(122) Agranulocytosis	13.2	(139) Iron deficiency anemia, unspecified
11.6	(90) Iron deficiency anemia, unspecified	10.6	(57) Iron deficiency anemia, unspecified	12.2	(128) Agranulocytosis
7.0	(54) Other specified disease of white blood cells	7.1	(38) Other specified diseases of white blood cells	10.8	(114) Thalassemias
3.9	(30) Thalassemias	5.6	(30) Thrombocytopenia, unspecified	4.4	(46) Sickle-cell trait
3.1	(24) Thrombocytopenia, unspecified	4.6	(25) Thalassemias	3.9	(41) Other specified diseases of WBC's
2.2	(17) Eosinophilia	2.6	(14) Sickle-cell trait	3.6	(38) Thrombocytopenia, unspecified
1.4	(11) Lymphadenitis, unspecified	2.2	(12) Eosinophilia	2.0	(21) Eosinophilia
1.3	(10) Other specified diseases	1.9	(10) Unspecified deficiency anemia	1.9	(20) Unspecified deficiency anemia
1.2	(9) Unspecified deficiency anemia	1.9	(10) Lymphadenitis, unspecified	1.9	(20) Other specified diseases
1.2	(9) Unspecified diseases	1.3	(7) Other specified diseases	1.5	(16) Polycythemia, secondary
1.0	(8) Iron deficiency anemia, due blood loss	1.1	(6) Anemias due glutathione metabolism	1.3	(14) Iron deficiency anemia, due blood loss
0.8	(6) Anemias due glutathione metabolism	1.1	(6) Polycythemia, secondary	1.0	(11) Anemias, due glutathione metabolism
0.8	(6) Sickle-cell trait	0.9	(5) Sickle cell anemia, unspecified	1.0	(11) Other hemoglobinopathies
0.8	(6) Other hemoglobinopathies	0.9	(5) Unspecified diseases	1.0	(10) Lymphadenitis, unspecified
0.8	(6) Unspecified diseases of white blood cells	0.7	(4) Other specified iron deficiency anemia	0.9	(9) Pernicious anemia
0.6	(5) Disease of spleen, other	0.7	(4) Primary thrombocytopenia	0.9	(9) Sickle cell anemia, unspecified
0.5	(4) Sickle cell anemia, unspecified	0.6	(3) Folate-deficiency anemia	0.8	(8) Other specified aplastic anemias
0.5	(4) Primary thrombocytopenia	0.6	(3) Other and unspecified coagulation defects	0.8	(8) Primary thrombocytopenia
0.4	(3) Folate deficiency anemia	0.6	(3) Chronic lymphadenitis	0.8	(8) Unspecified disease of WBC's

Table 11. Twenty Most Common Primary and Secondary Diagnoses of Mental Disorders (ICD-9 290-319)

<i>Percent of diagnoses in this ICD-9 category by type of registry; number of diagnoses; and ICD classification</i>								
<u>VA Registry, initial format (7345 participants)</u>			<u>VA Registry, revised format (7615 participants)</u>			<u>DoD's CCEP (15923 participants)</u>		
%	(No.)	with diagnosis in this category	%	(No.)	with diagnosis in this category	%	(No.)	with diagnosis in this category
19.2	(1412)	Prolonged post-traumatic stress disorder	20.6	(1571)	Tension headache	22.7	(3620)	Tension headache
17.0	(1249)	Depressive disorder	16.2	(1234)	Prolonged PTSD	14.1	(2247)	Depressive disorder
16.0	(1178)	Tension headache	16.0	(1216)	Depressive disorder	10.9	(1733)	Prolonged PTSD
9.5	(700)	Anxiety state, unspecified	6.9	(522)	Anxiety state, unspecified	6.2	(993)	Neurotic depression
4.1	(301)	Neurotic depression	4.4	(337)	Neurotic depression	4.9	(781)	Tobacco use disorder
3.0	(218)	Unspecified adjustment reaction	2.5	(194)	Organic personality syndrome	3.3	(518)	Anxiety state, unspecified
2.3	(171)	Unspecified acute reaction to stress	1.9	(146)	Nondependent abuse drugs, continuous	2.8	(453)	Major depressive disorder/single
1.9	(136)	Other acute reactions to stress	1.7	(131)	Unspecified adjustment reaction	2.7	(426)	Unspecified organic brain syndrome
1.7	(124)	Major depressive disorder, single episode	1.3	(96)	Major depressive disorder, single episode	1.8	(281)	Somatization disorder
1.5	(109)	Brief depressive reaction	1.0	(76)	Brief depressive reaction	1.6	(262)	Brief depressive reaction
1.3	(94)	Other alcohol dependence, unspecified	1.0	(75)	Panic disorder	1.6	(249)	Psychophysiological malfunction
1.0	(74)	Other alcohol dependence, continuous	1.0	(75)	Alcohol dependence, unspecified	1.6	(249)	Unspecified, acute reaction to stress
1.0	(72)	Panic disorder	1.0	(73)	Alcohol abuse	1.6	(248)	Unspecified adjustment reaction
0.8	(58)	Alcohol abuse, unspecified	0.9	(71)	Bipolar affective disorder	1.3	(212)	Alcohol abuse, unspecified
0.7	(55)	Unspecified neurotoxic disorder	0.8	(64)	Generalized anxiety disorder	1.1	(180)	Persistent disorder initiate/maintain sleep
0.7	(52)	Tobacco use disorder	0.8	(60)	Psychosexual dysfunction	1.0	(166)	Adjustment reaction, mixed emotional
0.7	(50)	Tobacco disorder, unspecified	0.8	(60)	Specific disorders of sleep, other	0.9	(151)	Panic disorder
0.6	(47)	Bipolar affective disorder, unspecified	0.8	(60)	Unspecified acute reaction to stress	0.8	(126)	Generalized anxiety disorder
0.6	(46)	Specific disorders of sleep, other	0.8	(58)	Alcohol dependence, continuous	0.7	(106)	Transient disorder initiating sleep
0.6	(45)	Other, mixed, unspecified drug abuse	0.7	(57)	Other specified affective psychosis	0.6	(100)	Other, unspecified alcohol dependence

Table 12. Twenty Most Common Primary and Secondary Diagnoses of Diseases of the Nervous System and Sense Organs (ICD-9 320-389)

Percent of diagnoses (number of diagnoses) and specific diagnosis in this ICD-9 category by type of registry

<u>VA Registry, initial format (4049 participants)</u>		<u>VA Registry, revised format (3805 participants)</u>		<u>DoD's CCEP (6369 participants)</u>	
%	(No.) with diagnosis in this category	%	(No.) with diagnosis in this category	%	(No.) with diagnosis in this category
18.4	(746) Migraine, unspecified	25.4	(969) Migraine, unspecified	26.9	(1711) Migraine, unspecified
13.5	(545) Unspecified hearing loss	10.0	(365) Unspecified hearing loss	5.5	(349) Carpal tunnel syndrome
6.3	(254) Tinnitus, unspecified	7.2	(274) Tinnitus, unspecified	5.0	(319) Other specified forms hearing loss
5.1	(205) Carpal tunnel syndrome	4.2	(161) Carpal tunnel syndrome	4.9	(310) Unspecified hearing loss
2.5	(103) Other specified hearing loss	3.2	(123) Variants of migraine	3.6	(230) Common migraine
2.3	(94) Myopia	2.7	(103) Sensorineural hearing loss, unspecified	3.5	(225) Sensorineural hearing loss
2.2	(88) Variants of migraine	1.7	(64) Other specified forms of hearing loss	2.6	(167) Tinnitus, unspecified
2.1	(87) Sensorineural hearing loss, unspecified	1.5	(58) Unspecified peripheral neuropathy	1.9	(123) Myopia
2.0	(81) Unspecified visual loss	1.4	(54) Disorder of refraction and accommodation	1.9	(119) Lesion of ulnar nerve
1.8	(71) Unspecified otitis media	1.3	(48) Myopia	1.4	(89) Essential tremor
1.7	(69) Other specified visual disturbance	1.2	(47) Essential and other specified tremor	1.3	(85) Variants of migraine
1.4	(55) Infective otitis externa, unspecified	1.2	(45) Unspecified otitis media	1.1	(67) Presbyopia
1.3	(51) Pterygium, unspecified	1.1	(42) Common migraine	1.0	(66) Classical Migraine
1.2	(50) Disorder of refraction and accommodation	1.1	(41) Unspecified visual loss	1.0	(62) Myoclonus
1.1	(44) Unspecified peripheral neuropathy	1.0	(37) Impacted cerumen	0.9	(58) Migraine
1.1	(44) Unspecified glaucoma	0.9	(35) Unspecified glaucoma	0.9	(57) Benign paroxysmal positional vertigo
1.1	(43) Conjunctivitis, unspecified	0.9	(33) Conjunctivitis, unspecified	0.9	(55) Other chronic allergic conjunctivitis
1.0	(40) Central hearing loss	0.8	(32) Other specified visual disturbances	0.8	(53) Unspecified peripheral neuropathy
0.9	(36) Impacted cerumen	0.8	(31) Central hearing loss	0.8	(51) Other specified visual disturbance
0.8	(34) Other forms of migraine	0.8	(30) Lesion of ulnar nerve	0.8	(48) Astigmatism, unspecified

Table 13. Twenty Most Common Primary and Secondary Diagnoses of Diseases of the Circulatory System (ICD-9 390-459)

Percent of diagnoses (number of diagnoses) and specific diagnosis in this ICD-9 category by type of registry

<u>VA Registry, initial format (3429 participants)</u>	<u>VA Registry, revised format (2336 participants)</u>	<u>DoD's CCEP (2989 participants)</u>
% (No.) with diagnosis in this category	% (No.) with diagnosis in this category	% (No.) with diagnosis in this category
41.6 (1425) Essential hypertension, unspecified	43.1 (1007) Essential hypertension, unspecified	42.0 (1255) Essential hypertension, unspecified
16.8 (577) Essential hypertension, benign	8.4 (196) Benign essential hypertension	6.2 (186) Unspecified hemorrhoids
5.8 (200) Unspecified hemorrhoids	6.7 (157) Unspecified hemorrhoids	3.3 (98) Mitral valve disorders
3.0 (102) Other cardiac dysrhythmias	2.7 (63) Other cardiac dysrhythmias	2.8 (85) Internal hemorrhoids
2.5 (86) Internal hemorrhoids	2.4 (55) Internal hemorrhoids	2.7 (82) Benign essential hypertension
2.1 (71) Varicose veins, no mention ulcer	2.2 (52) Varicose veins, no mention ulcer	2.2 (65) Essential hypertension
1.8 (62) Mitral valve disorders	2.0 (46) External hemorrhoids	2.1 (62) Scrotal varices
1.6 (55) External hemorrhoids	1.6 (38) Mitral valve disorders	1.9 (58) Raynaud's syndrome
1.5 (51) Scrotal varices	1.6 (37) Unspecified angina pectoris	1.9 (57) Coronary atherosclerosis
1.4 (47) Coronary atherosclerosis	1.6 (37) Coronary atherosclerosis	1.9 (56) External hemorrhoids
1.3 (45) Cardiac dysrhythmia, unspecified	1.6 (37) Scrotal varices	1.3 (38) Other cardiac dysrhythmias
1.1 (39) Cardiomegaly	1.5 (36) Cardiac dysrhythmia, unspecified	1.2 (37) Varicose veins without ulcer
0.8 (28) Chronic ischemic heart disease	1.1 (25) Transient global amnesia (cerebrovascular)	1.2 (36) Benign hypertensive heart disease
0.8 (28) Atrial fibrillation	1.0 (24) Cardiomegaly	1.0 (29) Other premature beats
0.8 (26) Old myocardial infarction	0.9 (21) Peripheral vascular disease	1.0 (29) Cardiomegaly
0.7 (23) Pulmonary valve disorders	0.9 (20) Atrial fibrillation	1.0 (29) Internal hemorrhoids with complication
0.6 (21) Other and unspecified angina pectoris	0.7 (17) Old myocardial infarction	0.9 (27) Orthostatic hypotension
0.6 (21) Coronary atherosclerosis unspecified vessel	0.7 (17) Chronic ischemic heart disease	0.9 (26) Aortic valve disorders
0.6 (20) Raynaud's syndrome	0.7 (17) Orthostatic hypotension	0.9 (26) Hypotension, unspecified
0.6 (19) Peripheral vascular disease	0.7 (16) Hypotension, unspecified	0.8 (23) Paroxysmal supraventricular tach

Table 14. Twenty Most Common Primary and Secondary Diagnoses of Diseases of the Respiratory System (ICD-9 460-519)

Percent of diagnoses (total number of diagnoses) and specific diagnosis in this ICD-9 category by type of registry

<u>VA Registry, initial format (6966 participants)</u>	<u>VA Registry, revised format (3926 participants)</u>	<u>DoD's CCEP (6253 participants)</u>
% (No.) with diagnosis in this category	% (No.) with diagnosis in this category	% (No.) with diagnosis in this category
20.1 (1398) Unspecified sinusitis (chronic)	18.6 (728) Asthma, unspecified	25.8 (1615) Allergic rhinitis, unspecified cause
15.3 (1063) Asthma, unspecified	18.0 (708) Allergic rhinitis, cause unspecified	18.5 (1159) Asthma, unspecified
14.6 (1019) Allergic rhinitis, cause unspecified	16.1 (631) Unspecified sinusitis, chronic	14.4 (901) Unspecified sinusitis (chronic)
6.9 (480) Chronic airway obstruction	6.7 (263) Chronic rhinitis	6.7 (419) Chronic rhinitis
4.8 (337) Chronic rhinitis	5.2 (206) Chronic airway obstruction	3.3 (206) Chronic airway obstruction
4.5 (313) Bronchitis, not specified acute/chronic	2.4 (96) Deviated nasal septum	2.3 (144) Deviated nasal septum
4.1 (287) Other diseases of the lung	2.4 (96) Unspecified chronic bronchitis	2.0 (126) Other diseases of sinuses
2.9 (202) Other diseases of sinuses	2.2 (88) Other diseases of sinuses	2.0 (123) Other diseases of lung
2.8 (197) Unspecified chronic bronchitis	2.2 (87) Other diseases of lung	1.5 (92) Intrinsic asthma
2.6 (183) Acute upper respiratory infections	2.2 (86) Bronchitis, not specified acute/chronic	1.5 (91) Chronic maxillary sinusitis
1.7 (116) Deviated nasal septum	2.0 (78) Acute upper respiratory infection	1.3 (84) Asthma
1.3 (94) Chronic maxillary sinusitis	1.0 (41) Allergic rhinitis due to other allergen	1.2 (73) Allergic rhinitis
1.2 (83) Acute pharyngitis	1.0 (40) Postinflammatory pulmonary fibrosis	1.1 (69) Acute upper respiratory infection
1.2 (82) Postinflammatory pulmonary fibrosis	1.0 (40) Other diseases respiratory system	1.1 (68) Other diseases trachea/bronchus
0.9 (64) Other diseases of respiratory system	1.0 (38) Acute pharyngitis	1.0 (60) Extrinsic asthma
0.8 (56) Pneumonia, organism unspecified	0.8 (33) Unspecified diseases respiratory system	1.0 (60) Postinflammatory pulmonary fibrosis
0.7 (47) Acute bronchitis	0.8 (30) Simple chronic bronchitis	0.9 (54) Acute sinusitis, unspecified
0.6 (45) Extrinsic asthma	0.7 (29) Chronic maxillary sinusitis	0.8 (51) Unspecified chronic bronchitis
0.6 (44) Simple chronic bronchitis	0.7 (29) Obstructive chronic bronchitis	0.8 (49) Allergic rhinitis due to pollen
0.6 (44) Obstructive chronic bronchitis	0.6 (24) Acute bronchitis	0.8 (47) Other chronic sinusitis

Table 15. Twenty Most Common Primary and Secondary Diagnoses of Diseases of the Digestive System (ICD-9 520-579)

Percent of diagnoses (total number of diagnoses) and specific diagnosis in this ICD-9 category by type of registry

<u>VA Registry, initial format (5569 participants)</u>			<u>VA Registry, revised format (3773 participants)</u>			<u>DoD's CCEP (7896 participants)</u>		
%	(No.)	with diagnosis in this category	%	(No.)	with diagnosis in this category	%	(No.)	with diagnosis in this category
28.9	(1610)	Unspecified noninfectious gastroenteritis	20.0	(753)	Irritable bowel syndrome	22.2	(1755)	Irritable bowel syndrome
10.6	(590)	Irritable bowel syndrome	18.9	(714)	Esophageal reflux	20.1	(1584)	Esophageal reflux
5.5	(306)	Esophageal reflux	6.3	(237)	Unspecified noninfectious gastroenteritis	8.7	(690)	Unspecified noninfect. gastroenteritis
4.8	(268)	Dyspepsia	6.2	(233)	Dyspepsia	4.9	(390)	Dyspepsia
3.6	(199)	Diaphragmatic hernia	3.8	(145)	Diaphragmatic hernia	4.3	(343)	Chronic gingivitis
3.5	(193)	Peptic ulcer, unspecified acute/chronic	3.4	(130)	Unspecified gastritis	3.0	(240)	Unspecified gastritis
2.8	(157)	Unspecified gastritis	2.8	(104)	Peptic ulcer, unspecified acute/chronic	2.1	(168)	Diaphragmatic hernia
2.2	(124)	Inguinal hernia	2.4	(92)	Inguinal hernia, unilateral	2.1	(164)	Esophagitis
2.2	(123)	Esophagitis	1.7	(64)	Chronic gingivitis	2.0	(154)	Chronic periodontitis
2.1	(117)	Chronic gingivitis	1.5	(56)	Arthralgia of temporomandibular joint	1.7	(135)	Reflux esophagitis
2.0	(113)	Other specified periodontal diseases	1.5	(56)	Constipation	1.6	(130)	Peptic ulcer, unspecified acute/chronic
1.8	(98)	Reflux esophagitis	1.2	(44)	Unspecified functional disorder of stomach	1.4	(110)	Other specified periodontal diseases
1.4	(79)	Constipation	1.1	(43)	Reflux esophagitis	1.4	(107)	Functional disorder of intestine
1.4	(78)	Hemorrhage of rectum and anus	1.1	(41)	Dental caries	1.3	(99)	Constipation
1.3	(75)	Blood in stool	1.1	(41)	Inguinal hernia, bilateral	1.0	(75)	Duodenitis
1.2	(66)	Hepatitis, unspecified	1.0	(38)	Hemorrhage of rectum and anus	0.9	(70)	Esophagitis, unspecified
1.0	(57)	Dental caries	0.9	(35)	Unspecified functional disorder of intestine	0.8	(66)	Hepatitis, unspecified
1.0	(57)	Duodenal ulcer, unspecified	0.9	(33)	Other specified periodontal disease	0.8	(63)	Unspecified gingival disease
1.0	(57)	Functional disorder of stomach	0.9	(33)	Duodenitis	0.7	(59)	Temporomandibular joint disorders
0.9	(50)	Diverticulitis of colon	0.8	(32)	Temporomandibular joint disorders	0.7	(56)	Dental caries

Table 16. Twenty Most Common Primary and Secondary Diagnoses of Diseases of the Genitourinary System (ICD-9 580-629)

Percent of diagnoses (total number of diagnoses) and specific diagnosis in this ICD-9 category by type of registry

<u>VA Registry, initial format (1631 participants)</u>			<u>VA Registry, revised format (1264 participants)</u>			<u>DoD's CCEP (1902 participants)</u>		
%	(No.)	with diagnosis in this category	%	(No.)	with diagnosis in this category	%	(No.)	with diagnosis in this category
14.3	(233)	Hematuria	9.0	(115)	Hematuria	12.4	(236)	Hematuria
8.8	(144)	Urinary Tract Infection, site not specified	7.5	(95)	Hyperplasia of prostate	7.1	(135)	Hyperplasia of prostate
8.0	(131)	Hyperplasia of prostate	6.4	(81)	Male infertility, unspecified	5.8	(111)	Male infertility, unspecified
7.1	(115)	Calculus of kidney	6.2	(78)	Calculus of kidney	4.3	(82)	Calculus of kidney
4.3	(70)	Prostatitis, unspecified	5.9	(75)	Urinary tract infection, site not specified	4.3	(81)	Urinary tract infection, site not specified
3.4	(55)	Male infertility, unspecified	4.5	(57)	Impotence of organic origin	4.1	(78)	Prostatitis, unspecified
3.1	(51)	Other disorders male genital organs	3.7	(47)	Prostatitis, unspecified	3.7	(71)	Chronic prostatitis
3.0	(49)	Impotence of organic origin	3.5	(44)	Other specified disorders of male genitals	2.8	(54)	Orchitis and epididymitis, unspecified
2.9	(48)	Orchitis and epididymitis, unspecified	2.8	(35)	Orchitis and epididymitis, unspecified	2.7	(52)	Other specified disorders male genitals
2.8	(45)	Irregular menstrual cycle	2.5	(31)	Unspecified disorder of male genitals	2.6	(49)	Unspecified disorder of male genitals
2.1	(34)	Hypertrophy of breast	2.2	(28)	Hypertrophy of breast	2.4	(46)	Infertility, female of unspecified origin
1.9	(31)	Chronic prostatitis	1.9	(24)	Dysmenorrhea	2.2	(41)	Unspecified symptom, female genitals
1.8	(30)	Diffuse cystic mastopathy	1.7	(22)	Hydrocele, unspecified	1.9	(36)	Spermatocele
1.6	(26)	Vaginitis, unspecified	1.7	(22)	Excessive menstruation	1.8	(34)	Oligospermia
1.5	(24)	Atrophy of testis	1.7	(21)	Infertility, female of unspecified origin	1.7	(33)	Irregular menstrual cycle
1.3	(22)	Unspecified disorder, male genitals	1.6	(20)	Diffuse cystic mastopathy	1.7	(32)	Other and unspecified ovarian cyst
1.3	(21)	Hydrocele, unspecified	1.4	(18)	Vaginitis and vulvovaginitis	1.5	(29)	Hydrocele, unspecified
1.3	(21)	Endometriosis	1.3	(16)	Atrophy of testis	1.4	(27)	Urethritis, unspecified
1.3	(21)	Dysmenorrhea	1.2	(15)	Chronic prostatitis	1.4	(27)	Endometrioses, site unspecified
1.3	(21)	Excessive menstruation	1.2	(15)	Endometriosis, site unspecified	1.3	(24)	Diffuse cystic mastopathy

Table 17. Twenty Most Common Primary and Secondary Diagnoses of Diseases of the Skin and Subcutaneous Tissue (ICD-9 680-709)

Percent of diagnoses (total number of diagnoses) and specific diagnosis in this ICD-9 category by type of registry

<u>VA Registry, initial format (6562 participants)</u>			<u>VA Registry, revised format (4167 participants)</u>			<u>DoD's CCEP (7051 participants)</u>		
%	(No.)	with diagnosis in this category	%	(No.)	with diagnosis in this category	%	(No.)	with diagnosis in this category
23.3	(1527)	Contact dermatitis, unspecified cause	23.3	(973)	Contact dermatitis, unspecified cause	17.2	(1211)	Contact dermatitis, unspecified cause
10.9	(712)	Alopecia, unspecified	9.9	(412)	Other specified diseases of hair	10.7	(752)	Alopecia, unspecified
9.8	(643)	Other specified diseases of hair	6.6	(276)	Alopecia, unspecified	8.3	(582)	Other specified diseases of hair
7.7	(506)	Other acne	6.6	(276)	Other acne	4.9	(346)	Erythematous squamous dermatosis
4.2	(275)	Erythematous squamous dermatosis	3.7	(155)	Seborrheic dermatitis	4.6	(323)	Other acne
4.0	(264)	Unspecified disorder of skin	3.6	(150)	Sebaceous cyst	4.2	(298)	Dyshidrosis
3.4	(224)	Sebaceous cyst	3.4	(140)	Unspecified disorder of skin	3.2	(224)	Other atopic dermatitis
3.4	(222)	Other psoriasis	2.9	(121)	Other psoriasis	2.8	(197)	Alopecia areata
2.5	(162)	Urticaria, unspecified	2.4	(102)	Dyshidrosis	2.5	(177)	Sebaceous cyst
2.2	(142)	Dyshidrosis	2.3	(97)	Other atopic dermatitis	2.2	(158)	Other psoriasis
1.9	(127)	Unspecified pruritic disorder	2.2	(90)	Other specified diseases sebaceous glands	2.2	(158)	Keratoderma, acquired
1.9	(123)	Other atopic dermatitis	1.9	(79)	Alopecia areata	2.2	(156)	Lichenification/lichen simplex chronic
1.6	(108)	Keratoderma, acquired	1.8	(75)	Keratoderma, acquired	2.1	(148)	Specified diseases sebaceous glands
1.5	(99)	Alopecia areata	1.8	(75)	Urticaria, unspecified	1.9	(135)	Urticaria, unspecified
1.4	(94)	Dyschromia	1.7	(69)	Other contact dermatitis	1.8	(124)	Seborrheic dermatitis, unspecified
1.3	(87)	Lichenification/lichen simplex chronic	1.6	(68)	Lichenification/lichen simplex chronic	1.6	(115)	Other specified urticaria
1.1	(70)	Scar condition and fibrosis of skin	1.5	(63)	Unspecified pruritic disorder	1.4	(99)	Alopecia
0.9	(59)	Actinic keratosis	1.3	(56)	Other specified disorders of skin	1.4	(96)	Unspecified disorders of skin
0.9	(59)	Other specified diseases sebaceous glands	1.3	(55)	Dyschromia, unspecified	1.1	(81)	Other diseases of hair o pollen
0.8	(55)	Other specified disorders of skin	0.3	(53)	Scar condition and fibrosis of skin	1.1	(79)	Actinic keratosis

Table 18. Twenty Most Common Primary and Secondary Diagnoses of Diseases of the Musculoskeletal System and Connective Tissue (ICD-9 710-739)

Percent of diagnoses (total number of diagnoses) and specific diagnosis in this ICD-9 category by type of registry

<u>VA Registry, initial format (12328 participants)</u>	<u>VA Registry, revised format (8404 participants)</u>	<u>DoD's CCEP (23012 participants)</u>
% (No.) with diagnosis in this category	% (No.) with diagnosis in this category	% (No.) with diagnosis in this category
11.7 (1446) Lumbago (low back pain)	10.2 (860) Lumbago (low back pain)	12.6 (2894) Lumbago (low back pain)
9.1 (1127) Pain in joints, multiple sites	10.1 (851) Pain in joint, site unspecified	7.8 (1803) Pain in joint, lower leg
7.6 (931) Pain in joint, site unspecified	8.0 (673) Pain in joint, multiple sites	6.5 (1506) Pain in joint, multiple sites
5.4 (665) Pain in joint, lower leg	4.9 (411) Myalgia and myositis unspecified	5.8 (1346) Pain in joint, site unspecified
4.6 (561) Pain in joint, other specified sites	4.8 (405) Pain in joint, lower leg	4.7 (1072) Osteoarthritis, site unspecified
4.4 (537) Myalgia and myositis unspecified	3.3 (279) Osteoarthritis, other specified sites	4.6 (1067) Osteoarthritis, localized, primary
2.5 (311) Osteoarthritis, other specified sites	3.2 (270) Osteoarthritis, lower leg	4.6 (1051) Myalgia and myositis unspecified
2.5 (309) Chondromalacia of patella	2.3 (192) Pain in joint, other specified sites	2.5 (580) Pain in joint
2.1 (263) Backache, unspecified	2.1 (180) Chondromalacia, of patella	2.1 (478) Backache, unspecified
2.0 (248) Pain in joint, shoulder region	1.5 (125) Osteoarthritis, site unspecified	1.9 (433) Other specified disorders of joint
1.9 (235) Osteoarthritis, lower leg	1.5 (125) Backache, unspecified	1.8 (403) Osteoarthritis, unspec. general/local
1.3 (161) Pain in limb	1.5 (123) Pain in joint, shoulder region	1.5 (346) Other affections of shoulder
1.3 (158) Flat foot	1.3 (108) Pain in limb	1.4 (322) Pain in joint, shoulder region
1.2 (146) Spondylosis, no mention myelopathy	1.1 (94) Spondylosis, no mention myelopathy	1.4 (314) Osteoarthritis, lower leg
1.1 (137) Disorders bursae/tendons of shoulder	1.1 (91) Lumbosacral disc disorder	1.2 (281) Plantar fascial fibromatosis
1.0 (127) Arthropathy, unspecified	1.0 (82) Lumbosacral spondylosis	1.2 (271) Chondromalacia of patella
1.0 (127) Lumbosacral disc disorder	1.0 (81) Cervicalgia	1.1 (256) Disorders bursae/tendons of shoulder
0.9 (116) Lumbosacral spondylosis	0.9 (79) Disorders of sacrum	1.1 (248) Lateral epicondylitis
0.9 (113) Disorders of sacrum	0.9 (78) Disorders bursae/tendons of shoulder	1.1 (242) Flat foot
0.8 (103) Pain in joint, ankle and foot	0.9 (73) Flat foot	0.9 (216) Osteoarthritis, lower leg

Table 19. Twenty Most Common Primary and Secondary Diagnoses of Symptoms, Signs and Ill-Defined Conditions (ICD-9 780-799)

Percent of diagnoses (total number of diagnoses) and specific diagnosis in this ICD-9 category by type of registry

<u>VA Registry, initial format (1552 participants)</u>		<u>VA Registry, revised format (3451 participants)</u>		<u>DoD's CCEP (20982 participants)</u>	
%	(No.) with diagnosis in this category	%	(No.) with diagnosis in this category	%	(No.) with diagnosis in this category
12.6	(195) Nonspecific abnormal result -- liver	11.0	(378) Headache	18.6	(3905) Malaise and fatigue
11.1	(173) Other abnormal blood chemistry	9.8	(339) Other unknown cause morbidity/mortality	13.5	(2835) Headache
11.1	(173) Other unknown cause morbidity/mortality	6.6	(225) Malaise and fatigue	11.8	(2480) Other general symptoms
8.1	(126) Other nonspecific abnormal serum enzymes	6.3	(216) Other general symptoms	6.5	(1370) Other insomnia
7.7	(119) Nonspecific reaction TB skin test	5.1	(176) Other abnormal blood chemistry	5.1	(1075) Rash & nonspecific eruption
7.0	(109) Nonspecific elevation transaminase	5.0	(171) Rash & nonspecific skin eruption	4.8	(1006) Sleep disturbance, unspecified
6.3	(98) Nervousness	4.5	(155) Diarrhea	4.5	(952) Other symptoms respiratory system
5.2	(80) Other nonspecific findings in blood	3.4	(118) Other insomnia	3.9	(820) Other unspecified sleep apnea
4.2	(65) Elevated blood pressure reading	3.1	(106) Nonspecific abnormal result -- liver	2.1	(432) Nonspecific reaction TB skin test
2.9	(45) Abnormal EKG	3.0	(105) Other ill-defined conditions	1.6	(335) Painful respiration
2.6	(40) Nonspecific abnormal chest x-ray	2.1	(74) Nervousness	1.5	(319) Diarrhea
2.5	(39) Proteinuria	1.9	(66) Other malaise and fatigue	1.3	(275) Chest pain, unspecified
2.4	(38) Nonspecific abnormal result – pulmonary	1.9	(64) Other symptoms respiratory system	1.2	(252) Disturbance of skin sensation
2.3	(35) Nonspecific finding stool contents	1.7	(59) Nonspecific reaction TB skin test	1.1	(225) Dizziness and giddiness
1.9	(29) Other ill-defined conditions	1.6	(54) Alteration of consciousness	1.0	(217) Abnormal pain, unspecified site
1.8	(28) Abnormal glucose tolerance test	1.5	(53) Other symptoms of abdomen/pelvis	1.0	(209) Sleep disturbances
1.0	(16) Other abnormal clinical findings	1.5	(51) Chest pain	0.9	(196) Nonspecific elevation transaminase
0.8	(13) Other nonspecific findings -- urine	1.3	(45) Other unspecified sleep apnea	0.9	(192) Abnormal weight gain
0.8	(13) Nonspecific abnormal result -- thyroid	1.2	(43) Other chest pain	0.9	(187) Cough
0.7	(11) Elevated sedimentation rate	1.2	(42) Sleep disturbance, unspecified	0.8	(177) Other chest pain

Table 20. Twenty Most Common Primary and Secondary Diagnoses of Injury and Poisoning (ICD-9 800-999)

Percent of diagnoses (total number of diagnoses) and specific diagnosis in this ICD-9 category by type of registry

<u>VA Registry, initial format (2280 participants)</u>			<u>VA Registry, revised format (1050 participants)</u>			<u>DoD's CCEP (1193 participants)</u>		
%	(No.)	with diagnosis in this category	%	(No.)	with diagnosis in this category	%	(No.)	with diagnosis in this category
7.9	(180)	Toxic effect gas, fumes, or vapors	5.9	(62)	Sprains & strains, lumbosacral joint	7.0	(84)	Sprains & strains, knee and leg
5.7	(129)	Toxic effects, specified gases/fumes/vapors	5.0	(52)	Lumbar sprain and strain	6.2	(74)	Allergy, unspecified
5.5	(126)	Lumbar sprain and strain	4.5	(47)	Sprains & strains, ankle and foot	4.2	(50)	Sprains & strains, rotator cuff
4.4	(101)	Sprains & strains, ankle and foot	4.1	(43)	Allergy, unspecified	4.2	(50)	Sprains & strains, ankle and foot
3.9	(89)	Sprains & strains, neck	4.0	(42)	Sprains & strains, neck	3.4	(41)	Sprains & strains, neck
3.7	(84)	Sprains & strains, lumbosacral joint	3.6	(38)	Sprains & strains, unspecified site back	2.9	(35)	Other tear cartilage of knee
3.4	(79)	Allergy, unspecified	3.3	(35)	Sprains & strains, unspecified site knee	2.7	(33)	Angioneurotic edema
3.4	(78)	Sprains & strains, unspecified site back	2.6	(27)	Injury knee, leg, ankle, and foot	2.6	(32)	Lumbar sprains and strains
2.7	(62)	Injury knee, leg, ankle, and foot	2.3	(24)	Sprains & strains, unspecified shoulder	2.3	(28)	Tear of medial cartilage or meniscus
2.3	(52)	Other tear cartilage of knee	2.1	(22)	Sprains & strains, rotator cuff	2.2	(26)	Ill-defined sprains and strains
2.2	(51)	Sprains & strains, unspecified site knee/leg	2.0	(21)	Other tear cartilage of knee	1.8	(21)	Sprains & strains, unspecified shoulder
1.9	(44)	Closed dislocation of shoulder	2.0	(21)	Sprains & strains, sacroiliac region	1.8	(21)	Injury knee, leg, ankle, and foot
1.9	(43)	Sprains & strains, sacroiliac region	2.0	(21)	Toxic effects, unspecified gas/fumes/vapor	1.8	(21)	Motion sickness
1.8	(42)	Toxic effect, unspecified non-medical	2.0	(21)	Other effects of external causes	1.8	(21)	Unspecified adverse effect of drug
1.7	(40)	Sprains & strains, unspecified shoulder	1.7	(18)	Closed dislocation of shoulder	1.6	(18)	Sprains & strains, other site shoulder
1.5	(35)	Sprains & strains, rotator cuff	1.2	(13)	Late effect of fracture	1.6	(18)	Sprains & strains, lumbosacral joint
1.4	(33)	Other effects of external causes	1.2	(13)	Angioneurotic edema	1.1	(13)	Fracture lumbar, closed
1.3	(31)	Fracture of ankle, closed	1.1	(12)	Other specified sites of sprains and strains	1.1	(13)	Sprains & strains, hip and thigh
1.2	(28)	Unspecified adverse effect of drug	1.1	(12)	Unspecified adverse effect drug/medicinal	1.1	(13)	Sprains & strains, knee and leg
1.1	(26)	Angioneurotic edema	1.0	(11)	Fracture of ankle -- unspecified, closed	1.0	(11)	Sprains & strains, sacroiliac region

Table 21. Percentage of Primary Diagnoses with a Secondary Diagnosis of “Symptoms, Signs, and Ill-Defined Conditions”

<i>Primary Diagnosis</i>	Percent (number) with a Secondary Diagnosis of Symptoms, Signs, and Ill-Defined Conditions	
	<u>VA Registry Revised Format</u> (n = 21306)	<u>DoD’s CCEP</u> (n = 32876)
001 -- 139 Infectious and Parasitic Diseases	10.1 (70)	29.5 (244)
140 – 208 Malignant Neoplasms	8.5 (10)	20.1 (27)
240 – 279 Endocrine, Nutritional, and Metabolic Diseases, and Immunity Disorders	13.8 (80)	31.0 (231)
280 – 289 Diseases of the Blood and Blood-Forming Organs	12.8 (18)	31.7 (66)
290 – 319 Mental Disorders	10.1 (292)	33.5 (1863)
320 – 389 Diseases of the Nervous System and Sense Organs	9.7 (122)	32.8 (584)
390 – 459 Diseases of the Circulatory System	9.2 (75)	33.8 (270)
460 – 519 Diseases of the Respiratory System	9.8 (144)	30.6 (625)
520 – 579 Diseases of the Digestive System	8.7 (103)	36.5 (724)
580 – 679 Diseases of the Genitourinary System	11.8 (38)	30.4 (138)
680 – 709 Diseases of the Skin and Subcutaneous Tissue	9.4 (134)	26.4 (499)
710 – 739 Diseases of the Musculoskeletal System and Connective Tissue	10.2 (286)	36.8 (2391)
780 – 799 Symptoms, Signs, and Ill-Defined Conditions	35.1 (393)	44.1 (2558)
800 – 999 Injury and Poisoning	9.5 (27)	30.9 (95)

Time Series Analysis

Table 22 presents the percent distribution of the symptoms recorded in the initial and revised VA registry databases for the calendar years 1992 to 1999. As reflected in the layout of the table, the initial VA registry codesheet was used to record examinations in the years 1992 through 1995, whereas the revised VA codesheet was used to record examinations from 1996 forward. The initial codesheet was different structurally than the revised codesheet, with the former recording up to three symptoms compared to at most 10 in the revised VA registry.

For any particular symptom listed in Table 22, the distribution by year of examination for either type of codesheet was reasonably stable. There is a marked increase in the percent of veterans reporting symptoms by year of examination when comparing the data recorded on the revised codesheet with the initial codesheet. This is a reflection of both the limited coding range employed in the initial codesheet and the fact that the revised codesheet could record up to 10 symptom codes compared to only three on the initial codesheet.

The most frequently reported symptom for each year in the initial VA registry was fatigue, but the most frequently reported symptom across all years in the revised VA registry was joint and muscle pain as observed in the CCEP (Table 23). The revised VA registry format is structurally closer to the CCEP than the initial codesheet by virtue of the potential number of symptoms that can be recorded. There did not appear to be any trailing off in the frequency of reported symptoms in the later years of the revised VA registry as was observed for the CCEP.

Table 23 presents the percent distribution of ten common symptoms in the DoD's CCEP by calendar year of examination for the years 1994 to 1999. The symptoms tabulated in the CCEP were captured using a checklist of symptoms administered to veterans during the evaluation. These are often referred to as physician-elicited symptoms. Within all of the symptom categories there is considerable variation from year to year in the percent of persons examined who report having the symptom in question. A common pattern for each of the reported symptoms in the CCEP is that compared to all other examination years, 1997 had the highest proportion of persons who report a particular symptom. Also, there is a dramatic drop off in the reporting of symptoms, with fewer symptoms reported in 1998 and 1999.

To evaluate these patterns further, the distribution of the number of symptoms reported by calendar year was assessed for the CCEP, which primarily evaluated active duty troops. The percent reporting no symptoms was 20%, 21%, 15%, and 16% from 1994 through 1997, but jumped to 92% and 74% in 1998 and 1999. These data suggest that just as the interest in enrolling for a CCEP examination trailed off in 1998 and 1999, the number of symptoms reported by each veteran and noted by the examining physician also trailed off. Despite the variation from year to year, within any given year, the top three most frequently reported symptoms were joint and muscle pain, fatigue, and headaches.

Table 22. Percent Distribution of Symptoms Recorded for Gulf War Veterans in the VA Registry by Year of Examination

Symptoms Category	Examination Year							
	Initial VA Registry				Revised VA Registry			
	1992 %	1993 %	1994 %	1995 %	1996 %	1997 %	1998 %	1999 %
Fatigue	20.2	16.6	22.7	22.4	24.3	24.0	21.9	25.2
Headache	16.2	13.4	19.8	21.2	28.2	28.5	26.6	25.9
Joint/Muscle Pain	11.9	13.8	17.7	16.6	37.3	39.1	39.8	41.8
Memory Problem	11.5	10.7	15.2	16.7	21.4	26.0	24.7	24.3
Rash	14.7	16.1	20.0	18.5	24.3	25.5	25.3	23.6
Abdominal Pain	3.4	2.4	2.8	2.8	4.3	4.7	4.7	4.8
Diarrhea	10.6	7.8	9.1	9.4	13.8	14.5	13.9	12.7
Shortness of Breath	8.2	7.6	8.1	8.3	9.8	10.1	9.8	10.4
Sleep Disturbance	4.9	4.7	5.7	6.7	12.5	13.5	15.3	14.3
Weight Control	2.7	1.4	1.6	1.3	2.2	2.4	2.8	2.9
Total Persons by Examination Year	1000	13262	23778	10953	5672	8050	3709	1485

Table 23. Percent Distribution of Symptoms Recorded for Gulf War Veterans in the DoD CCEP by Year of Examination

Symptom Category	Examination Year						
	1994 %	1995 %	1996 %	1997 %	1998 %	1999 %	All Years %
Fatigue	51.7	41.4	58.0	65.5	4.9	18.8	46.6
Headache	41.8	35.2	53.0	60.1	4.2	15.5	40.8
Joint/Muscle Pain	52.9	49.1	64.5	70.1	5.1	19.7	51.8
Memory Problem	37.1	31.3	46.0	53.9	3.8	14.2	36.2
Rash	29.9	26.9	37.9	43.3	3.0	12.9	30.0
Abdominal Pain	19.0	15.0	29.1	35.9	2.1	9.1	20.8
Diarrhea	22.3	16.3	36.3	47.9	2.5	10.6	25.5
Shortness of Breath	12.8	18.7	32.9	40.2	1.9	10.5	23.0
Sleep Disturbance	35.7	13.0	45.6	53.6	3.7	15.2	35.9
Weight Control	8.2	6.2	26.8	43.0	1.4	9.1	17.1
Total Veterans by Examination Year	4225	12804	5075	6920	2583	1269	32876

Table 24 presents the percent distributions of broad diagnostic categories by year of examination for diagnoses recorded either in the initial VA registry (years 1992-1995) or in the revised VA registry (years 1996-1999). Within either the initial or revised registry, the percent having a diagnosis in any one category appears to be fairly uniform across the applicable years. This was true except for the diagnosis of “Symptoms, Signs, and Ill-defined Conditions,” which increased in frequency each year in the revised VA registry. As with the symptom table for the VA registry breakdown (Table 22), an increase in frequency for a particular diagnostic group is seen between the years covered by the initial VA codesheet and the time period covered by the revised codesheet. This increase is a reflection of the increased coding from a maximum of 3 diagnoses in the initial registry to a maximum of 10 diagnoses in the revised registry.

Diagnoses involving the musculoskeletal system and mental disorders are among the most frequently reported diagnoses in the VA registries, as with the CCEP diagnostic data (Table 25). While the category “Symptoms, Signs and Ill-defined Conditions” is among the top three diagnostic categories in the CCEP, it was almost never used on the initial VA codesheet and was not frequently used on the revised codesheet.

Table 25 presents the percent distribution of diagnoses by year of examination among the 32,876 veterans evaluated in the CCEP. Diagnoses again are grouped by broad diagnostic categories, and individuals with multiple diagnoses in a single category are counted only once in that category. Unlike the distribution of symptoms by year of examination (Table 23), the frequency of diagnoses reported in the CCEP is fairly uniform from year to year. Unlike self-reported symptoms, there was no unusual drop in percentages after 1997 for any of the diagnostic categories that would suggest a trailing off in the problems affecting Gulf War veterans. The three most frequently recorded diagnoses in the CCEP were those involving the musculoskeletal system; symptoms, signs, and ill-defined conditions; and, mental disorders.

Table 24. Percent Distribution of Diagnoses Recorded for Gulf War Veterans in the VA Registry by Year of Examination

Diagnostic Category	Examination Year							
	Initial VA Registry				Revised VA Registry			
	1992 %	1993 %	1994 %	1995 %	1996 %	1997 %	1998 %	1999 %
Infectious and Parasitic Disease	7.9	7.5	7.4	6.4	9.7	9.3	10.2	8.7
Malignant Neoplasms	0.1	0.4	0.5	0.4	0.7	0.8	1.0	0.8
Endocrine, Nutritional, Metabolic, Immunity	5.3	5.5	5.8	6.5	9.2	9.5	12.5	12.7
Blood and Blood-Forming Organs	2.2	1.4	1.7	1.6	2.7	2.5	2.2	2.2
Mental Disorders	14.8	13.4	15.3	16.3	34.0	36.6	35.3	37.6
Nervous System and Sense Organs	7.7	8.0	8.0	9.1	17.7	17.4	18.1	19.5
Circulatory System	6.2	6.7	6.9	7.6	10.4	10.4	11.8	12.9
Respiratory System	20.3	14.5	14.1	13.6	18.7	18.5	17.4	18.2
Digestive System	14.8	10.7	11.5	11.4	17.3	17.1	18.7	18.0
Genitourinary System	3.0	3.2	3.4	3.3	6.3	5.6	5.3	6.6
Skin and Subcutaneous Tissue	14.6	13.1	13.9	12.5	19.0	18.9	18.5	18.5
Musculoskeletal System and Connective Tissue	27.7	23.2	24.8	27.8	37.3	39.5	38.3	46.7
Symptoms, Signs, and Ill-Defined Conditions	1.9	2.5	3.1	4.1	12.9	16.7	20.8	21.0
Injury and Poisoning	5.6	5.9	4.3	3.9	4.9	4.7	4.6	6.0
Total Persons by Exam Year	1000	13262	23778	10953	5672	8050	3709	1485

Table 25. Percent Distribution of Diagnoses Recorded for Gulf War Veterans in the DoD CCEP by Year of Examination

Diagnostic Category	Examination Year						All Years
	1994	1995	1996	1997	1998	1999	
	%	%	%	%	%	%	%
Infectious and Parasitic Disease	8.8	10.3	10.2	9.3	9.7	9.2	9.8
Malignant Neoplasms	0.6	0.4	0.7	0.7	1.0	1.4	0.6
Endocrine, Nutritional, Metabolic, Immunity	8.1	8.8	9.1	9.8	11.7	11.6	9.3
Blood and Blood-Forming Organs	2.8	3.4	2.6	3.1	4.1	3.5	3.2
Mental Disorders	47.9	49.4	57.6	46.1	38.9	36.6	48.4
Nervous System and Sense Organs	18.8	20.9	20.1	17.4	18.0	16.5	19.4
Circulatory System	7.6	8.9	9.5	9.4	9.9	11.3	9.1
Respiratory System	18.2	22.0	18.9	16.2	14.0	18.4	19.0
Digestive System	25.9	23.9	27.0	22.5	21.8	19.2	24.0
Genitourinary System	5.3	5.8	6.0	5.7	5.8	6.0	5.8
Skin and Subcutaneous Tissue	20.2	23.1	22.2	19.7	19.9	17.9	21.4
Musculoskeletal System and Connective Tissue	60.1	68.9	74.0	71.3	76.0	78.6	70.0
Symptoms, Signs, and Ill-Defined Conditions	75.2	61.0	53.5	68.9	64.8	65.8	63.8
Injury and Poisoning	2.7	3.5	4.1	3.8	4.9	2.8	3.6
Total Veterans by Examination Year	4225	12804	5075	6920	2583	1269	32876

Veterans Evaluated in Both the VA and DoD Registries

There were 2,922 veterans who were examined in both the VA and DoD clinical evaluation programs. This is approximately 3% of all registry participants. Comparing these veterans' demographic and military characteristics to that of the entire group of registry participants shows that the overlap group more closely resembled CCEP participants, except for the fact that a greater percentage of the overlap group (36%) served with the National Guard and Reserves than did the entire group of CCEP participants (9%). This is consistent with the fact that National Guard and Reservists generally would have been eligible for a VA registry examination earlier than veterans whose unit component designation was "Active Duty."

The other area where the overlap group was different from the overall CCEP group was the fact that a greater proportion of the overlap group served only in Saudi Arabia (43% vs 32%), away from direct combat. This is consistent with the fact that a larger percentage of the overlap group belonged to the National Guard and Reserves, a military component less likely to be sent to Kuwait or Iraq as ground troops.

Table 26 presents the distribution of symptoms reported by veterans in the overlap group. Compared to the symptoms recorded in the CCEP and the symptoms recorded in the VA registries (Table 5), every symptom category in the overlap group was reported at a higher rate. These data indicate that veterans in the overlap group report greater ill health on average than the registry participants who underwent only one examination.

For diagnoses in the overlap group (Table 27), musculoskeletal diseases and mental disorders were the most frequently recorded diagnoses, as was true for overall participants in the three registries (Table 6). Also, the frequency of many diagnostic categories was similar between the overlap group and the general registry populations.

In summary, the group of 2,922 Gulf War veterans seeking multiple registry examinations report more ill health than other registry participants but have not received a greater number of diagnoses. VA plans further research of this unique group of veterans (see *Future Research*, page 78).

Table 26. Percent Distribution of Symptoms for the 2,922 Veterans Who Were Examined in Both the VA and DoD Gulf War Registry Programs

Symptom Category	Initial VA %	Revised VA %	CCEP %
Joint/Muscle Pain	16.1	53.2	61.1
Fatigue	21.7	29.0	57.5
Headache	20.3	34.5	49.1
Memory Problem	16.8	32.9	48.0
Rash	19.6	28.5	39.3
Sleep Disturbance	8.3	17.8	47.2
Shortness of Breath	8.5	13.5	29.1
Abdominal Pain	2.1	6.0	27.9
Diarrhea	3.8	17.1	31.2
Total Veterans	2922	1593	1329

Table 27. Percent Distribution of Diagnoses Recorded for the 2,922 Veterans Who Were Examined in Both the VA and DoD Gulf War Registry Programs

Diagnostic Category	Initial VA %	Revised VA %	CCEP %
Infectious and Parasitic Disease	7.3	10.4	10.3
Malignant Neoplasms	0.8	1.1	1.0
Endocrine, Nutritional, Metabolic, Immunity	6.7	9.9	10.6
Blood and Blood-Forming Organs	1.8	2.3	3.5
Mental Disorders	15.8	33.6	46.9
Nervous System and Sense Organs	9.6	22.9	21.4
Circulatory System	7.7	13.5	10.3
Respiratory System	15.8	18.7	20.3
Digestive System	11.0	20.4	26.9
Genitourinary System	3.3	7.7	5.7
Skin and Subcutaneous Tissue	13.2	20.4	21.1
Musculoskeletal System and Connective Tissue	26.6	45.8	54.9
Symptoms, Signs, and Ill-Defined Conditions	2.7	12.4	46.7
Injury and Poisoning	4.5	7.1	2.7
Total Veterans	2922	1593	1329

Analysis of Spouses and Children of Veterans

As of October 31, 2001, a total of 1,121 individuals had participated in the clinical program that evaluated spouses and children of veterans. Included in the program were 415 adult female spouses, 19 adult male spouses, 355 female children of veterans, and 332 male children of veterans. The following table provides the most common diagnoses among spouses and children. No unusual health problems were observed in this population.

Table 28. Twenty Most Common Diagnoses in VA Clinical Evaluation Program for Spouses and Children of Veterans

No. with Diagnosis	ICD-9 Code	Diagnosis
58	493.9	asthma, unspecified
34	692.9	contact dermatitis, unspecified cause
27	465.9	acute upper respiratory infections, unspecified site
26	382.9	unspecified otitis media
21	V20.2	routine infant or child health check
21	477.9	allergic rhinitis, cause unspecified
20	691.8	other atopic dermatitis and related conditions
17	784.0	headache
14	278.00	obesity, unspecified
12	311	depressive disorder, not elsewhere classified
12	473.9	unspecified sinusitis (chronic)
12	783.4	lack of expected normal physiological development in childhood
11	314.01	attention deficit disorder with hyperactivity
10	472.0	chronic rhinitis
9	307.81	tension headache
9	314.00	attention deficit disorder without mention of hyperactivity
9	315.39	developmental speech or language disorder, other
9	706.1	other acne
8	V20.1	other healthy infant or child receiving care
8	564.0	constipation

Epidemiological Analysis

Methods – Epidemiological Analysis

A second important area of research is to compare diagnostic information contained in these clinical databases with several major sources of exposure data. Although registry participants were self-selected and not chosen randomly from the entire Gulf War veteran population, limited epidemiologic analysis can be conducted to generate hypotheses about the causes of veterans' health problems. Because innumerable possible comparisons can be conducted using the registry databases and exposure data, all interpretation of statistical analyses has to consider: 1) the occurrence of chance findings; 2) biologic plausibility; and, 3) likely bias and confounding from selection and reporting bias. Available sources of exposure data included the following:

1. One type of exposure data is the self-reports of veterans. Registry participants were asked about potentially hazardous exposures during the Gulf War. For the combined database of these three clinical programs, the following self-reported exposures are available for analysis:
 - a. Diesel and other petrochemical fumes
 - b. Smoke from tent heaters
 - c. Burning trash and feces
 - d. Smoke from oil fires
 - e. Passive smoking
 - f. Skin exposure to fuels
 - g. Paints and solvents
 - h. CARC (chemical agent-resistant coating)
 - i. Personal use of pesticides and insect repellents
 - j. Pyridostigmine bromide tablets
 - k. Microwaves
 - l. Depleted uranium (DU)
 - m. Anthrax vaccination
 - n. Eating food not provided by the military
 - o. Eating or drinking contaminated food
 - p. Bathing in water not provided by the military

Exposure data can be compared with diagnostic information to determine whether there are significant associations. However, this analysis is limited by the fact that self-reported exposures rarely can be verified or quantitated and are subject to recall and reporting biases.²³⁷

2. In addition to self-reported information, investigations can be conducted using other sources of exposure data derived from extensive studies conducted to evaluate Gulf War health questions using the Deployment Environmental Surveillance Program Geographic Information System (GIS). A GIS has been established that provides information on the daily location of U.S. Gulf War troops -- both at the unit level and for individuals -- from the beginning of Operation Desert Shield (August 8, 1990) to 10 months after the ground war (December 31, 1991). This database was constructed by examining all existing Gulf War records, such as troop unit logbooks and situation reports, that contained daily troop-unit

location data by latitude and longitude. Over 5 million records were examined. The individual personnel in each troop unit were determined from the Defense Manpower Data Center's Gulf War Registry.

This GIS database can be used to conduct a number of assessments, which compare battlefield geographic locations with participation in the three registries and with diagnostic findings from the registries.¹⁹⁸

Results – Epidemiological Analysis

Because of the massive amount of complex data, it was possible to provide only basic analysis and preliminary results in this monograph. More detailed analyses can be conducted with the linked database of registry data.

The proportional distribution for the time of arrival in the Gulf theater of operations was very similar in the three registry programs (Table 29). Persons examined in the CCEP were more likely than VA registry personnel to have served in Iraq or Kuwait, but the percentage having combat MOS codes were similar across all registry programs. It is important to control for these characteristics in epidemiological assessments of registry data because of potential differences in exposures among the various Gulf War veteran populations.

Table 29. Percent Distribution for Time and Place in Theater and Assignment to a Combat Specialty Among Veterans in the VA and DoD Clinical Registries

Characteristic*	Percent Distribution		
	Initial VA (n = 49,079)	Revised VA (n = 21,306)	CCEP (n = 32,876)
<i>Time in Theater</i>			
Left Before Desert Storm	2.0	2.4	1.7
Present In Desert Storm	91.3	91.8	94.1
Arrived After Desert Storm	6.6	5.8	3.5
Unknown	0.0	0.0	0.7
<i>Place in Theater</i>			
Land only	68.6	66.6	70.2
Land/Water	19.8	20.6	20.5
Water	1.5	2.3	0.6
Unknown	10.1	10.5	8.7
<i>Country Deployed in Theater</i>			
Iraq/Kuwait	44.7	50.1	58.8
Saudi only	43.7	37.1	31.9
<i>Combat MOSC+</i>			
Yes	12.1	12.0	13.8
No	87.9	88.0	86.2

* Data on deployment characteristics provided by the U.S. Army Center for Health Promotion and Preventive Medicine (CHPPM), Washington, DC.

+ MOSC = Military Occupational Specialty Codes.

Table 30 provides information on self-reported exposures during the Gulf War. A high proportion of registry participants reported a wide variety of potential exposures. The most commonly reported exposures were to: 1) petroleum fumes and fuel, 2) passive cigarette smoking, 3) burning trash or feces, 4) oil well fire smoke, and 5) local food.

Table 30. Self-reported Exposure Histories of VA and DoD Registry Participants

Potential exposure during Gulf War	Percent Self-Reporting Exposure	
	Revised VA Registry (n = 21,306)	DoD CCEP (n = 32,876)
Diesel and other petrochemical fumes	90.9	89.5
Passive smoking	89.1	85.4
Skin exposure to fuel	74.8	NR
Burning trash/feces	77.3	NR
Smoke from oil well fires	75.5	70.6
Ate food other than provided by military	70.1	66.0
Pesticides (creams, sprays)	68.5	67.6
Smoke from tent heaters	70.6	70.0
Pyridostigmine bromide pills	69.4	78.9
Other paints and solvents	53.7	56.0
Anthrax vaccination	53.0	49.6
CARC paint	36.5	44.9
Microwaves	32.8	28.9
Ate or drank contaminated food	35.3	23.5
Bathed in water not provided by military	29.9	30.2

NR = not recorded in CCEP

In table 31, participants in the three registries were compared with all Gulf War veterans to determine whether demographic characteristics were associated with enrollment and completion of a VA or DoD registry examination. Women Gulf War veterans were significantly more likely to participate in a registry examination than men. This finding is consistent with civilian health care practices: Women are more likely than men to visit a health care provider for a broad range of health complaints.

There was a linear relationship between age and enrollment in a registry. The older the veteran, the more likely they were to participate in one of the registries. Married veterans also were slightly more likely to enroll for a registry examination, but this finding may reflect the fact that older (and more often married) veterans had a registry examination. For unknown reasons, veterans whose home of record was the Southwest were the least likely to enroll in one of the registries. There was no clear association between the race/ethnicity of Gulf War veterans and enrollment for a registry examination.

In table 32, participants in the three registries were compared with all Gulf War veterans to determine whether military characteristics were associated with completing a registry examination. Reservists were much more likely to have participated in one of the clinical evaluation programs. This fact has been pointed to as possible evidence that Reservists were not in as good general health as active duty troops. However, higher rates of participation in the registries by Reservists may indicate a problem with access to health care, rather than more severe health problems. Because active duty personnel had ready access to free DoD health care after the war, they had the opportunity to have their questions and concerns answered by a knowledgeable health care provider during routine health care. Active duty troops did not need to undergo a registry examination to address most health complaints.

In contrast to active duty troops, Reservists and National Guard personnel lost access to the military health care system as soon as they re-deployed to the United States and returned to an inactive military status. For no-cost VA health care, Reservists and National Guard personnel generally have to demonstrate a service-connected health problem or meet a financial means test. As a result, the VA Gulf War registry became a primary source of high-quality health care for many veterans from the Reserves and National Guard, particularly veterans of limited means or with insufficient private health insurance. Higher numbers of non-active duty veterans therefore could be expected to take advantage of the VA program during the first few years after the war. The finding that enlisted personnel were significantly more likely to enroll for a registry examination may also reflect a relative lack of private health care insurance compared to officers with greater access to civilian health care (Table 32).

Army and Marine Corps troops were more likely to participate in the registries than Air Force or Navy personnel (Table 32). This finding may be due to the more arduous duties of ground troops, who often sustain musculoskeletal injuries – one of the most common health problems of registry participants. The higher rate of participation of ground troops in the registries could also result from adverse exposures during the ground war, which were not shared by Air Force and Navy personnel. For example, ground troops exposed to oil well fire smoke as determined by the GIS were more likely to participate in the registries (Table 33). However, it is noteworthy that the veterans who had stayed in the theater of operations for the longest period of time were

only slightly more likely to obtain a registry examination (Table 33). Additionally, in one epidemiologic study of Gulf War veterans, the period of deployment to the Arabian Gulf was not associated with unexplained physical symptoms.²³⁸

In table 33, participants in the three registries were compared with all Gulf War veterans to determine whether certain Gulf War exposures were associated with completing a registry examination. As already noted, exposure to oil well fire smoke was associated with registry participation. In addition, troops near the destruction of chemical warfare agents at Khamisiyah were more likely to participate in one of the registries. However, these veterans had been contacted individually by letter after the extent of possible CW exposure was determined, and the letter recommended that they obtain a registry evaluation.

Two studies have been conducted that focused on veterans who may have been exposed to CW agents after the demolitions at Khamisiyah: No association was found between having been in proximity to the demolitions and hospitalization after the war in a DoD hospital.²³⁹ And, no increase in mortality was observed among veterans who may have been exposed to sarin and cyclosarin as determined by two plume models of the Khamisiyah demolitions.²⁴⁰

Table 33 also shows that receiving the anthrax or botulinum vaccine was not associated with registry participation. In contrast, a history of hospitalization before the war was associated with later participation in the registries. This finding indicates that veterans who had health problems before deployment had greater health problems after the war compared to other veterans.

Table 31. Adjusted Odds Ratios for the Outcome of Participation in the VA or DoD Registries among Gulf War Veterans by Demographic Characteristics

Demographic Characteristics	All Gulf War Veterans Number (% of total)	Registry Participants Number (% of total)	Odds Ratio*	95% CI*
<i>Sex</i>				
Male [†]	630,900 (93.0)	88,968 (90.0)	--	--
Female	47,688 (7.0)	9,867 (10.0)	1.33	1.30--1.37
<i>Age</i>				
< 22 years old [†]	170,560 (25.1)	19,358 (19.6)	--	--
22-25 years old	169,404 (25.0)	20,805 (21.0)	1.06	1.04--1.08
26-31 years old	169,277 (24.9)	24,289 (24.6)	1.31	1.28--1.34
> 31 years old	169,347 (25.0)	34,383 (34.8)	2.04	1.99--2.09
<i>Race/ethnicity</i>				
White [†]	456,745 (67.3)	61,466 (62.2)	--	--
Black	155,589 (22.9)	27,684 (28.0)	1.08	1.06--1.09
Hispanic non Black	24,438 (3.6)	3,017 (3.0)	0.94	0.90--0.98
Other	41,816 (6.2)	6,668 (6.8)	1.20	1.16--1.24
<i>Marital Status</i>				
Not married [†]	326,803 (48.2)	41,704 (42.2)	--	--
Married	351,785 (51.8)	57,131 (57.8)	1.07	1.06--1.09
<i>Home of Record</i>				
Southwest [†]	144,419 (21.3)	19,537 (19.8)	--	--
Southeast	139,034 (20.5)	24,405 (24.7)	1.16	1.13--1.19
Northwest	90,795 (13.4)	12,923 (13.1)	1.13	1.10--1.16
Northeast	250,552 (36.9)	36,125 (36.5)	1.10	1.08--1.12
Non-US/unknown	53,788 (7.9)	5,845 (5.9)	1.23	1.19--1.27

* Adjusted odds ratio and 95 percent confidence interval (CI).

[†] The reference category.

Table 32. Adjusted Odds Ratios for the Outcome of Participation in the VA or DoD Registries among Gulf War Veterans by Military Characteristics

Military Characteristics	All Gulf War Veterans Number (% of total)	Registry Participants Number (% of total)	Odds Ratio*	95% CI*
<i>Status</i>				
Active duty [†]	571,690 (84.3)	72,373 (73.2)	--	--
Reserve and National Guard	106,898 (15.7)	26,462 (26.8)	1.62	1.59--1.66
<i>Military Pay Grade</i>				
Commissioned officer [†]	65,155 (9.6)	6,322 (6.4)	--	--
Enlisted	604,469 (89.1)	90,924 (92.0)	2.04	1.98--2.10
Warrant officer	8,964 (1.3)	1,589 (1.6)	1.39	1.31--1.48
<i>Branch of Service</i>				
Navy and Coast Guard [†]	156,672 (23.1)	6,521 (6.6)	--	--
Army	342,240 (50.4)	75,511 (76.4)	4.57	4.44--4.70
Marines	102,374 (15.1)	10,614 (10.7)	2.64	2.55--2.73
Air Force	77,302 (11.4)	6,189 (6.3)	1.56	1.50--1.61
<i>Occupational Category</i>				
Electronic equipment repairers [†]	50,397 (7.4)	4,959 (5.0)	--	--
Infantry, gun crews, and seamanship	160,998 (23.7)	21,518 (21.8)	1.09	1.05--1.12
Communications and intelligence	62,860 (9.3)	8,723 (8.8)	1.01	0.97--1.05
Health care	42,737 (6.3)	7,600 (7.7)	1.18	1.13--1.23
Other technical	14,068 (2.1)	2,507 (2.5)	1.09	1.03--1.15
Functional support	78,307 (11.5)	12,785 (12.9)	0.97	0.94--1.01
Electrical/mechanical equipment	128,391 (18.9)	16,342 (16.5)	1.06	1.02--1.10
Craftworkers	24,902 (3.7)	3,631 (3.7)	1.27	1.21--1.33
Service and supply handlers	82,780 (12.2)	15,810 (16.0)	1.05	1.01--1.09
Non-occupational	7,204 (1.1)	755 (0.8)	0.99	0.91--1.07
Missing	25,944 (3.8)	4,205 (4.3)	1.04	0.99--1.09

* Adjusted odds ratio and 95 percent confidence interval (CI).

[†] The reference category.

Table 33. Adjusted Odds Ratios for the Outcome of Participation in the VA or DoD Registries among Gulf War Veterans by Wartime Exposures and by a History of Pre-War Hospitalization

Characteristic	All Gulf War Veterans Number (% of total)	Registry Participants Number (% of total)	Odds Ratio*	95% CI*
<i>Oil Well Fire</i>				
Not exposed [†]	66,645 (9.8)	3,102 (3.1)	--	--
Exposed	429,312 (63.3)	77,479 (78.4)	1.79	1.70--1.89
Unsure	182,631 (26.9)	18,254 (18.5)	1.19	1.13--1.25
<i>Khamisiyah Plume</i>				
Not under plume [†]	579,677 (85.4)	74,363 (75.2)	--	--
Under 2000 defined plume	98,921 (14.6)	24,472 (24.8)	1.10	1.08--1.12
<i>Vaccine**</i>				
No vaccine and unknown [†]	670,587 (98.8)	96,868 (98.0)	--	--
Botulinum toxin	530 (0.1)	88 (0.1)	1.16	0.92--1.48
Anthrax	7,460 (1.1)	1,876 (1.9)	0.91	0.86--0.96
Both	11 (0.0)	3 (0.0)	0.93	0.23--3.77
<i>Total days in theater</i>				
1-92 days [†]	171,852 (25.3)	16,266 (16.5)	--	--
93-149 days	168,074 (24.8)	27,441 (27.8)	1.17	1.14--1.20
150-197 days	176,794 (26.0)	27,773 (28.1)	1.21	1.18--1.25
198-572 days	161,868 (23.9)	27,355 (27.6)	1.24	1.20--1.29
<i>Prewar Hospitalization</i>				
No [†]	637,141 (93.9)	91,851 (92.9)	--	--
Yes	41,447 (6.1)	6,984 (7.1)	1.19	1.16--1.23

* Adjusted odds ratio and 95 percent confidence interval (CI).

[†] The reference category.

** Classification of vaccine status for this analysis was obtained from an indexed summary of biological defense vaccination records held by the U.S. Army Medical Material Development Activity, Fort Detrick, MD, as of 9 February 1996. The index was constructed from available verified (initialed or counter-signed) rosters of immunizations administered during the Gulf War deployment.

Future Research

A number of research studies using Gulf War veteran health registry data are being sponsored by DoD and VA. The Naval Health Research Center (NHRC) in San Diego has three ongoing epidemiological studies, focusing in whole or in part, on CCEP and VA health registry data. The first study is an extension of work already published where the investigators sought to identify demographic, deployment, and exposure predictors of registry participation.¹⁴⁰ The original study included data from 74,000 registry participants and demonstrated that older, Army, National Guard, enlisted, and female troops were most likely to have participated in a Gulf War health registry. The new study of risk factors will include data from over 100,000 registry participants. Statistical methods used to determine predictors of registry participation include logistic regression modeling and multivariate polychotomous logistic regression model analysis.

In a second study, researchers at NHRC are employing time series analytic techniques to predict participation in the DoD CCEP based on news events regarding Gulf War veteran's health problems. The study will determine whether major news media programs on Gulf War health issues prompted veterans to seek clinical evaluation. These two DoD-directed investigations are in the final drafting stages.

In a third NHRC study, an investigation is underway to determine if registry participants were more likely than non-participants to be hospitalized in DoD medical treatment facilities during the immediate post-war period (3 years from August 1, 1991 to June 6, 1994) for: 1) all causes, 2) diagnoses in major ICD-9-CM categories, and 3) specific diagnoses of special interest to veterans.

VA's Environmental Epidemiology Service (EES), Washington, DC, also is involved in a number of analyses of the data contained in the combined Gulf War clinical registries. Nested case-control analyses are being conducted for selected diagnoses, including post traumatic stress disorder (PTSD), dermatitis, lumbago, all cancers combined, migraine headaches, peripheral neuropathy, chronic obstructive pulmonary disease (COPD), and asthma. Multiple logistic analyses are being run for each of these diagnoses with adjustments for various demographic and military characteristics. Potential exposures to be explored in these logistic models include nerve gas, oil well fire smoke and particulates, anthrax vaccinations, self-reported exposures, and combat military assignments.

VA's EES additionally is conducting longitudinal analyses of registry data. Longitudinal evaluations are focusing on changes over time in disease and symptom patterns, and in the patterns of VA health care utilization and compensation for the registry participants. A final area of investigation is a detailed comparison of symptoms and diagnoses between CCEP and VA registry data for the 2,922 individuals who had a medical examination in both the VA and DoD clinical evaluation programs.

Conclusion

The VA *Gulf War Registry Health Examination Program* was a nationwide effort to provide Gulf War veterans with access to high quality health care. This clinical evaluation program served as entrée into the VA health care system for a new generation of war veterans. The VA registry also has been an effective tool for educating both health care providers and Gulf War veterans. By creating a specific program within VA, it was possible to furnish designated health care personnel with up-to-date information on a complex and rapidly changing health issue. As a result, VA physicians were able to offer veterans knowledgeable health care soon after the Gulf War. In addition, the VA registry generated a mailing list of concerned veterans, which has been used to provide information directly to this population as new clinical and research findings have become available.

In 1994, the Department of Defense developed the *Comprehensive Clinical Evaluation Program* (CCEP) and the VA upgraded its Gulf War registry. These two clinical evaluation programs were designed to collect comparable data on the health of Gulf War veterans. The initiation of DoD's Gulf War clinical evaluation program was critical in addressing the health concerns of veterans still on active duty. Because the DoD and VA clinical registries focused on different groups of veterans, they provided enhanced health care for the entire population of Gulf War veterans. Together, VA and DoD Gulf War clinical registries have provided a systematic clinical examination for over 14% of this population of war veterans. No previous military population has been as extensively evaluated as have Gulf War veterans.

In addition to patient care, the CCEP has assisted DoD in its outreach and educational efforts among military health care providers and among veterans and their families. Because of the DoD and VA clinical evaluation programs, informed health care professionals were available to answer many of the questions that veterans had about their wartime experiences, which is a prime responsibility of the government after sending troops to war.

Over the past 10 years, the clinical data obtained from the VA and DoD registries also contributed to health surveillance efforts among Gulf War veterans. Computerized clinical data obtained from this population of health care-seeking veterans has been continuously evaluated to identify unusual patterns of disease. Data from these clinical programs served another important role in research, by helping to generate hypotheses for further scientific studies on the health consequences of service in the Arabian Gulf.

The registries, which are in effect large clinical case-series, have increased our awareness and understanding of the wide spectrum of symptoms and health problems experienced by Gulf War veterans. More directly than any other method, face-to-face clinical examinations by VA and DoD physicians brought home the distress and needs of Gulf War veterans. The knowledge gained from examining veterans in the initial VA registry also proved critical in providing government assistance. Clinical registry data were used to develop and implement legislation that provided Gulf War veterans with disability assistance for unexplained symptoms (Public Law 103-446, November 2, 1994; "The Persian Gulf War Veterans Benefits Act").

Because of the inherent limitations of even very large clinical case-series, caution has to be exercised in the interpretation of registry data. The participants of these clinical evaluation programs are a self-selected group of veterans who were concerned about possible adverse exposures during military service. As a result, these veterans are not entirely representative of the overall population of Gulf War veterans. In fact, data from the VA National Survey of Gulf War veterans and results from other studies of U.S. and British veterans indicate that registry participants are more ill than other Gulf War veterans.

Because registry participants are not a random sample of Gulf War veterans, it is difficult to compare specific rates of various illnesses in the registries with other military and civilian populations. For example, it is not possible to determine whether a higher than expected percentage of registry patients have developed cancer, a neurological disorder, psychological problems, or kidney disease. Nor is it possible to determine whether a particular exposure in the Gulf caused an illness. Nevertheless, alarm bells would have sounded if a large number of registry participants had presented severely ill with a particular disease that could be associated with a wartime exposure.

Just as clinical case series cannot be used to determine specific rates of disease, conclusions about the overall health of Gulf War veterans cannot be drawn by considering the total number of registry participants (over 100,000 to date). Although one out of seven U.S. Gulf War veterans enrolled and were evaluated in one of the three registries, this does not mean that 100,000 Gulf War veterans have an unusual syndrome or are experiencing a serious illness. More than 80% of veterans evaluated in the registries had well-known health problems and received conventional diagnoses and treatment. Moreover, 6% to 9% of evaluated veterans reported that they were in very good or excellent health, or that they did not have a clinically significant new illness. Both VA and DoD have repeatedly encouraged all veterans with health concerns or questions to enroll in one of the clinical evaluation programs, whether they felt ill or not. This inclusive approach was taken in order to ensure that the health needs of all Gulf War veterans were adequately addressed by the government.

Although the registries cannot provide specific rates of disease, the massive outreach effort brought large numbers of veterans into the VA and DoD health care system for a standardized clinical evaluation, which increased the chances of identifying anything unusual. A clinical case-series, as provided by the VA and DoD registries, is the optimum initial approach for determining whether a population is suffering from a new or unique illness.²⁴¹ Whenever the question arises about a possible new syndrome the first step that has to be taken is to actually examine sick patients. It is not possible to draw conclusions from unconfirmed reports of an unusual disease or to design scientific studies before information is obtained by directly observing the nature of the problem. Consequently, the clinical data provided by the Gulf War registries in the USA, Britain, and Canada were critical in designing the initial research studies of Gulf War veterans.

In over 100,000 direct clinical examinations, no single type of illness predominated. Instead, Gulf War veterans were found to have a wide variety of health problems that are observed in other outpatient populations. Systematic evaluation of such a large population of veterans is unlikely to have missed examples of a serious disease. As noted seven years ago by an

independent scientific committee of the Institute of Medicine, which assessed the objective findings from the first 10,000 CCEP examinations, a unique illness that was both severe and common among Gulf War veterans would probably have been identified; whereas, a mild illness or a disease that affected a small number of veterans might escape detection.¹³⁵

Now that over 100,000 veterans have been examined since the end of the Gulf War, it is improbable that large numbers of Gulf War veterans could have developed a particular health problem, which has remained undetected over an 11 year period. The registries are unlikely to have missed examples of serious disease because Gulf War veterans with more severe health problems have tended to enroll for a registry examination. It also is important to note that a unique war syndrome has not been identified among the military veterans deployed by the other 40 Coalition countries or among the nearly one million local inhabitants of northern Saudi Arabia and Kuwait.

Although a unique health problem has not been identified, some research studies have found indications of various abnormalities among small groups of veterans. Consequently, VA and DoD supported research is in progress to determine whether these findings apply to a larger population of veterans and whether they are related to an adverse exposure during the Gulf War.³¹ Gulf War veterans also could develop well-known diseases with longer latency periods, as has happened among Vietnam veterans. For instance, there has been a determination that Vietnam veterans may be at increased risk of type II diabetes from exposure to Agent Orange. The health of Gulf War veterans therefore will have to be assessed in prospective studies. The VA continues to update mortality data on Gulf War veterans. In addition, there are several Federally-funded, longitudinal studies of morbidity among Gulf War veterans, and the DoD has designed a large epidemiological study, the Millennium Cohort Study, to assess the long-term health of deployed troops.³¹

The findings from over 100,000 clinical examinations have substantially aided health care efforts. Gulf War veterans who report health problems are definitely ill. However, they do not have a single type of health problem. Consequently, Gulf War veterans have to be evaluated and treated as individuals. Assumptions cannot be made about the health of a Gulf War veteran who presents for clinical evaluation. Each veteran requires a medical history and screening examination, with treatment tailored to the specific needs of the patient. For Gulf War veterans who have well-known health problems effective therapy is available. Treatment also is available for veterans with chronic, unexplained symptoms. Cognitive-behavioral therapy has been shown to reduce disability from many kinds of illnesses.^{242,243}

Several important lessons have been learned from the implementation and analysis of the VA and DoD Gulf War clinical evaluation programs. These registries have clearly shown that they can:

1. Provide high quality health care to concerned war veterans;
2. Serve an important educational and risk communication function for veterans and their families;
3. Generate research hypotheses; and,

4. Provide objective clinical data needed to design appropriate clinical and epidemiological research studies

Another important lesson learned from the Gulf War registry experience has been that structural differences must be eliminated in the design stage when more than one clinical registry is established for a population of veterans. Careful attention has to be paid to what tests are done, and how the data is captured and reported. Even minor differences in the structure of large clinical programs can have a substantial effect on analysis, preventing ready integration of databases. Close coordination will thus be required between VA and DoD in any future assessment of post-deployment health problems.

When considering the use of special clinical evaluation programs in the future, their shortcomings have to be understood as well. Because a clinical registry has to ensure a systematic and uniform clinical assessment to generate consistent data, clinicians are not free to eliminate unnecessary tests and procedures based on clinical judgment -- although both VA and DoD physicians have been encouraged to expand the scope of the standardized registry examination whenever necessary to arrive at a definite diagnosis. Due to this standardization, special clinical programs waste health care resources and generate confusion from false positive test results.

These problems have to be considered before deciding to implement a clinical registry, which is not based on a specific disease category. In addition, special clinical programs do not benefit veterans presenting for routine inpatient and outpatient care and not for a registry examination.

To address the shortcomings of special clinical evaluation programs, VA and DoD have taken concrete steps to better understand and routinely manage post-deployment health problems, and to improve veterans' satisfaction with their health care.^{244,245} Both VA and DoD have established deployment health research centers to determine the causes and most effective treatments for veterans' health problems. In addition, they are using an evidence-based approach to develop clinical practice guidelines for the evaluation of military personnel and veterans following hazardous deployments.²⁴⁶ Just completed are a "Post-Deployment Health Evaluation and Management Guideline" and a clinical practice guideline for chronic fatigue and muscle pain. A clinical guideline for PTSD will be a future step in the development of a sound strategy for the screening, assessment, and care of veterans returning from military deployments.

The regular use of clinical practice guidelines will decrease the need for *ad hoc* clinical evaluation programs. For the first time, troops will be specifically screened in the primary health care setting for illnesses that may be related to a military deployment. The Gulf War registry programs were good tools for bringing veterans into the VA and DoD health care systems, providing knowledgeable health care, and facilitating risk communication and educational efforts. However, special clinical programs only reach a minority of veterans and the clinical findings from self-selected populations are difficult to interpret. In contrast, the post-deployment clinical practice guidelines will ensure that the health problems of all veterans returning from hazardous deployments are addressed whenever they seek care in the DoD or VA health systems.

In addition to deployment research centers and clinical practice guidelines, DoD and VA have developed comprehensive educational and outreach programs. They have instituted internet web sites and augmented outreach efforts to provide deployed personnel and veterans, and their families, with timely information on health risks and the availability of clinical care and assistance.^{244,247} Web sites and other sources of deployment information also have been developed to assist military and VA health care personnel caring for service members and veterans following deployment.²⁴⁸

Eleven years after the war it is clear that the VA and DoD Gulf War clinical evaluation programs made an invaluable contribution to the health care of Gulf War veteran. Importantly, these special clinical programs pointed the way to improved systems of health care for future veterans of hazardous deployments. This report provides a summary of the clinical findings from the systematic examination of over 100,000 Gulf War veterans. These data will aid clinicians caring for Gulf War veterans and can be used to develop further research hypotheses.

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Figure 1. Gulf War Veterans Evaluated in the VA and DoD Clinical Evaluation Programs

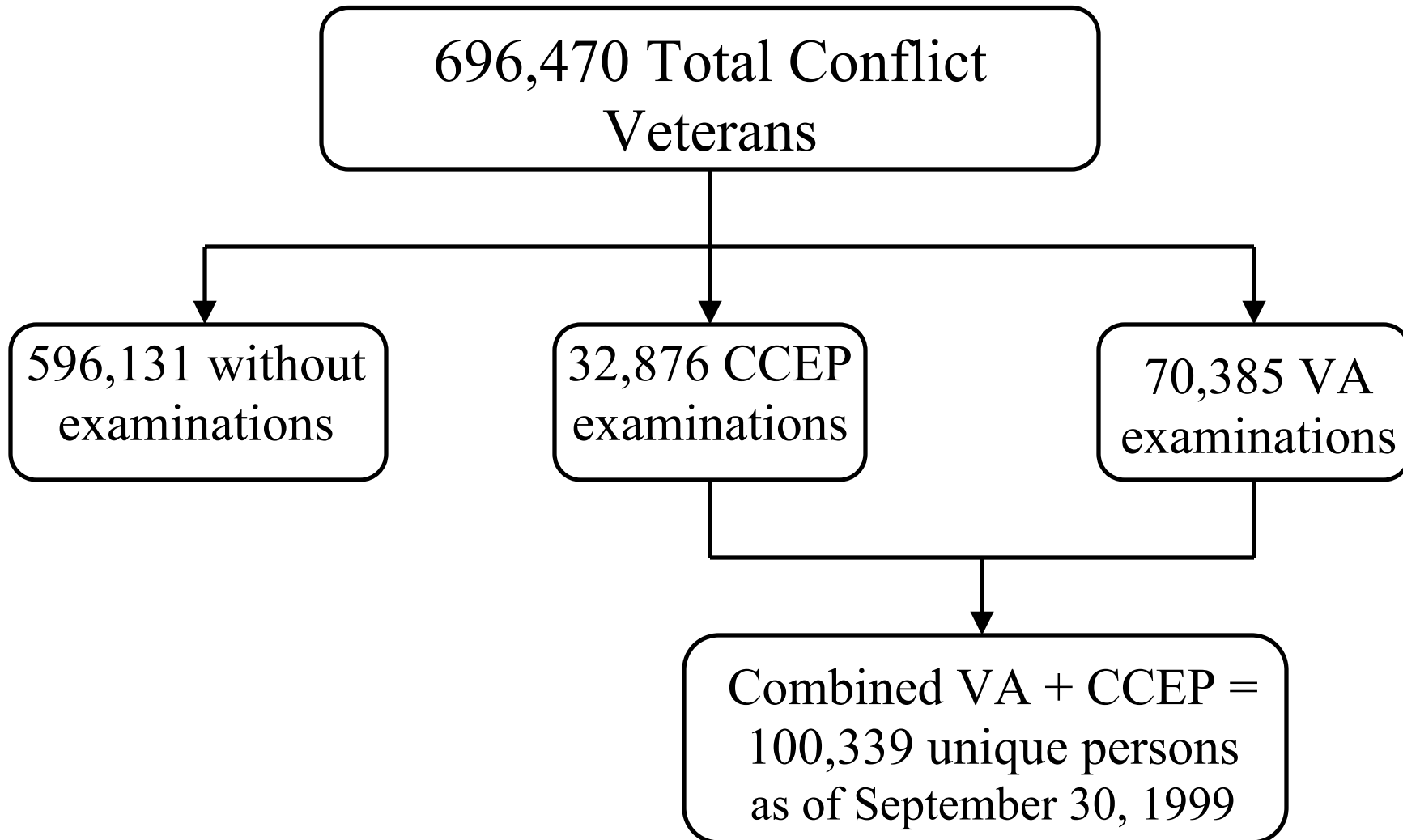


Figure 2. Number of Participants Enrolling in the Gulf War Clinical Evaluation Programs by Calendar Year

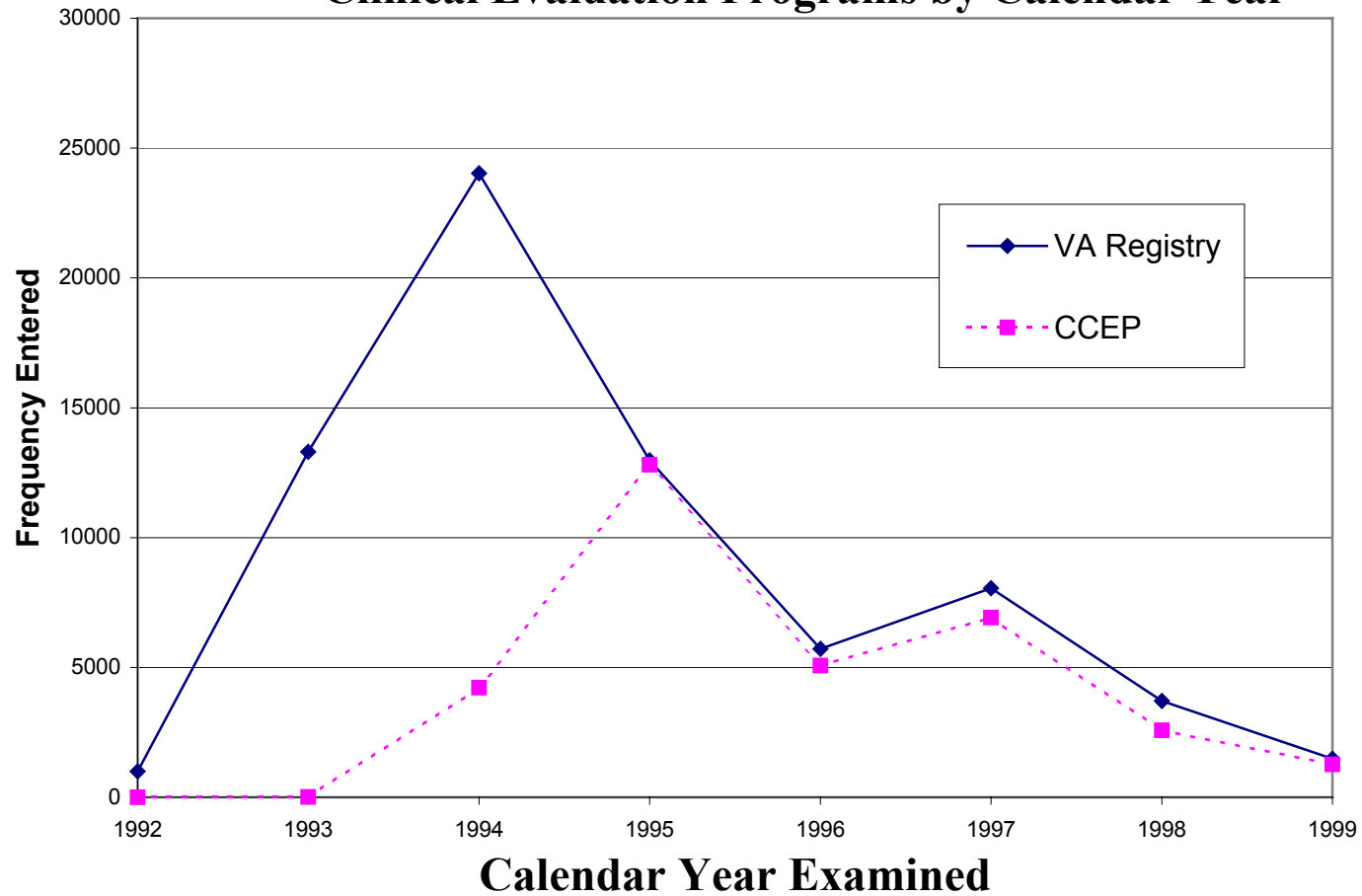
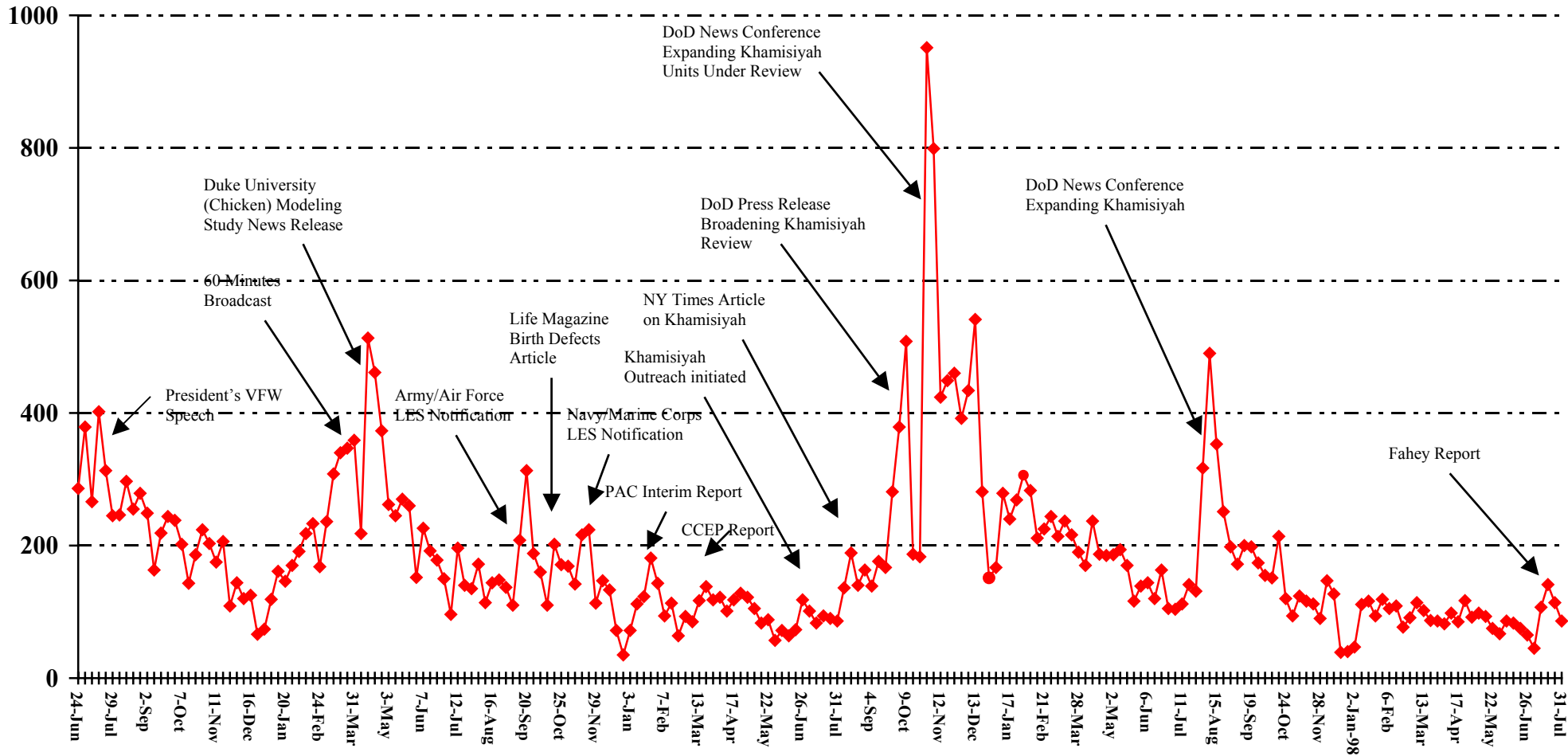


Figure 3. DOD CCEP Hotline Referrals: Influence of Popular Media Reports on Registry Enrollment (June 1994 - 31 July 1998)



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