

ene receptor antagonists during pregnancy. *J Allergy Clin Immunol* 2007;119:618-25.

2. National Asthma Education and Prevention Program Asthma and Pregnancy Working Group. NAEP Expert Panel report:

managing asthma during pregnancy: recommendations for pharmacologic treatment — 2004 update. *J Allergy Clin Immunol* 2005;115:34-46. [Erratum, *J Allergy Clin Immunol* 2005;115:477.]

Care of War Veterans with Mild Traumatic Brain Injury

TO THE EDITOR: The views expressed by Hoge and colleagues in their Perspective article (April 16 issue)¹ on the role of mild traumatic brain injury (TBI) in postdeployment dysfunction are not upheld by the clinical experience of most experts who provide care. The authors' concern that the post-deployment system of care implemented by the Veterans Health Administration (VHA) has unintended adverse health consequences is based on inaccurate information.

Screening for TBI is part of broader post-deployment screening for potential health problems, including post-traumatic stress disorder (PTSD), depression, alcohol abuse, infectious diseases, and chronic symptoms. Screening by the VHA helps to identify populations at risk and to structure standardized care. Screening for TBI identifies symptomatic persons who may have had TBI and need a more comprehensive evaluation. This interdisciplinary evaluation determines whether TBI occurred; identifies active symptoms, relevant medical conditions, and psychiatric factors; and permits the development of a treatment plan. These evaluations are typically conducted in rehabilitation-medicine clinics designed specifically for cases of mild TBI.

Overlap in the symptoms of residual effects of concussion, PTSD, depression, and chronic pain is well recognized and is the rationale for an interdisciplinary approach. The majority of veterans who are screened have been determined not to have TBI, yet many have symptoms that are evaluated and treated — according to clinical practice guidelines developed by a panel of experts, including Hoge.² Mental health services are integrated into these programs, and patient education regarding an expected positive outcome is a cornerstone intervention. Ongoing medical education activities help to ensure the provision of standardized care that follows these empirical treatment strategies.

Barbara Sigford, M.D., Ph.D.

Minneapolis VA Medical Center
Minneapolis, MN 55417

David X. Cifu, M.D.

Hunter Holmes McGuire VA Medical Center
Richmond, VA 23249
david.cifu@va.gov

Rodney Vanderploeg, Ph.D.

James A. Haley VA Medical Center
Tampa, FL 33612

The views expressed are those of the authors and do not necessarily represent the views of the Department of Veterans Affairs.

1. Hoge CW, Goldberg HM, Castro CA. Care of war veterans with mild traumatic brain injury — flawed perspectives. *N Engl J Med* 2009;360:1588-91.

2. The Management of Concussion/mTBI Working Group. VA/DOD clinical practice guideline for management of concussion/mild traumatic brain injury. Washington, DC: Department of Veterans Affairs, 2009.

TO THE EDITOR: The opinions expressed by Hoge et al. are flawed and misrepresent the evidence. More specifically, TBI, like other diseases, presents with a continuum of severity (mild to severe). To argue that mild TBI has a different epidemiology is to ignore evidence of this spectrum of severity. Substituting the term “concussion” for mild TBI changes the rhetoric, not the science or sequelae.

The accepted incidence of postconcussive symptoms in civilians is 5 to 20%,^{1,2} not 3 to 5%. A range of factors contributes to the presentation of symptoms and recovery in cases of mild TBI. Indeed, a set of symptoms has been found to be both sensitive and specific in the diagnosis of mild TBI.³ Thus, although some symptoms may be non-specific (as with many other medical conditions), others are not. Experienced clinicians consider all contributing factors in making diagnostic decisions. Education after mild TBI has been found to reduce distress rather than exacerbate the condition.⁴

The opinions expressed by Hoge et al. may harm service members and civilians alike by limiting the identification of persons who are injured and the provision of appropriate care, thereby causing unnecessary suffering, disability,⁵ and ultimately greater taxpayer expense.

Susan Connors, B.A.

Brain Injury Association of America
Vienna, VA 22182

Wayne A. Gordon, Ph.D.

American Congress of Rehabilitation Medicine
Indianapolis, IN 46220
wayne.gordon@mountsinai.org

David A. Hovda, Ph.D.

National Neurotrauma Society
Los Angeles, CA 90095

1. Alexander MP. Mild traumatic brain injury: pathophysiology, natural history, and clinical management. *Neurology* 1995;45:1253-60.
2. Wrightson P, Gronwall D. Time off work and symptoms after minor head injury. *Injury* 1981;12:445-54.
3. Gordon WA, Haddad L, Brown M, Hibbard MR, Sliwinski M. The sensitivity and specificity and self-reported symptoms in individuals with traumatic brain injury. *Brain Inj* 2000;14:21-33.
4. Mittenberg W, Canyock EM, Condit D, Patton C. Treatment of post-concussion syndrome following mild head injury. *J Clin Exp Neuropsychol* 2001;23:829-36.
5. Gordon WA. A wound obscure, yet serious: consequences of unidentified traumatic brain injury are often severe. Washington, DC: Dana Press, 2009. (Accessed July 10, 2009, at <http://www.dana.org/news/cerebrum/detail.aspx?id=13570>.)

TO THE EDITOR: Although we applaud Hoge et al. for raising awareness about the assessment and treatment of TBI, our study¹ was described incorrectly. First, the authors stated that we “illogically” concluded that quickly resolving concussions cost more than PTSD or depression. We agree that this conclusion would have been illogical, and in fact our cost estimates for mild TBI apply only to 1800 diagnosed, treated cases reported by the Department of Defense. Cases requiring treatment have not resolved quickly and have necessitated substantial outpatient rehabilitation and resultant unemployment costs. Second, the Perspective article describes our study as “biased” in claiming that 300,000 veterans have TBI. However, our report did not estimate the current prevalence of TBI. We concluded that 300,000 people had probable TBI while deployed but that the number of people who are currently experiencing any impairment is unknown. We agree with the authors that additional research is needed to characterize the long-term sequelae of TBI and to improve treatment for those with these impairments.

Christine Eibner, Ph.D.

Terry L. Schell, Ph.D.

Lisa H. Jaycox, Ph.D.

RAND
Arlington, VA 22202
eibner@rand.org

1. Tanielian T, Jaycox LH, eds. *Invisible wounds of war: psychological and cognitive injuries, their consequences, and services to assist recovery*. Santa Monica, CA: RAND, 2008. (Accessed July 10, 2009, at <http://www.rand.org/pubs/monographs/MG720/>.)

THE AUTHORS REPLY: When health policies are based more on the opinions of experts than on rigorous science, unnecessary risks may result. Sigford and colleagues confirm that “experts” in the Department of Veterans Affairs (VA) have selected specialty services over primary care models as the preferred strategy for treating postwar symptoms attributed to concussion/mild TBI, ignoring substantial evidence to the contrary.¹ Primary care professionals provide the majority of care to veterans yet had virtually no representation on committees responsible for drafting current concussion/mild TBI health policies. Research has shown that clinical guidelines developed by primary care professionals agree with the evidence-based literature more often than do guidelines developed by specialists.² Controversies regarding concussion/mild TBI will not get resolved unless there is critical evaluation of the problems inherent in expert consensus processes.³

Effective interventions rely on precise terminology and correct interpretation of clinical and epidemiologic data. The 1995 review article by Alexander,⁴ frequently quoted to support claims such as that of Connors et al. that persistent symptoms develop in 5 to 20% of individuals after concussion, has been discredited through reexamination of the source material^{5,6}; 3 to 5% is as accurate an estimate as current case definitions allow.^{5,6} The terms “TBI,” “mild TBI,” “postconcussive symptoms,” and “concussion” are not simply semantics but are crucial for effective patient communication and the fostering of positive expectations for recovery.

Given the importance of positive expectations, the RAND investigators’ report that 300,000 veterans experienced a “probable traumatic brain injury,” based on a question that cannot distinguish concussion from other causes of battlefield confusion, defies explanation. Presenting noncomparable cost estimates for concussion/mild TBI and PTSD together in one paragraph of their report was equally irresponsible.

The belief by subject-matter experts that clinical experience or unique symptoms can reliably make a diagnosis in individuals who retrospectively report concussion/mild TBI has not been

substantiated in well-controlled or prospective studies.^{1,5,6} Of veterans identified as having sustained a concussion/mild TBI, nearly half are “confirmed” to have persistent postconcussive symptomatology in VA and Department of Defense clinical evaluations. This is inconsistent with the natural history of concussion and suggests that the evaluation process itself reinforces misdiagnosis. As sociologist Robert K. Merton wrote in 1948, “The specious validity of the self-fulfilling prophecy perpetuates a reign of error.” Harm to service members and veterans results not from scientific perspectives expressed in peer-reviewed journals but from implementation of non-evidence-based policies and programs. The imperative is to act on all available knowledge in a deliberately scientific manner, but above all else, “First, do no harm.”

Charles W. Hoge, M.D.

Herb M. Goldberg, B.A., B.Ed.

Walter Reed Army Institute of Research
Silver Spring, MD 20910
charles.hoge@us.army.mil

Carl A. Castro, Ph.D.

U.S. Army Medical Research and Materiel Command
Fort Detrick, MD 21702

The views expressed are those of the authors and do not represent the official policy or position of the U.S. Army or the Department of Defense.

1. Hoge CW, Goldberg HM, Castro CA. Care of war veterans with mild traumatic brain injury: flawed perspectives. *N Engl Med* 2006;360 (Web-only supplement). (Available at <http://content.nejm.org/content/vol360/issue16/index.dtl>)
2. Raine R, Sanderson C, Hutchings A, Carter S, Larkin K, Black N. An experimental study of determinants of group judgments in clinical guideline development. *Lancet* 2004;364:429-37.
3. Oxman AD, Fretheim A, Schünemann HJ. Improving the use of research evidence in guideline development: introduction. *Health Res Policy Syst* 2006;4:12.
4. Alexander MP. Mild traumatic brain injury: pathophysiology, natural history, and clinical management. *Neurology* 1995;45:1253-60.
5. McCrea MA. Mild traumatic brain injury and postconcussion syndrome: the new evidence base for diagnosis and treatment. Oxford, England: Oxford University Press, 2008:163-7.
6. Iverson GL, Zasler ND, Lange RT. Post-concussive disorder. In: Zasler ND, Katz DI, Zafonte RD, eds. *Brain injury medicine: principles and practice*. New York: Demos Medical Publishing, 2007:373-403.

Whole-Body Magnetic Resonance Neurography

TO THE EDITOR: Noninvasive selective visualization of the whole peripheral nervous system may be useful but has not been possible. Although the brain and spinal cord are well visualized with magnetic resonance (MR) imaging, peripheral nerves cannot be selectively visualized by commonly used methods, such as T_1 -weighted and (fat-suppressed) T_2 -weighted imaging, because of the similarity in signal intensities between the peripheral nerves and surrounding structures on these images.^{1,2} This report describes an MR-based approach that is capable of selectively visualizing the peripheral nervous system over long trajectories in a single examination: whole-body MR neurography.

We used a 1.5-T system (Achieva, Philips Healthcare) to perform whole-body MR neurography on a healthy 23-year-old male volunteer and a 73-year-old man with clinicopathological findings (numbness in both hands and a tendency to fall) that supported the diagnosis of chronic inflammatory demyelinating polyneuropathy (CIDP). CIDP is a chronically progressive or relapsing symmetric sensorimotor disorder, with a relatively low incidence, leading to peripheral-nerve thickening.³

The applied whole-body MR neurography technique is based on the recently developed concept

of diffusion-weighted whole-body imaging with background body signal suppression (DWIBS).⁴ This diffusion-weighted sequence depicts tissues with a relatively long T_2 relaxation time and an impeded diffusion such as the brain, spinal cord, and peripheral nerves.⁴ Furthermore, the use of a short-inversion-time inversion recovery prepulse for robust fat suppression over an extended field of view and heavy diffusion weighting ensure the suppression of unwanted signals, like those of free fluid, fat, muscles, tendons, and blood vessels.⁴ Most important, this concept allows image acquisition under free breathing. As a result, the image-acquisition time is efficiently long, as compared with breath-hold and respiratory-triggered image acquisition. This, in turn, allows thin-slice acquisitions and multiple-slice excitations for three-dimensional reformatting and display.⁴

In the healthy volunteer, normal-sized brachial and lumbosacral plexi were visualized, whereas other peripheral nerves could hardly be seen (Fig. 1A). In contrast, in the 73-year-old patient with CIDP, whole-body MR neurography showed symmetrical, widespread thickening of peripheral nerves in the entire body (Fig. 1B).

We have demonstrated the feasibility of whole-