Research to Improve the

Post-Deployment Health and Quality of Life of Veterans



DISCOVERY - INNOVATION - ADVANCEMENT

POST-DEPLOYMENT HEALTH

VA Research is conducting a wide array of studies to better understand and treat health challenges related to military deployments, ranging from mental health concerns and brain injuries to environmental exposures and infectious diseases.





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A Message to Our Veterans



Walk into any VA medical center in the nation, and you'll meet Veterans of all ages—some barely in their 20s, others in their 80s and 90s, even some past the remarkable age of 100.

They served in eras spanning from World War II to Operation New Dawn. Some fought in steamy Pacific jungles, others in scorched deserts or on frozen mountainsides.

With each war, each conflict on foreign soil, each deployment, our Veterans have come home with special health challenges. We in VA have done our best to care for them and promote their recovery.

Some deployment-related health problems are common to every generation of war Veterans. One example is posttraumatic stress disorder (PTSD), known in previous eras as "soldier's heart," "shell shock," or "combat fatigue." Other issues, such as Agent Orange exposure, are linked to service in particular eras and settings.

For nearly nine decades, VA researchers have driven improvements in how our nation helps Veterans heal after their deployments. VA studies, always focused on the Veteran, have addressed the full range of physical, mental, and emotional issues related to wartime service. Some of the earliest VA research, in the mid-1920s, sought to help World War I Veterans who had survived mustard gas attacks. VA researchers looked at the long-term health effects of these exposures, such as chronic bronchitis. Other studies, in this era as well as after World War II, focused on tuberculosis, a significant problem among returning Servicemembers.

Fast-forward to 2011, and VA researchers continue to diligently pursue solutions to the most pressing deployment-related health challenges. Veterans who served in Iraq and Afghanistan are benefiting from new approaches to PTSD treatment, as are many Veterans from previous eras who continue to receive PTSD care. The high prevalence of traumatic brain injury—mainly from blasts—among recent Veterans has spurred innovations in brain imaging. And in VA prosthetics labs and clinics, artificial limbs with space-age componentry and control systems are being developed and tested to give unprecedented independence to Veterans who have undergone traumatic amputations.

In this brochure, you'll get a brief overview of these and other exciting developments in the area of post-deployment health. I invite you to visit our website at **www.research.va.gov** to learn more.

Long-term epidemiologic studies

VA is conducting, funding, or collaborating with other agencies—namely DoD—on several longitudinal epidemiologic studies focused on deployment health. These studies track Servicemembers and Veterans over several years and collect health information at various time points, and through various methods—such as in-person exams, telephone or mail surveys, or medical chart reviews. The goal is to identify health issues related to deployment and explore their possible causes.

• The "Millennium Cohort Study" is the largest prospective health project in military history. Now in its 10th year, the study is funded by DoD and supported by VA and civilian researchers. Almost 150,000 Servicemembers have participated so far, about half of whom have been deployed to Iraq or Afghanistan or surrounding regions, and a third of whom are women. The study has already produced valuable knowledge and resulted in dozens of scientific publications, addressing mental as well as physical health. A study appearing in the May 2011 Archives of General Psychiatry, for example, traced the role of pre-deployment psychiatric conditions and deployment-related physical injuries in the development of post-deployment PTSD.

• The "National Health Study for a New Generation of U.S. Veterans," now under way, will involve up to 60,000 Veterans who served between 2001 and 2008, about half of whom were deployed to Iraq or Afghanistan. The VA Office of Public Health will follow the Veterans through 2013 and ask about a wide range of mental and physical health topics, as well as hazardous exposures. A subset of study participants will take part in the Markers for the Identification, Norming, and Differentiation of TBI and PTSD (MIND) study. This trial will focus on the complex interplay between the two conditions, with the goal of improving diagnosis and treatment. • The "Longitudinal Health Study of Gulf War Era Veterans" is one of the largest scientific research studies on the health of Gulf War Veterans. This study compares changes in the health of 1990-1991 deployed Gulf War Veterans to Veterans not deployed to the Gulf War. Published findings from this research have provided a better understanding of functional health, acute and chronic diseases, multi-symptom illnesses, and mental health outcomes among Gulf War-era Veterans. VA Office of Public Health researchers conducted a baseline survey of 30,000 Veterans in 1995 and a follow-up survey in 2005. They are now planning to survey this group of Veterans a third time.

 "Long Term Health Outcomes of Women's Service During the Vietnam Era," sponsored by VA's Cooperative Studies Program, is the most comprehensive study to date of the mental and physical health of women who served during the Vietnam era. Already under way, the effort will include up to 10,000 women, including those who served in or near Vietnam—many as nurses—and others who served stateside. The study is expected to play a critical role in shaping VA care for this cohort of women Veterans and forging a future research agenda. A similar study, involving some 10,000 male members of the Vietnam Era Twin Registry, was undertaken previously and is still in progress. In addition, VA is supporting a long-term project called the National Vietnam Veterans Longitudinal Study to help provide definitive information about the longterm effects of combat-related mental health.



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Mental health

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Post-deployment mental health is a top priority for VA research. Areas of particular interest include PTSD, depression, substance abuse, and suicide prevention.

VA's landmark clinical trial of prolonged exposure therapy for PTSD in women, published in the *Journal of the American Medical Association* in 2007, yielded results that have already impacted the lives of thousands of Veterans, both women and men. This study, along with other research, has resulted in the national dissemination and implementation of evidence-based psychotherapies for PTSD. Prolonged exposure therapy, in particular, is now strongly recommended in the VA/Department of Defense (DoD) Clinical Practice Guidelines for PTSD.

As of early 2011, VA had trained more than 3,000 mental health providers in prolonged exposure therapy or another evidence-based treatment known as cognitive processing therapy. Many therapists have completed both trainings.

In related research, VA investigators are exploring the use of virtual reality software to assist in prolonged exposure therapy. Other groups are looking at the role of telehealth in providing therapy to Veterans who may live far from VA clinics or are unable to travel.

Aside from behavioral therapy, VA studies are influential in helping providers and their patients choose the right pharmaceutical treatments for PTSD and related issues. A major clinical trial published in August 2011 in the *New England Journal of Medicine* found that Veterans with chronic, tough-to-treat posttraumatic stress disorder showed little benefit from an anti-psychotic given to augment their existing drug or psychotherapy treatment. The study was conducted by VA and Yale University.

Other key studies now under way:

• "Neuropsychological and Mental Health Outcomes of OIF: A Longitudinal Cohort Study" is examining the possible lasting health effects of the Iraq War. The effort involves several hundred Army soldiers who had taken part in an earlier joint VA-DoD study. Researchers hope to learn about any enduring effects of war on mood and stress symptoms, thinking and reaction skills, and daily function.

• The San Diego-based "Marine Resiliency Study" involves more than three battalions of Marines. Researchers are probing dozens of risk factors, from biological to behavioral, that may affect the ability to withstand mental and emotional stress.

Importantly, these studies are collecting valuable mental and physical health information prior to deployment, and then conducting assessments after the deployment ends. Such efforts help researchers pinpoint the health impacts of combat duty.

Other ongoing research includes a large multisite clinical trial of an inexpensive generic drug, prazosin, shown in smaller trials to ease PTSD-related nightmares; an investigation into the genetic basis of anxiety; and studies on suicide risk factors, especially among combat Veterans.

In mental health as in other areas, VA works closely with private and public partners, including federal agencies such as DoD and the National Institutes of Health (NIH). In 2009, VA and other federal partners convened an expert panel focused on substance abuse and related mental illnesses among military personnel, Veterans, and their families. The meeting resulted in new funding from VA and NIH for 16 innovative research projects. Among the studies based at VA sites:

- In West Haven, VA researchers are exploring differences in addiction behaviors between men and women Veterans.
- In Little Rock, VA investigators are conducting in-depth interviews with Veterans coping with substance abuse to better understand post-deployment addiction and treatment-seeking.
- At the Philadelphia VA Medical Center, investigators are working with Veterans who have an addiction and PTSD to study whether the two issues are best treated at the same time or one after the other.

Women Veterans: Special Focus on Mental Health

VA has significantly increased research on women Veterans' health in recent years. Many of these studies have focused on improving screening for mental health needs, identifying the effects of military stressors on post-deployment reintegration and readjustment, and understanding gender differences in barriers to obtaining mental health care.

Studies on military sexual trauma (MST) are probing the complex relationships among different pre-military and deployment-related traumas, and how these experiences affect women's mental and physical health throughout their lives. One study, published in the *American Journal of Public Health* in August 2010, found that among Iraq and Afghanistan Veterans using VA care, 15 percent of women and fewer than 1 percent of men reported a history of MST. Those reporting MST were more likely to have a mental health diagnosis such as PTSD, anxiety, depression, or a substance use disorder.

A supplement in the July 2011 issue of *Women's Health Issues* included a series of articles on women Veterans' health, including several on mental health topics such as PTSD and military sexual trauma. The abstracts can be accessed at www.whijournal.com.

Traumatic Brain Injury

Due to the widespread use of roadside bombs, or improvised explosive devices (IEDs), in Iraq and Afghanistan, high



numbers of U.S. troops have been exposed to blasts. Some personnel have endured several blasts during a tour of duty, and the experience can be repeated over two or three tours.

As a result, many Servicemembers have returned home with traumatic brain injury (TBI). The majority of cases are classified as mild, but even these Veterans can experience lasting symptoms, such as headaches or impaired mood and focus, that significantly impact work, communal, and family life.

VA has been in the forefront of research on TBI. The efforts span biomedical lab studies that examine brain cells; studies of new brain-imaging techniques; research on vision and hearing deficits linked to blast exposures and TBI; creation of a registry of Veterans with TBI; and comparative effectiveness trials looking at different methods of cognitive rehabilitation.

Two areas of TBI research that are particularly promising:

Brain Imaging VA researchers are exploring the use of innovative technologies such as diffusion tensor imaging—a variation of magnetic resonance imaging that detects abnormalities in the brain's white matter—and magnetoencephalography, which tracks the firing of neurons and thus pinpoints problems in how brain cells communicate with each other. Advances in this area will help researchers define the structural and biochemical changes that occur in blast-related TBI, and track improvements in brain function as a result of treatment.

Registry For Veterans of Iraq and Afghanistan who are experiencing symptoms of a TBI, researchers are creating a comprehensive registry by collecting VA data on demographics, military service, medical and treatment histories, causes and severity of injuries, VA disability claims status, and vital status. The registry will allow for comparisons of screening, diagnostic methods, and treatment outcomes, with the goal of improving outcomes for Veterans who have experienced this injury.

Polytrauma

Today, Servicemembers who are seriously wounded in combat are surviving in far greater numbers than in the past, due mainly to advances in body armor, battlefield medicine, and medical evacuation techniques. As a result, many Servicemembers are returning home with severe, complex wounds and injuries, some of which may involve lifelong disability.

VA research addresses the full spectrum of health issues typically involved in polytrauma: limb loss, brain injury, pain, vision and hearing loss, spinal cord injury, infection, burns, PTSD. Aside from studies that focus individually on these issues, there is a growing body of research addressing polytrauma as a topic in its own right. For example, a study published in the *American Journal of Physical Medicine and Rehabilitation* in June 2010 discussed the impact of the "polytrauma clinical triad"—pain, PTSD, and TBI—on the quality of sleep for affected Veterans.

Much of VA's research on polytrauma is conducted in collaboration with clinicians at VA's four main polytrauma care centers, in Richmond, Tampa, Minneapolis, and Palo Alto. More information on the polytrauma/TBI system of care can be found at www.polytrauma.va.gov.

Reaching Out to Caregivers

Partly as a result of the Caregivers and Veterans Omnibus Health Services Act of 2010, an increasing network of services and resources is now available for family caregivers of Veterans, including those caring for Veterans with deployment-related health conditions. Even before this expansion of services, VA researchers had increased their efforts to identify the needs of Veterans' caregivers and to develop and evaluate programs that offer vital support.

For example:

- Researchers at the Memphis VA Medical Center have been testing a telephone intervention based on the Army's Spouse Battlemind program. The telephone outreach includes education, support, and cognitive behavioral therapy to build spouses' resilience during the post-deployment reintegration phase.
- At the VA Puget Sound Health Care System, researchers have examined the value of peer visitors not only for Veterans with polytrauma and brain injury, but for their caregivers as well.
- A team with the polytrauma and brain injury branch of VA's Quality Enhancement Research Initiative has conducted extensive surveys of more than 500 family caregivers of severely injured Veterans. The results were published online in August 2011 in the *Journal* of Head Trauma and Rehabilitation and have been disseminated among VA policymakers to help guide services.

Gulf War Veterans' Illnesses

During and after the first Gulf War in the early 1990s, those deployed to the region reported health problems at higher rates than those who were not deployed.

Common symptoms have included headaches, joint and muscle pain, fatigue, attention and memory difficulty, indigestion, sleep disturbances, respiratory problems, and skin abnormalities. Some of the Veterans reporting health problems meet the diagnostic criteria for chronic fatigue syndrome or fibromyalgia. Most, however, have what VA terms "medically unexplained chronic multisymptom illnesses."

Although the exact causes remain unknown, several VA epidemiologic studies have documented the higher rates of physical and mental illness reported by deployed Gulf War Veterans.

For example:

• In 2007 in the *British Journal of Psychiatry*, researchers with VA and Harvard University reported that the rate of mental disorders and psychological symptoms that began during the Gulf War era was twice as high among deployed versus non-deployed Veterans.

- In a study published in 2009 in the *Journal of the International Neuropsychological Society*, the same researchers found subtle declines of motor speed and sustained attention among deployed Veterans, "despite overall intact neuropsychological functioning."
- A study that appeared in September 2011 in the *American Journal of Epidemiology* compared changes in health between 1995 and 2005 among nearly 9,000 deployed and non-deployed Veterans of the Gulf era. The study confirmed and extended earlier findings: Deployed Veterans were more likely than non-deployed Veterans to report new health problems and greater persistence of existing illnesses. Differences between the groups were seen in areas such as limitation of daily activities, repeated clinic visits, recurrent hospitalizations, self-perceived health status, and chronic fatigue and posttraumatic stress symptoms.



VA continues to support research dedicated to understanding chronic multi-symptom illnesses and the long-term health effects of potentially hazardous substances to which Gulf War Veterans may have been exposed, such as depleted uranium or smoke from oil well fires.

Visit www.publichealth.va.gov for a full discussion of these issues, as well as information about VA's comprehensive Gulf War Registry health exams, free to eligible Veterans.

Some of this research is supported through the Department of Defense and the Congressionally Directed Medical Research Program, including a study by Dr. Ronald Bach of the Minneapolis VA Medical Center, who is examining the level of a protein called "tissue factor" in blood samples from Gulf War Veterans. The protein promotes healthy clotting. Too much of it, however, can restrict blood flow in small blood vessels throughout the body. Over time, this can lead to symptoms such as pain, fatigue, and slowed thinking—all associated with Gulf War Veterans' health problems. Dr. Bach's team is also measuring other proteins linked to coagulation, as well as to inflammation. The researchers hope their analysis will uncover new biomarkers for Gulf War Veterans' illnesses.

Longer-term plans include a new study of Gulf War Veterans through VA's Cooperative Studies Program (www.research.va.gov/programs/csrd/csp.cfm). The effort entails collection of survey data and banking of blood in a "biorepository" to better understand genetic influences on Gulf War illnesses and responses to treatments. This study, like other VA research in this area, is guided by Institute of Medicine reports, recommendations from the VA Research Advisory Committee on Gulf War Veterans' Illnesses (www.va.gov/rac-gwvi), and rigorous evaluations of the existing scientific and medical literature.

VA also recognizes the importance of studying other conditions that may affect Gulf War Veterans, such as brain cancer, amyotrophic lateral sclerosis (Lou Gehrig's disease, or ALS), and multiple sclerosis. VA maintains very active research portfolios in each of these areas, with the aim of improving life for Veterans of any era who may be affected.

Hazardous Exposures

Much of VA's Gulf War research centers on the possible longterm health effects of potential exposures to environmental toxins. This area of research plays a role with regard to other conflicts, as well.

Working in conjunction with the VA Office of Research and Development, the VA Office of Public Health conducts large-scale epidemiologic studies—as well as outreach and educational campaigns—focused on hazardous exposures linked to various eras. Agent Orange, an herbicide used in Vietnam and Korea, is a prime example. Possible exposures associated with deployment to Iraq and Afghanistan involve burn pits, infectious diseases, shrapnel containing depleted uranium, toxic paints used on military vehicles, and other issues.

In late 2011, VA will receive the results of an in-depth Institute of Medicine review on the potential adverse health effects of burn pit exposure. VA is also sponsoring other studies on this topic, with the goal of guiding future research and tailoring policy, care, and services to reflect the latest knowledge.

A thorough discussion of VA-sponsored research on hazardous exposures can be found at www.publichealth.va.gov.

Prosthetics and Related Issues

VA supports several teams of talented bioengineers and health scientists who are developing and testing the newest generation of prosthetic devices. Some of this technology is designed to replace an amputated limb; other systems and devices, known as "neural prostheses," replace the function of an injured nervous system.

Neural prostheses typically involve delivering small electrical currents to activate muscles that are no longer receiving electrical brain impulses through the spinal cord. The technology can help those with paralysis to use a hand or even walk. Other applications are designed to restore or assist bladder or bowel function.

This work complements VA biomedical and clinical studies on spinal cord injury and limb loss. Of particular note in these areas:

• The new VA Spinal Cord Injury Collaborative Translational Consortium is building teams of leading investigators almost a "Who's Who" of spinal cord research in the U.S. today—to nurture high-risk, high-return ideas and to build synergy among scientists in pursuit of the same goal. As part of this effort, a group at the San Diego VA Medical Center is using proteins to coax nerve cells to sprout new axons, and identifying networks of genes that trigger nerve regrowth.

• Scientists at the Center for Regenerative and Restorative Medicine, based at the Providence VA Medical Center, are studying how to merge biological tissues and non-biological materials to create lifelike "biohybrid" limbs to restore lost or severely wounded limbs.

Prosthetics Highlights

High-tech arm—VA is testing a high-tech prosthetic arm developed for the Defense Advanced Research Projects Agency by DEKA Integrated Solutions. Veterans in the study are providing feedback to guide DEKA in optimizing the arm's features and function. VA is also looking at the possibility of mounting these advanced prosthetic arms on wheelchairs for Veterans with highlevel spinal cord injuries, thus expanding their ability to do everyday tasks on their own. In related research, VA and Brown University researchers are conducting feasibility studies to see if the DEKA arm can be controlled through brain-computer interfaces. They are using technology called "BrainGate," which involves a tiny array of electrodes that is implanted in the brain.

Bionic ankle—In early 2011, a Special Forces Veteran who served in Iraq and Afghanistan became the first VA patient to be fitted with a bionic ankle developed by researchers with VA, the

Massachusetts Institute of Technology, and Brown University. The ankle, known as the PowerFoot, has been shown to reduce fatigue and improve balance. It features microprocessors and sensors that continually evaluate and adjust ankle position.



For more information

- VA Research and Development www.research.va.gov
- VA Public Health
 www.publichealth.va.gov
- War Related Illness and Injury Study Center www.warrelatedillness.va.gov
- VA Polytrauma/TBI System of Care www.polytrauma.va.gov
- National Center for PTSD www.ptsd.va.gov
- Defense and Veterans Brain Injury Center www.dvbic.org

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