Geographic Access to VHA Rehabilitation Services for Traumatically Injured Veterans

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The flip side of the decrease in mortality after traumatic injury associated with OEF and OIF is the increase in the number of veterans dealing with long-term sequelae of these injuries. These investigators examine how well the geographic distribution of VA rehabilitation resources matches up with veterans' locations.

The VHA has devoted significant effort to ensuring that veterans of Operation Enduring Freedom (OEF) and Operation Iraqi Freedom (OIF) receive appropriate health care resources with the development of such initiatives as the Seamless Transition Program, the Polytrauma System of Care, and specialized mental health clinics. Nevertheless, a report by the VA Office of Inspector General (OIG) suggests that OEF/OIF veterans with traumatic injuries experience obstacles in obtaining access to postacute rehabilitation care.[1] Furthermore, because OEF/OIF veterans have different sociodemographic characteristics, military experiences, and health conditions than veterans of preceding service eras, they can be expected to have distinctive medical needs and expectations.

Compared to those of prior military engagements, the injuries sustained by today's soldiers are not as lethal due, in part, to advances in military protective gear and the enhanced ability of medical personnel to respond to the needs of the injured. Specifically, the placement of medical personnel near combat zones and the ability to evacuate the wounded to technically sophisticated medical facilities have increased the survival of soldiers wounded in action.[2]

A consequence of this reduced mortality, however, is an increased incidence of certain types of injuries. It is estimated that approximately 22% of the wounded personnel passing through Landstuhl Regional Medical Center in Landstuhl, Germany have suffered a traumatic brain injury (TBI). By contrast, roughly 13% of Vietnam veterans who were wounded in combat had a brain injury—chiefly because the mortality rate among U.S military personnel who sustained a brain injury while fighting in Vietnam was 75%.[3] Moreover, it took 45 days, on average, for soldiers wounded in Vietnam to arrive in the United States, whereas this interval averages about four days for Iraqi theater casualties.[4]

Because OEF/OIF veterans are experiencing a greater degree of traumatic injuries, including multiple traumatic injuries (known as polytrauma), they may have a greater need for long-term rehabilitation services than veterans of past conflicts. In addition, because of their unique health care needs, injured OEF/OIF veterans may encounter obstacles in obtaining access to postacute rehabilitation services that could affect their outcomes. The aforementioned OIG survey, which specifically addressed access to care for patients with TBI, found that 38% of respondents reported that transportation was "a major obstacle

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toward getting enough help."[1] Available research also suggests that the ease with which patients can access specialized rehabilitation care may vary depending on the geographic distance between the patient and the treatment site.[5] Primary health care providers' patterns of referral also play an important role in determining access to rehabilitation services.[5,6]

To increase knowledge concerning access to health care services for OEF/OIF veterans, we studied a subpopulation of these war fighters with traumatic injury who separated from the armed forces and used health care services at a VHA facility during fiscal year (FY) 2003 or FY 2004. Here, we present the results of this study, which identify geographic areas where the need for VHA rehabilitation services and potential access gaps appear greatest.

METHODS

Our study design was retrospective and cross-sectional. The group of participants included in the study consisted of all OEF/OIF veterans who accessed the VA health care system between October 1, 2002 and September 30, 2004 and had *International Classification of Diseases, Ninth Revision, Clinical Modification* (ICD-9-CM) diagnostic codes in their records that identified them as potential candidates for rehabilitation. Qualifying ICD-9-CM codes were selected in seven impairment groups: (1) traumatic brain dysfunction; (2) traumatic spinal cord dysfunction; (3) traumatic amputation; (4) burns; (5) legal blindness/visual impairment; (6) orthopedic disorders; and (7) auditory dysfunction (Table 1). The study protocol was approved by the University of Florida Institutional Review Board and the VA Subcommittee for Clinical Investigations.

Data sources

Data in this study were extracted from three main sources: the OEF/OIF roster, medical SAS (SAS Institute Inc., Cary, NC) datasets, and facility information from the VHA Planning System Support Group (PSSG).

The OEF/OIF roster lists personnel who have served in Iraq, Afghanistan, or both; separated from the military; and either enrolled in the VA health care system or used a VA facility for health care. This SAS dataset is cumulative, and it is updated as new information is received. From the OEF/OIF roster, we extracted the scrambled Social Security numbers (SCRSSNs) of OEF/OIF veterans who had contact with the VHA during the

Table 1. ICD-9-CM[a] codes used to identify participants for the study

Impairment category	Codes
Traumatic brain dysfunction	
Open	800.50–800.99, 801.50–801.99, 803.50–803.99, 804.50–804.99, 851.10–851.99, 852.10–852.59, 853.10–853.19, 854.10–854.19, 905.0
Closed	310.2, 800.00–800.49, 801.00–801.49, 803.00–803.49, 804.00–804.49, 851.00–851.89, 852.00–852.49, 853.00–853.09, 854.00–854.09, 905.0, 907.0
Traumatic spinal cord dysfunction	806.00–806.9, 907.2, 907.3, 952.00–952.9, 953.0–953.9
Traumatic amputation	887.0–887.7, 896.0–896.3, 897.0–897.7, 905.9, E878.5, V49.6, V49.7
Burns	941.00–941.59, 942.00–941.59, 943.00–943.59, 944.00–944.59, 945.00–945.59, 946.00–946.59, 947.00–947.59, 948.00–948.59
Legal blindness/visual impairment	369.01, 369.02, 369.05, 369.11, 369.4, 369.15, 368.9, 367.9
Orthopedic disorders	820.00–820.9, 821.00–821.39, 808.8–808.9, 827–828, 823.00–823.92, 839.00–839.9, 905.1–905.6
Auditory dysfunction	384.2x, 385.23, 386.53–386.56, 388.11, 388.12, 388.31, 388.32, 388.42–388.44, 388.71, 388.72, 389.01–389.04, 389.11, 389.12, 389.14, 389.15, 389.16, 389.18, 389.2, 872.00, 872.01, 872.02, 872.10–872.12, 872.61–872.64, 872.69, 872.71–872.74, 872.79, 872.9

[a]ICD-9-CM = *International Classification of Diseases, Ninth Revision, Clinical Modification.*

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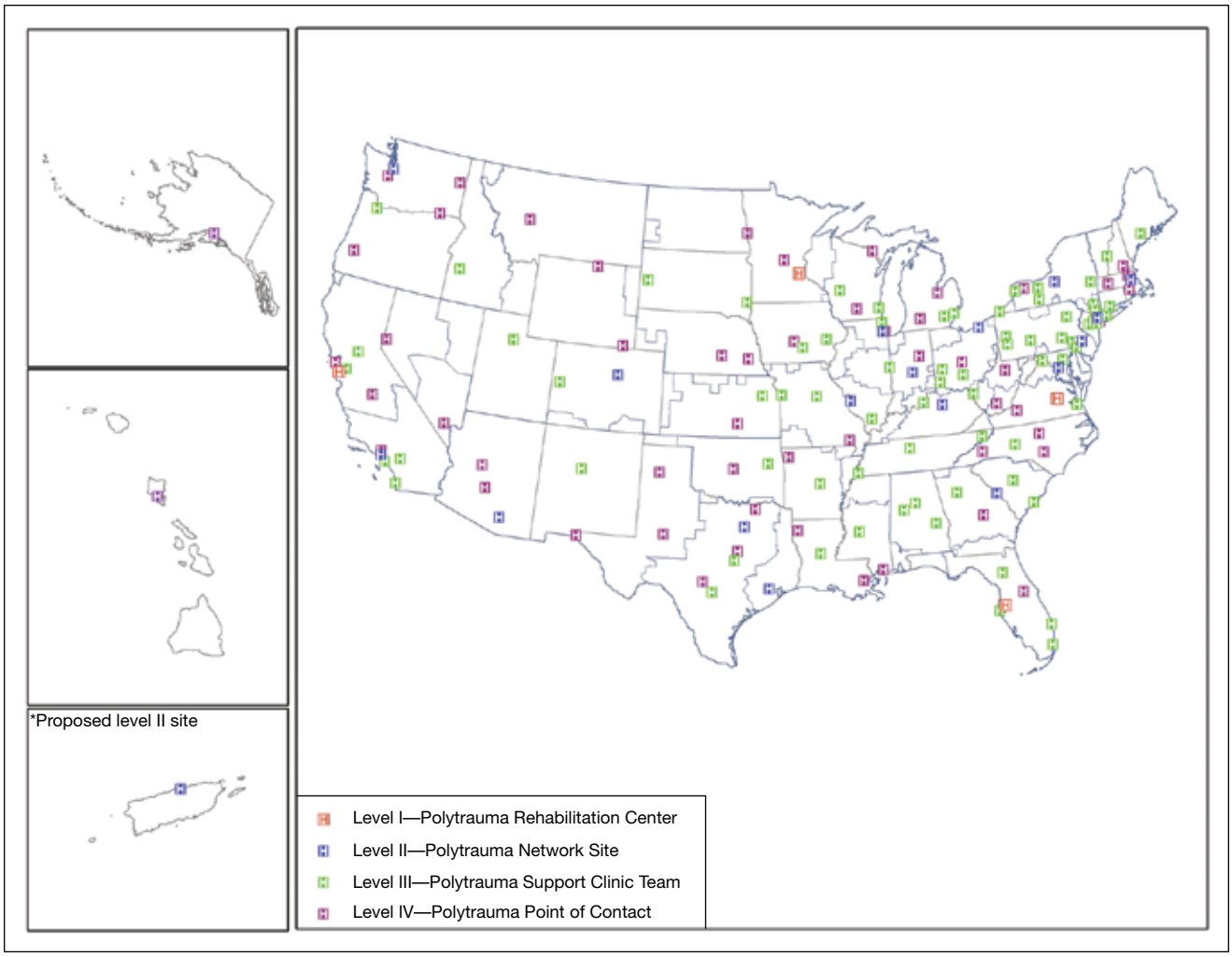

Figure 1. Geographic location of facilities (levels I through IV) in the VA's Polytrauma System of Care.

study period, and we used this number as a patient identifier to link with other VA databases.

The VA electronically captures workload at all of its facilities through the VA Health Information System and Technology Architecture (VistA). Selected information is rolled up to the national level and made accessible to researchers with approved clearance through SAS datasets generated out of the National Patient Care Database. Workload from various clinical settings can be linked to each patient using the SCRSSN. In this way, we extracted data on OEF/OIF veterans who used VHA services during the study period from the inpatient, outpatient, and extended care datasets.

The PSSG maintains a database of all VHA facilities, called the VA Site Tracking System. This database includes the street address, latitude, and longitude of each facility. Driving time bands of 0 to 15 minutes, 15 to 30 minutes, 30 to 60 minutes, 60 to 120 minutes, and 120 to 240 minutes around each VHA facility are available from the PSSG as shape files compatible with the Geographic Information System (GIS) software used in this study (ArcMap 9.2; ESRI, Redlands, CA). The shape files are created using a methodology that adjusts for population density and type of road.

Geographic analyses

For this study, the VHA Physical Medicine and Rehabilitation Service provided information on the level of rehabilitation care available in the VHA Polytrauma System of Care (Figure 1). Polytrauma Rehabilitation Centers (level I) provide

acute, comprehensive, inpatient rehabilitation. Polytrauma Network Sites (level II) provide specialized, postacute rehabilitation in consultation with the Polytrauma Rehabilitation Centers in a setting appropriate to veterans' needs. These Network Sites provide case management for existing and emerging conditions and identify local VA and non-VA resources for care. Polytrauma Support Clinic Teams (level III) are groups of rehabilitation providers who deliver follow-up services in consultation with regional and network specialists. The Polytrauma Point of Contact (level IV) facilities provide referrals to higher level rehabilitation services. This extensive network of facilities encompasses all 50 states—and a level II site has been proposed for San Juan, PR.

In addition to the standard time bands available from the PSSG, a band of 480 minutes (eight hours) was calculated for the four level I Polytrauma Rehabilitation Centers using the same methodology. Time bands calculated for the other facilities in the Polytrauma System of Care were as follows: level II, four hours; level III, one hour; and level IV, 30 minutes. For the purposes of our study, we assumed that the proposed level II site in San Juan, PR would receive that designation in the near future.

A gap analysis was performed using five steps: (1) locate polytrauma level I to IV centers and patient zip code origins; (2) apply the access criteria to create time bands around facilities; (3) identify zip codes outside of the time bands; (4) aggregate the number of patients to the county level; and (5) identify counties with more than 10 patients outside of the time bands. Counties with more than 10 patients outside of the time bands were flagged as areas with potential gaps.

RESULTS

Study cohort

We identified a two-year total of 7,842 OEF/OIF veterans with traumatic injury who used VA health care (Table 2). In both years, hearing impairment was the most common injury, with 58% of the FY 2003 and 65.3% of the FY 2004 cohorts having a diagnostic code in this impairment group. The second most common affliction for both years was visual impairment (30.5% of the FY 2003 and 27% of the FY 2004 cohorts). The proportion of polytrauma patients in the cohort increased from 4.7% in FY 2003 to 5.7% in FY 2004.

The mean age of the study participants was 38.1 years in the FY 2003 cohort and 34.9 years in FY 2004 cohort. Contrary to the popular stereotype of very young casualties, the age group with the largest representation among our population of OEF/OIF veterans with traumatic injury was 35 to 44 years during both FYs. Male veterans overwhelmingly outnumbered female veterans in both FYs (92% versus 8%, respectively, for both FYs). Racially, approximately two thirds of both the FY 2003 and FY 2004 cohorts were white. Blacks represented about 13% and Hispanics comprised roughly 16% of both cohorts.

For the combined cohort, the median distance to level I, level II, and level III polytrauma facilities was 411, 121, and 64 miles, respectively. The median distance to the closest VA health care facility was 22 miles.

Access to rehabilitation services

For each veteran included in the study cohort, the zip code of the veteran's known home address was plotted against the map of polytrauma facility drive time bands to determine whether the zip code fell within or outside the time band for the nearest facility (Figure 2). Overall, the results showed 88.2% of OEF/OIF veterans included in the study were within designated time bands for VHA rehabilitation services.

To identify areas with potential access gaps, we aggregated the number of veterans from the study cohort who were located outside the drive time bands at the county level and identified counties that contained more than 10 such veterans. This analysis revealed four counties in Alabama (Marion, Lamar, Madison, and Mobile) and one county each in Nevada (Clark), North Dakota (Ward), Texas (El Paso), Hawaii (Honolulu), Alaska (Anchorage), and Mississippi (Jackson) as having potential access gaps. Clark County, NV and El Paso County, TX had the highest numbers of veterans outside the drive time bands (64 and 30 veterans, respectively).

DISCUSSION

According to the results of our study, the VHA provides access to rehabilitation care for the majority of traumatically injured OEF/OIF veterans. More than 10% of these veterans, however, may face access barriers due to excessive travel time. As the number of traumatically injured military personnel returning to the United States and separating from the armed forces rises, it will be increasingly important to use available tools, such as the VHA's Medical SAS datasets and GIS software, to continue monitoring where these veterans are located vis-à-vis VHA facilities.

Past research has shown the relationship between timely receipt of rehabilitation services and patient outcomes. In 1999, the National Institutes of Health's Consensus Panel on Rehabilitation of Persons with Traumatic Brain Injury stressed the

Table 2. Characteristics of OEF[a]/OIF[b] cohorts

Characteristic	FY[c] 2003 cohort (n = 1,923)	FY 2004 cohort (n = 5,917)	Combined cohort (N = 7,842)
Impairment group, no. (%)[d]			
Traumatic brain dysfunction	88 (4.6)	244 (4.1)	332 (4.2)
Open	13 (0.7)	50 (0.8)	63 (0.8)
Closed	87 (4.5)	241 (4.1)	328 (4.2)
Traumatic spinal cord dysfunction	48 (2.5)	77 (1.3)	125 (1.6)
Traumatic amputation	24 (1.3)	78 (1.3)	102 (1.3)
Burns	58 (3.0)	110 (1.9)	168 (2.1)
Visual impairment	587 (30.5)	1,600 (27.0)	2,187 (27.9)
Orthopedic	100 (5.2)	307 (5.2)	407 (5.2)
Auditory dysfunction	1,115 (58.0)	3,865 (65.3)	4,980 (63.5)
Polytrauma	91 (4.7)	336 (5.7)	427 (5.4)
Demographic characteristics			
Male gender, no. (%)	1,767 (91.9)	5,456 (92.2)	7,223 (92.1)
Age in years, mean (SD)	38.1 (10.5)	34.9 (10.5)	35.6 (10.6)
Age categories, no. (%)			
< 25 years	298 (15.5)	1,421 (24.0)	1,719 (21.9)
25–34 years	407 (21.2)	1,536 (26.0)	1,943 (24.8)
35–44 years	655 (34.1)	1,768 (29.9)	2,423 (30.9)
45–54 years	455 (23.7)	991 (16.7)	1,446 (18.4)
≥ 55 years	108 (5.6)	203 (3.4)	311 (4.0)
Race, no. (%)			
White	1,259 (65.5)	3,849 (65.0)	5,108 (65.1)
Black	260 (13.5)	772 (13.0)	1,032 (13.2)
Hispanic	299 (15.5)	1,002 (16.9)	1,301 (16.6)
Other	58 (3.0)	175 (3.0)	233 (3.0)
Data missing	47 (2.4)	121 (2.0)	168 (2.1)
Median distance in miles			
To nearest VA facility	21	23	22
To nearest level III facility	58	66	64
To nearest level II facility	118	121	121
To nearest level I facility	411	411	411

[a]OEF = Operation Enduring Freedom. [b]OIF = Operation Iraqi Freedom. [c]FY = fiscal year. [d]Total number of patients in all categories exceeds total number of patients in the study because some patients had multiple impairments.

wide geographic variation in access to rehabilitation services and the resulting adverse consequences of not receiving timely treatment.[5] In burn patients there is some evidence that intensive treatment on a specialized burn unit by a multidisciplinary team may shorten length of stay and speed the patient's recovery.[7] Among patients with lower extremity orthopedic problems, the amount of physical therapy received by patients during hospitalization was found to be related directly to functional improvement at discharge.[8,9] Furthermore, benefits from continued outpatient rehabilitation after hospitalization have been reported for patients with spinal cord dysfunction as well, with the greatest functional improvements being made for patients who received

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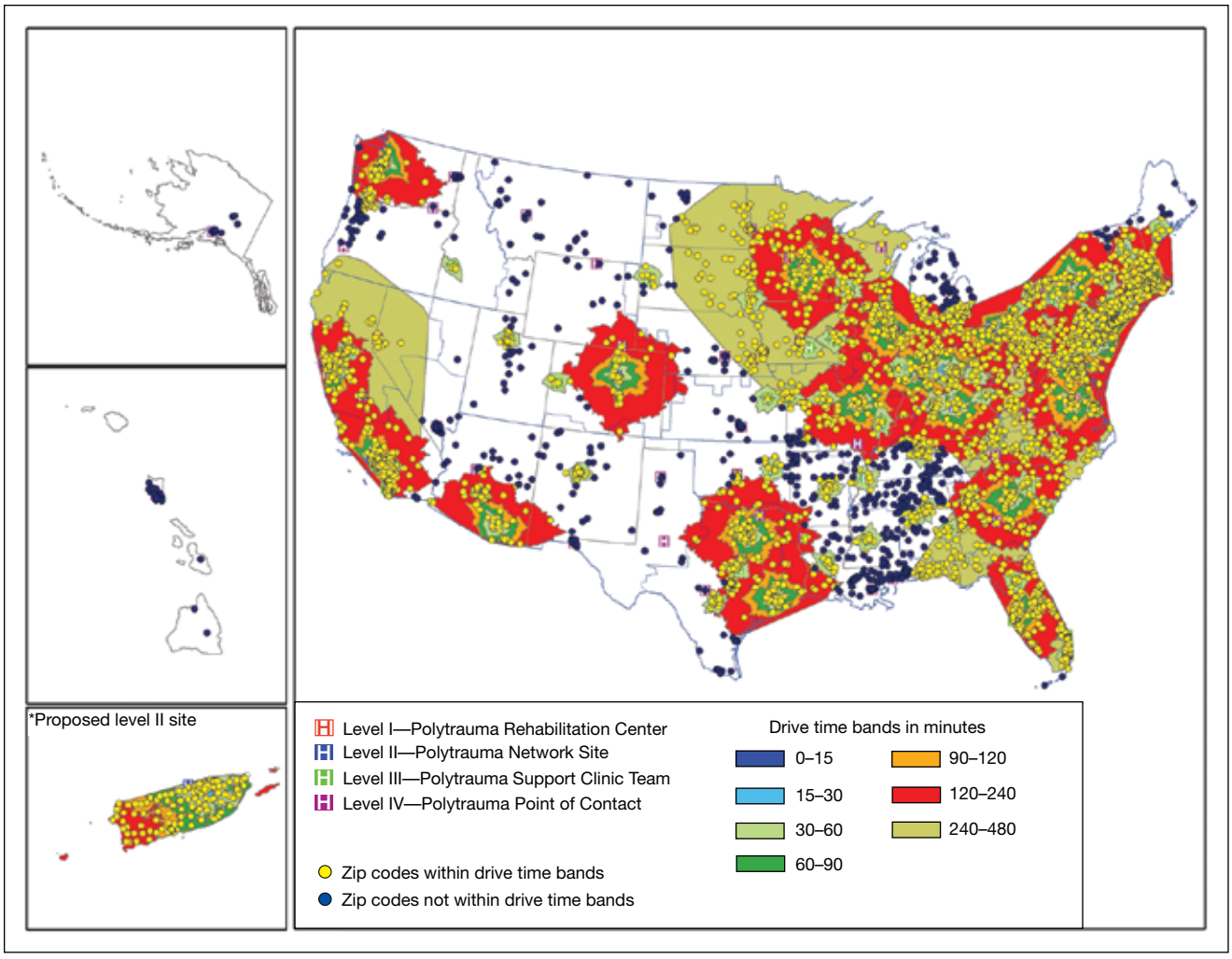

Figure 2. Zip codes of traumatically injured Operation Enduring Freedom/Operation Iraqi Freedom veterans included in the study, plotted in relation to (drive time) distance from nearest VA polytrauma facility. Drive time bands were calculated around the facilities, based on their designation as level I, II, III, or IV facilities. Each zip code plotted represents one or more veterans included in the study.

more than 40 hours of rehabilitation after discharge.[10]

In 1997, the VHA had 65 specialized inpatient rehabilitation units. Today, there are only 45 such units.[11] Given the small number of these valued units, it is vital to ensure that they are located where there is the greatest need for rehabilitation services. If new resources are added, it is equally important to locate them where they will have the greatest impact.

Study limitations

There are several limitations to this study. The first is that we did not have access to data that would have indicated whether veterans used rehabilitation services outside of the VHA. Some returning veterans with traumatic injury, who have private insurance, may use the VHA for select services and access a non-VHA provider for other services. Second, data in our study are from only two cross-sectional points in time: FY 2003 and FY 2004. Access to and patterns of rehabilitation services use among the traumatically injured cohort of OEF/OIF veterans may have changed over time. Finally, the level of polytrauma care in VHA facilities may have upgraded from the FY 2003 to FY 2004 time period studied.

FUTURE DIRECTIONS

Future work will include replication of the analyses to update the list of areas where access gaps may exist. It

will also be important to locate OEF/OIF veterans who do not use VHA services. Timely completion of these studies requires access to data and, for investigations into veterans not using the VHA, data use agreements across federal agencies. Once data sharing is streamlined between the VA and DoD, monitoring the location and needs of the returning war fighters in relation to VHA services can be performed on a regular basis using the methodology developed for this study. ●

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