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Fractures among Members of Active Components, US Armed Forces, 1998-2003

Injuries are consistently a leading cause of morbidity and mortality among U.S. servicemembers.[1-5] Members of the U.S. military are at risk of acute traumatic injuries during training and operations (e.g., parachuting, driving, flying, operating heavy equipment)[1,3,4,6,7,8] as well as off-duty (e.g., participating in sports, driving, fighting).[3,5,9] Fractures—breaks, ruptures, or cracks in bone or cartilage—are relatively common acute traumatic injuries.[2-4,7,8] While most fractures are not life threatening or extremely costly (in terms of medical resources), they generally cause physical disabilities and decrements of operational capabilities that last for weeks to months.[3] This report summarizes the incidence rates, trends, and demographic correlates of fractures among members of the active components of the U.S. Armed Forces from 1998-2003.

Methods. The Defense Medical Surveillance System was searched to identify all records of hospitalizations and ambulatory visits with diagnoses of fractures (ICD-9-CM: 800-829; 733.1; 733.93; 733.95) among active duty servicemembers from 1998 through 2003. All reports of fractures (regardless of the position of the diagnosis, if more than one) were grouped into 36 categories (e.g., based on affected bones and general causes). To exclude follow-up visits of single fracture episodes, only one fracture per category per person per 180 days was included. Thus, for example, if an individual fractured a femur and an ankle during a single episode, both were counted as incident fractures in their respective categories, and all diagnoses of femur or ankle fracture within 180 days of the incident episode were considered follow-up visits and were excluded. For summary purposes, the 36 categories were further grouped in relation to affected anatomical sites (with a separate category for stress fractures).

Results. During the 6-year surveillance period, 289,807 active duty servicemembers had a total of 452,688 fractures. The crude fracture incidence rate was 54.7 per 1,000 person-years (table 1). Approximately one-third of all affected individuals had more than one fracture during the period. The mean number of fractures per affected servicemember was 1.56.

Fractures involving the hand (13.8 per 1,000 person-years) and foot (12.1 per 1,000 person-years) were the most frequent overall (table 1). In general, numbers and rates of fractures (overall and site specific) were stable from 1998 through 2002—then declined in 2003 (due, at least in part, to underascertainment of cases among deployed servicemembers) (figure 1, table 2).

Of note, the overall rate of "stress fractures" (a separate category for this analysis) was 7.4 per 1,000 person-years (table 1). In contrast to other groups, reports of "stress fractures" increased sharply in the later years of the surveillance period (table 2).

In general, fracture rates were higher among women than men (due in large part to the extreme relative excess of stress fractures among young females) (figure 2). However, men had substantially higher rates than women of hand, face, shoulder, and rib fractures (figure 2).

Overall and site specific rates of fractures tended to decrease with age. For example, rates of stress fractures—and to a lesser extent, foot, leg, and pelvis fractures—were much higher among teenaged compared to older servicemembers. In contrast, rib fracture rates were higher among servicemembers older than 40 compared to those younger (figure 2).

In general, fracture rates were higher in the Marine Corps (75.4 per 1,000 person-years) and Army (71.3 per 1,000 person-years) than in the Air Force and Navy (figure 3). Compared to members of the other Services, Marines had higher rates of hand, foot, leg, face, shoulder, and unspecified fractures. Stress fracture rates were higher in the Army than the other Services.

Finally, in general, the highest rates of fractures overall and by site were in the "non-occupational" (includes trainees and students) (87.6 per 1,000 person-years), "infantry, gun crews, and seamanship" (includes most combat-specific occupations) (67.7 per 1,000 person-years), and "service and supply handler" (65.4 per 1,000 person-years) occupational groups (table 3). Of note, "craftsworkers" had the highest

Table 1. Frequencies and rates of fractures, active components, U.S. Armed Forces, 1998-2003

	Frequency	Percentage of total	Rate per 1,000 person-years
Total	*452,688*	*100.0*	*54.7*
Hand			
Phalanges of hand	45,128	10.0	5.5
Metacarpal	41,112	9.1	5.0
Carpal	25,053	5.5	3.0
Multiple hand bones	3,175	0.7	0.4
(subtotal: hand)	*114,468*	*25.3*	*13.8*
Foot			
Tarsal and metatarsal	46,700	10.3	5.6
Ankle	36,909	8.2	4.5
Phalanges of foot	16,937	3.7	2.0
(subtotal: foot)	*100,546*	*22.2*	*12.1*
Stress/spontaneous			
Spontaneous, stress (pre-2001)	47,012	10.4	5.7
Spontaneous, stress: tibia or fibula	6,891	1.5	0.8
Spontaneous, stress: other	4,576	1.0	0.6
Spontaneous, stress: metatarsals	2,884	0.6	0.3
(subtotal: stress/spontaneous)	*61,363*	*13.6*	*7.4*
Leg			
Tibia and fibula	27,892	6.2	3.4
Femur	9,314	2.1	1.1
Patella	3,757	0.8	0.5
(subtotal: leg)	*40,963*	*9.0*	*4.9*
Arm			
Radius and ulna	30,263	6.7	3.7
Humerus	7,571	1.7	0.9
(subtotal: arm)	*37,834*	*8.4*	*4.6*
Unspecified			
(subtotal: unspecified)	*33,516*	*7.4*	*4.0*
Face			
Nasal	10,383	2.3	1.3
Skull	3,516	0.8	0.4
Other facial	3,227	0.7	0.4
Mandible	3,169	0.7	0.4
Orbital	2,641	0.6	0.3
Malar and maxillary	2,358	0.5	0.3
(subtotal: face)	*25,294*	*5.6*	*3.1*
Shoulder			
Clavicle	8,723	1.9	1.1
Scapula	1,730	0.4	0.2
(subtotal: shoulder)	*10,453*	*2.3*	*1.3*
Vertebra			
(subtotal: vertebra)	*9,336*	*2.1*	*1.1*
Multiple			
Multiple-lower limb	3,868	0.9	0.5
Multiple-upper limb	2,333	0.5	0.3
Multiple-facial and other	587	0.1	0.1
Multiple-lower limbs and other	351	0.1	0.0
Multiple-upper limbs and other	216	0.0	0.0
Multiple-trunk	146	0.0	0.0
(subtotal: multiple)	*7,501*	*1.7*	*0.9*
Ribs			
(subtotal: ribs)	*6,457*	*1.4*	*0.8*
Pelvis			
(subtotal: pelvis)	*4,396*	*1.0*	*0.5*
Sternum			
(subtotal: sternum)	*487*	*0.1*	*0.1*
Larynx and trachea			
(subtotal: larynx, trachea)	*74*	*0.0*	*0.0*

rates of hand fractures and the second-highest rate of arm fractures (table 3).

Editorial comment. Fractures (in the absence of other serious injuries) are often considered common, easily treatable, acute traumatic injuries. In fact, fractures are a significant source of morbidity and lost duty time among members of the U.S. Armed Forces.[1-3]

This analysis documents that, in general, hands and feet are the most common sites of fractures among U.S. servicemembers. Of note, among females (particularly those younger than 20 years old), stress fractures are the most common fractures.

Efforts to prevent stress fractures of the lower extremities among initial entry (particularly female) trainees should continue to be emphasized.[5,10] Among younger males, particularly soldiers and Marines with combat-specific occupational specialties, prevention efforts could be guided by information regarding the circumstances (e.g., on duty, off duty) and activities (e.g., sports participation, parachuting, motorcycling, alcohol consumption, fighting) most often associated with fracture risk.

Finally, worksite safety procedures (in both garrison and field settings) should be emphasized to prevent acute traumatic injuries, particularly of fingers, hands, and arms, among military craftsmen (e.g., machinists, carpenters, plumbers, construction equipment operators).

Analysis and report by Karen E. Johnson, MS, Analysis Group, Army Medical Surveillance Activity.

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Figure 1. Rates of fractures by category and gender, US Armed Forces, 1998-2003.

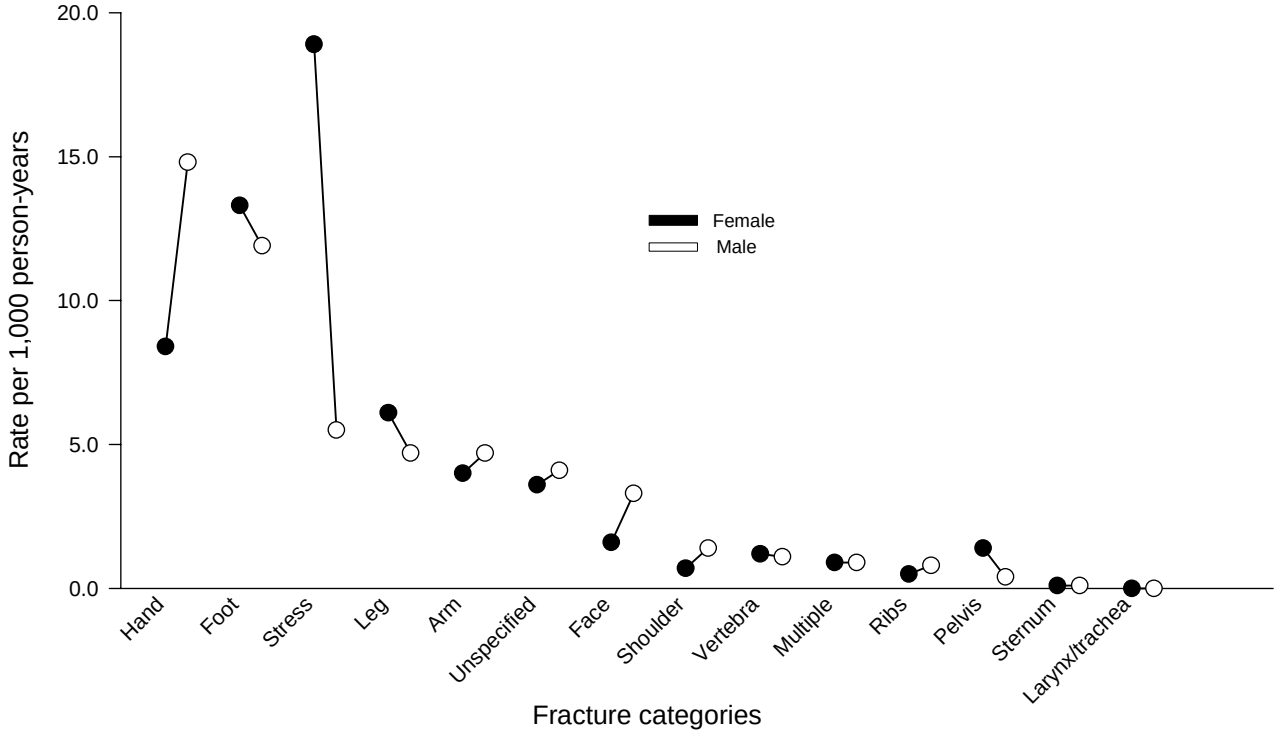

Figure 2. Rates of fractures by category and age group, US Armed Forces, 1998-2003.

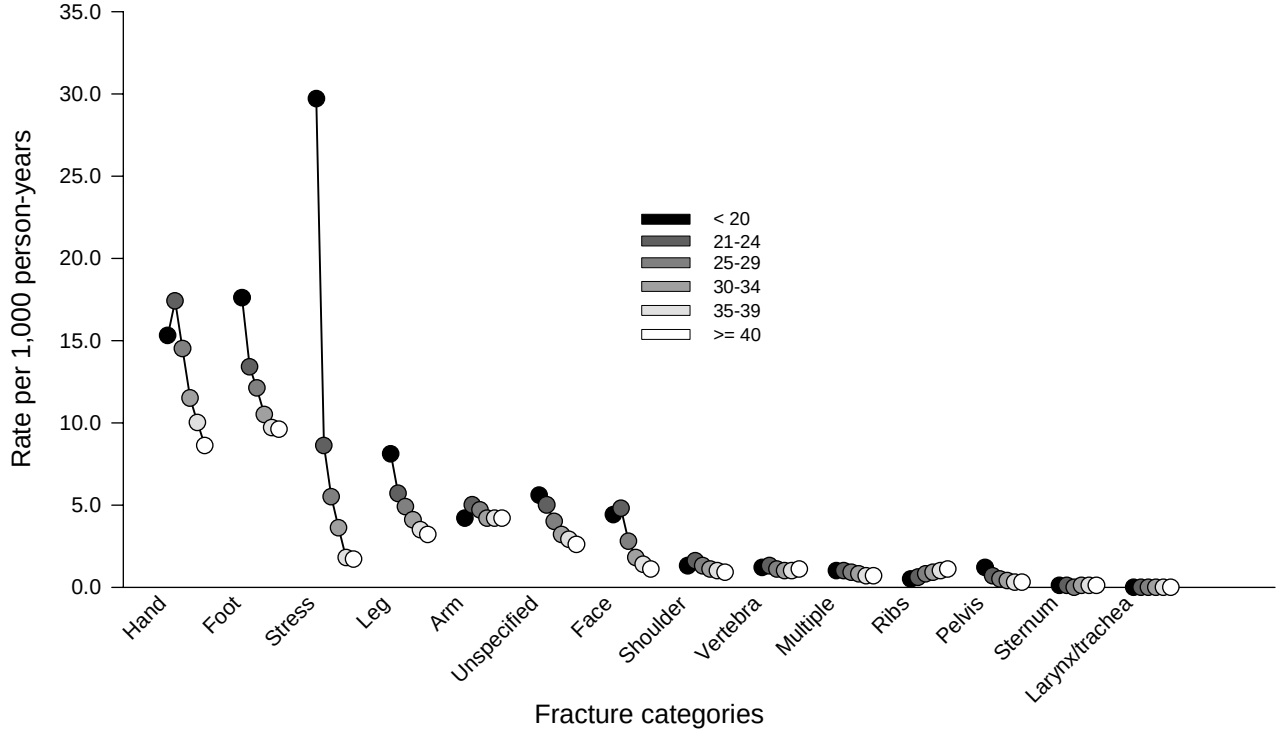

Table 2. Rates* of fractures, by category and year, active components, U.S. Armed Forces, 1998 - 2003

	1998	1999	2000	2001	2002	2003	Total
Hand	14.44	13.88	14.30	14.09	14.28	12.03	13.83
Foot	11.59	11.67	12.90	13.17	12.89	10.72	12.15
Stress/spontaneous	6.69	6.82	6.46	6.02	8.54	9.85	7.41
Leg	4.57	4.77	5.15	5.64	5.38	4.21	4.95
Arm	5.06	4.88	4.43	4.87	4.63	3.58	4.57
Unspecified	5.36	5.83	5.67	3.69	2.54	1.32	4.05
Face	2.28	2.44	3.24	3.57	3.42	3.38	3.06
Shoulder	1.04	1.14	1.28	1.39	1.44	1.28	1.26
Vertebra	1.07	0.99	1.11	1.21	1.22	1.17	1.13
Multiple	1.31	1.07	1.01	0.89	0.67	0.50	0.91
Ribs	0.47	0.60	0.84	0.92	0.92	0.92	0.78
Pelvis	0.30	0.41	0.58	0.60	0.75	0.55	0.53
Sternum	0.05	0.06	0.06	0.07	0.06	0.06	0.06
Larynx and trachea	0.01	0.01	0.01	0.01	0.01	0.01	0.01
Total	54.24	54.59	57.03	56.11	56.76	49.59	54.69

* Per 1,000 person-years

Figure 3. Rates of fractures by category and service, US Armed Forces, 1998-2003.

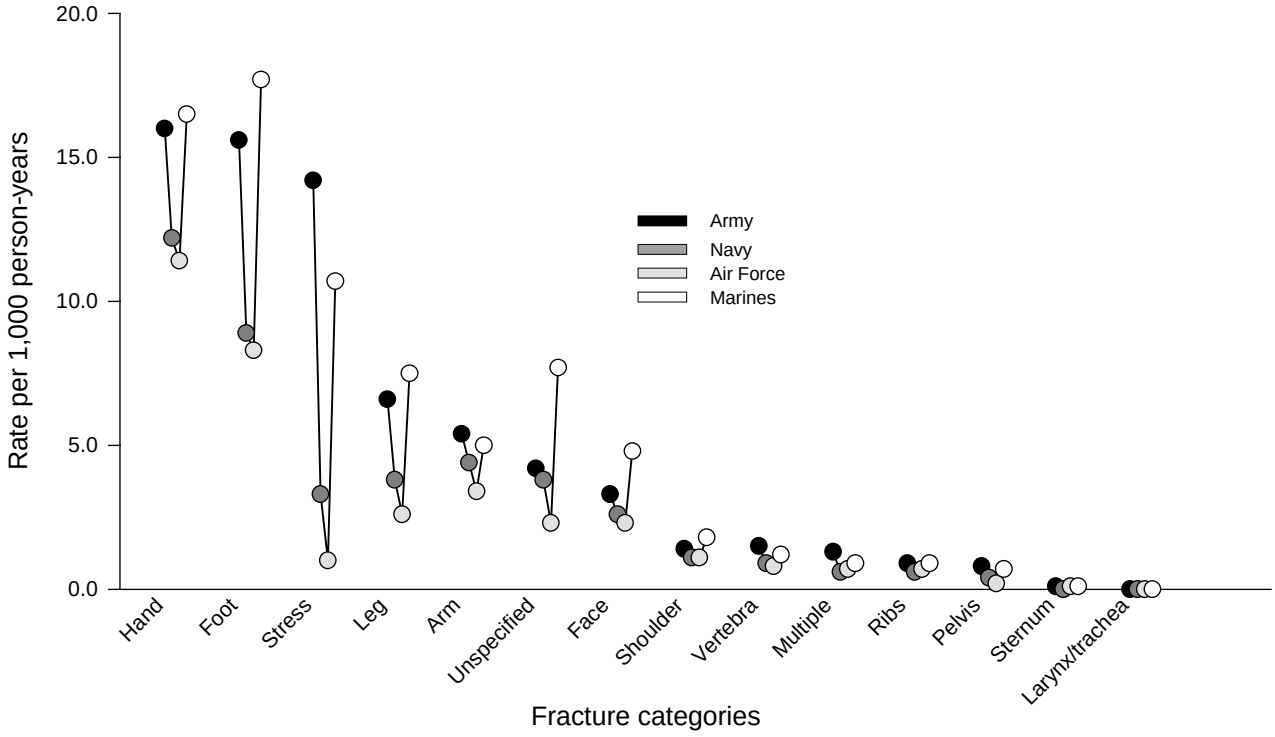

Table 3. Rates* of fractures, by category and occupational group, US Armed Forces, 1998-2003

	Hand	Foot	Stress	Leg	Arm	Unspec	Face	Other	Total
Non-occupational (officer, enlisted)	13.3	**20.9**	**27.1**	**9.4**	3.3	**5.3**	**3.7**	4.5	**87.6**
Enlisted									
- Infantry, gun crews, seamanship	**17.0**	**15.4**	7.7	**6.3**	***5.7***	**5.0**	**4.7**	**5.9**	**67.6**
- Service and supply handlers	16.0	**13.5**	**11.4**	6.1	4.9	**4.8**	3.3	5.3	**65.4**
- Oth technical, allied specialists	15.1	12.6	8.7	5.5	4.9	4.3	3.3	5.0	59.4
- Craftsworkers	**18.2**	12.9	4.6	5.0	**5.1**	4.3	**3.7**	**5.5**	59.2
- Health care specialists	13.4	12.9	**10.5**	5.4	4.8	3.7	2.7	5.0	58.4
- Unknown	10.8	13.1	8.7	**6.7**	4.6	3.2	2.7	**6.1**	56.0
- Communications, intelligence	13.4	11.6	7.2	4.7	4.7	4.5	3.0	4.5	53.7
- Electrical/mech equip repairers	**16.2**	11.2	4.3	4.4	**5.0**	4.1	3.4	5.0	53.4
- Electronic equip repair	14.4	10.6	6.7	4.6	4.8	4.3	2.9	4.5	52.7
- Functional support, admin	11.9	10.5	6.1	4.0	3.9	3.5	2.4	3.8	46.1
Officers									
- Unknown	9.4	9.9	1.8	3.1	4.0	2.0	2.7	4.8	37.8
- Scientists/professionals	8.6	9.6	2.6	3.6	3.4	2.7	1.3	3.6	35.3
- Engineering/maintenance	9.2	8.5	2.1	2.9	3.5	2.7	1.7	3.5	34.1
- Administration	8.8	9.1	2.5	2.8	3.6	2.5	1.7	3.0	34.1
- Intelligence	9.2	9.1	1.8	2.8	3.5	2.7	1.3	3.5	33.8
- Supply, procurement, allied	8.8	8.3	2.0	3.2	3.3	2.5	1.4	3.7	33.2
- Tactical operations	7.8	7.9	1.9	3.0	3.5	2.3	1.6	3.8	31.9
- Health care	7.2	7.9	1.9	2.8	3.7	2.2	1.1	3.2	30.0
- Generals, executives, NEC	6.4	7.9	1.8	2.6	3.4	2.9	0.7	3.0	28.6
Overall	13.8	12.1	7.4	4.9	4.6	4.0	3.1	4.7	54.7

* Per 1,000 person-years

Bold indicates the 3 highest occupational group-specific rates in each fracture category

Frequencies and Characteristics of Medical Evacuations of Soldiers by Air (with Emphasis on Non-battle Injuries), Operations Enduring Freedom/Iraqi Freedom (OEF/OIF), January-November 2003

Non-battle injuries are a major cause of morbidity and mortality during combat operations. For example, among Marines who served in Vietnam from 1965 through 1971, 28% of all first-time disease and non-battle injury (DNBI)-related hospitalizations were for non-combat "accidents, poisonings, and violence" and musculoskeletal conditions.[1] More recently, during Operations Desert Shield and Storm, non-battle injuries (NBIs) and other musculoskeletal conditions accounted for more hospitalizations (39%) than any other general cause.[2] In addition, of the 372 deaths among US military personnel in these operations, 52% resulted from NBIs and approximately 40% were the direct result of combat.[3]

In the past, reports of casualties during combat operations have generally taken months to years to compile. As a result, findings of analyses could not affect policies or practices in the same operations. Medical air evacuations during combat operations are indicated for patients with injuries, illnesses, and/or other medical conditions that require higher levels of diagnostic, therapeutic, and/or rehabilitative care. Routinely collected medical air evacuations data from areas of responsibility (AOR) with ongoing combat operations may be useful to identify causes of injuries, improve ongoing efforts to reduce NBIs, and develop and implement new interventions during the same operations.

The overall objective of this analysis was to determine the potential of using routinely collected air evacuation data from the Transportation Command Regulating and Command and Control Evacuation System (TRAC2ES) to monitor the number and nature of injuries during ongoing combat operations (in order to establish prevention priorities during the same operations). Specific objectives were to determine the feasibility of using TRAC2ES data to characterize causes of injuries using NATO Standardization Agreement (STANAG) "cause of injury" codes; to estimate the proportion of medical evacuations during Operations Enduring Freedom and Iraqi Freedom (OEF/OIF) that were attributable to injuries (battle and non-battle related); and to identify causes of injuries that might be targeted for new or enhanced prevention efforts.

Methods. Air evacuation data from TRAC2ES were used for the analysis. At the time of the analysis, the data documented all medical air evacuations that were conducted by the U.S. Transportation Command (USTRANSCOM) from 1 January 2003 through 22 November 2003.

TRAC2ES data included all individuals who were air evacuated by the USTRANSCOM during the surveillance period. The analysis was limited to U.S. Army soldiers (regular Army, Army Reserve, and Army National Guard) who were participants in Operations Enduring Freedom (OEF) and/or Iraqi Freedom (OIF) and were medically evacuated by air from the U.S. Central Command (CENTCOM) AOR. If soldiers were air evacuated more than one time for the same diagnosis, only the first air evacuation was included. If soldiers were air evacuated more than one time for unrelated diagnoses, only the first evacuation for each unique diagnosis was included.

The medical conditions of soldiers who were medically evacuated by air were identified from ICD-9-CM (International Classification of Disease, 9th Revision, Clinical Modification) codes that were recorded in TRAC2ES. For this analysis, the TRAC2ES-assigned ICD-9-CM codes were accepted, without attempting to validate the codes from other data sources. For this report, diagnoses were summarized by principal major diagnostics categories of the ICD-9-CM. If cases had more than one reported ICD-9-CM code, only the first listed ("primary") diagnosis was used.

To determine the feasibility of coding injuries by their causes, a 10% random sample (n=954) of all air evacuations was selected. ICD-9-CM codes and patient "history" text fields in TRAC2ES were reviewed to classify each evacuation as an injury, illness, or a late effect of a prior injury/chronic musculoskeletal condition. For all injuries, the patient "history" field was used to ascertain the cause and to classify it with a NATO Standardization Agreement (STANAG) "cause of injury" code.

Results. Globally, there were 39,487 individuals who were medically air evacuated during the surveillance period. Approximately one-fourth (n=9,532, 24.1%)

of these were soldiers who were evacuated from the CENTCOM AOR.

Fifty-one percent of all soldiers who were air evacuated from the CENTCOM AOR were younger than 30, and 47% were junior enlisted (E1-E4) (table 1). Eighty-seven percent of all air evacuated soldiers were participants in Operation Iraqi Freedom; and 85% of all air evacuations were related to "diseases and non-battle injuries" (DNBI) (table 2). The principal diagnosis categories that accounted for the most air evacuations of soldiers were "injuries and poisonings" and "musculoskeletal and connective tissue disorders" (table 3).

Nearly half (48.1%) of all air evacuations of soldiers were related to injuries (i.e., battle and non-battle injuries, late effects of pre-existing injuries, chronic musculoskeletal conditions) (table 4). Non-battle injuries accounted for approximately three-fourths (76.2%) of all battle and non-battle injury-related air evacuations.

Distributions by age, rank, casualty event, and principal diagnosis group were similar in the 10% random sample and the total medical evacuation cohort (tables 1-3). Of the 292 non-battle injuries that were included in the 10% random sample, the most frequent causes were falls, motor vehicle-related accidents (traffic and non-traffic), sports/physical training, crushing/blunt trauma, and lifting/pushing/pulling (table 5).

Editorial comment. This preliminary analysis of USTRANSCOM's air evacuation data from OEF/OIF supports the value of using TRAC2ES to quantify and characterize injuries that required air evacuation from the CENTCOM AOR. The analysis also demonstrates the feasibility of using the patient "history" field in TRAC2ES to classify injuries according to their causes (using NATO Standardization Agreement codes) and of using random samples of medical evacuation cohorts of interest to estimate injury causes overall.

Table 1. Age and military rank distributions, US Army soldiers who were evacuated by air from OEF/OIF for medical conditions, overall and in a 10% random sample

	All medically evacuated soldiers (n=9,532)		10% random sample (n=954)	
Age group	Frequency	Percent (%)	Frequency	Percent (%) ± 95% CI[1]
17-19	341	3.6	26	2.7 ± 1.0
20-29	4,461	46.8	447	46.9 ± 3.0
30-39	2,495	26.2	257	26.9 ± 2.7
40-49	1,243	13.0	121	12.7 ± 2.0
50+	370	3.9	32	3.4 ± 1.1
Unknown	626	6.6	73	7.7 ± 1.6
Military rank				
Enlisted				
Junior (E1-E4)	4,513	47.3	445	46.7 ± 3.0
NCO (E5-E7)	3,628	38.1	377	39.5 ± 2.9
NCO (E8-E9)	212	2.2	20	2.1 ± 0.9
Officer				
Company grade (O1-O3)	385	4.0	30	3.1 ± 1.0
Field grade/gen off (O4-O10)	258	2.7	21	2.1 ± 0.9
Warrant (WO1-WO4)	143	1.5	16	1.7 ± 0.8
Unknown	393	4.1	45	4.7 ± 1.3

[1]Percent ± 95% confidence interval

In the random sample drawn for this analysis, nearly half (48.1%) of all evacuations were for injuries (non-battle and battle) and other musculoskeletal conditions (chronic conditions and late effects of prior injuries). In addition, approximately three-fourths (76.2%) of all injuries in the sample were not battle related. The five leading causes of non-battle injuries (in descending order) were falls, motor vehicle-related accidents, sports and physical training, crushing or blunt trauma, and lifting/pushing/pulling. Of note, the three leading causes of injury-related hospitalizations during Operations Desert Shield and Desert Storm in 1990-1991 were motor vehicle accidents (19%), falls (19%), and sports/athletics (18%).[1]

Non-battle injuries during deployment operations are often amenable to prevention efforts. General steps in the process of developing and implementing cause-specific injury prevention programs include: 1) identifying the most important (e.g., serious, problem-prone, frequent) injury causes to help prioritize prevention efforts; 2) identifying individuals and groups at increased risk (e.g., specific units, occupations, locations); 3) establishing accountability and responsibility for implementing policies and programs; and 4) monitoring the effectiveness of policies, programs, and actions after they are implemented. Summaries of TRAC2ES data can be useful for steps 1, 2, and 4 of this process. Additionally, TRAC2ES data can enable the initiation of the process from the early stages of deployment operations.

TRAC2ES was developed as an administrative tool to track the movement of air evacuated patients. Even though there may be some missing data and miscoding of medical data (e.g., ICD-9-CM codes), this analysis confirms the feasibility of using the patient history text to categorize illnesses and injuries among air evacuated soldiers and to determine causes of injury. Similar to hospitalization data, TRAC2ES data are only informative regarding the relatively serious conditions that require air evacuation, rather than all injuries and illnesses that occur in the AOR.

In summary, this analysis demonstrates the potential usefulness of TRAC2ES data to monitor the frequencies and causes of serious non-battle injuries while deployment operations are ongoing. The analysis also demonstrates the feasibility of using routinely collected medical evacuation data to classify serious injuries by their causes.

Table 2. Frequencies of conditions that required medical evacuation by air, by operation and type, among US Army soldiers, overall and in 10% random sample

	All medically evacuated soldiers (n=9,532)		10% random sample (n=954)	
	Frequency	%	Frequency	Percent (%) ± 95% CI
OPN Enduring Freedom				
Battle injury	44	0.5	4	0.4 ± 1.6
Disease/non-battle injury	828	8.7	77	8.1 ± 1.7
OPN Iraqi Freedom				
Battle injury	953	10.0	85	8.9 ± 2.5
Disease/non-battle injury	7,292	76.5	751	78.7 ± 2.5
Other	5	0.0	0	0
Unknown	410	4.3	35	3.7 ± 1.1
Total	9,532	100.0	952	100.0

Analysis, report, and comment by Hauret KG, Jones BH, Canham-Chervak M, Bullock S, Canada S, Knapik JJ, Injury Prevention Program, US Army Center for Health Promotion and Preventive Medicine, and Cox K, formerly Air Forces Institute for Occupational Health.

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Table 3. Distributions of primary (first listed) diagnoses, by principal diagnosis groups of ICD-9-CM, among all and a 10% random sample of soldiers who were medically air evacuated from OEF/OIF

		All medically evacuated soldiers (n=9,532)		10% random sample (n=954)	
ICD-9-CM codes	Principal diagnosis groups	Frequency	Percent (%)	Frequency	Percent (%) ± 95% CI
800-999	Injury and poisoning	2,513	26.4	271	28.4 ± 2.7
710-739	Musculoskeletal and connective tissue	1,206	12.7	128	13.4 ± 2.1
780-799	Symptoms, signs, ill-defined conditions	893	9.4	85	8.9 ± 1.7
520-579	Digestive	842	8.8	78	8.2 ± 1.7
320-389	Nervous system and sensory organs	652	6.8	70	7.3 ± 1.6
580-629	Genitourinary	647	6.8	72	7.5 ± 1.6
290-319	Mental	506	5.3	43	4.5 ± 1.3
390-459	Circulatory	294	3.1	18	1.9 ± 0.8
460-519	Respiratory	287	3.0	39	4.1 ± 1.2
680-709	Skin	220	2.3	18	1.9 ± 0.8
001-139	Infectious and parasitic	165	1.7	21	2.2 ± 0.9
240-279	Endocrine	150	1.6	10	1.0 ± 0.6
140-239	Neoplasms	147	1.5	18	1.9 ± 0.8
630-677	Pregnancy-related	106	1.1	9	0.9
740-759	Congenital	71	0.7	6	0.6
280-289	Blood and blood-forming	30	0.3	1	0.1
760-779	Perinatal	4	0.0	1	0.1
V codes		92	1.0	5	0.5
E codes		295	3.1	28	2.9 ± 1.0
Missing		412	4.3	33	3.5 ± 1.1

Table 4. General diagnostic categories,* 10% random sample (n=954) of all medical air evacuations of soldiers, US Army, OEF/OIF

	Frequency	Percent (%) ± 95% CI
Illnesses and medical conditions	489	51.3 ± 3.0
Non-battle injuries	292	30.6 ± 2.8
Battle injuries	91	9.5 ± 1.8
Late effects of pre-existing injuries and chronic musculoskeletal conditions	76	8.0 ± 1.6
Unknown	6	0.6 ± 0.5

*Coding of TRAC2ES data using STANAG codes

Table 5. Causes of injury for non-battle injuries (n=292) in a 10% random sample of all medical air evacuations of soldiers, US Army, OEF/OIF

Cause of injury (per STANAG)	Injuries	Percent (%) ± 95% CI
Falls	47	16.1 ± 2.2
Motor vehicle-related accidents	37	12.7 ± 2.0
- traffic	30	*10.3 ± 1.8*
- non-traffic	7	*2.4 ± 0.9*
Sports and physical training	35	12.0 ± 2.0
Crushing or blunt trauma	20	6.8 ± 1.5
Lifting, pushing, pulling	17	5.8 ± 1.4
Environmental	11	3.8 ± 1.2
Twisting, turning, slipping	10	3.4 ± 3.4
Fire and other burns	8	2.7 ± 1.0
Foreign body (ears or eyes)	8	2.7 ± 1.0
Instrumentalities of war, own	7	2.4 ± 0.9
Machinery and tools	7	2.4 ± 0.9
Fighting	6	2.1 ± 0.9
Air transport	5	1.7 ± 0.8
Cutting and piercing	5	1.7 ± 0.8
Poisons and corrosives	5	1.7 ± 0.8
Medical/surgical complications	4	1.4 ± 0.7
Unspecified/unknown	60	20.5 ± 2.4

Update: Pre- and Post-deployment Health Assessments, US Armed Forces, September 2002-April 2004

The June 2003 issue of the MSMR summarized the background of, rationale for, and applicable polices and guidelines related to pre- and post-deployment health assessments of deploying servicemembers.[1-10] Briefly, prior to deploying, the health of each servicemember is assessed to ensure his/her medical fitness and readiness for deployment; and at the time of redeployment, the health of each servicemember is again assessed to identify medical conditions and/or exposures of concern—to ensure timely and comprehensive evaluation and treatment.

Completed pre- and post-deployment health assessment forms are routinely sent to the Army Medical Surveillance Activity (AMSA) where they are scanned, data entered, and archived in the Defense Medical Surveillance System (DMSS).[11] In the DMSS, data recorded on pre- and post-deployment forms are integrated with data that document demographic and military characteristics and medical experiences (e.g., hospitalizations, ambulatory visits, immunizations) of servicemembers.[11] The continuously expanding integrated DMSS database can be used to monitor the health of servicemembers who participate in various deployments.[11-13]

The overall success of deployment force health protection efforts depends in part on the completeness and quality of pre- and post-deployment health assessments. This report summarizes characteristics of servicemembers who completed pre- (since 1 September 2002) and post- (since 1 January 2003) deployment forms, responses to selected questions on pre- and post-deployment forms, and changes in responses of individuals from pre- to post-deployment.

Methods. For this update, the DMSS was searched to identify all pre- and post-deployment forms that were completed after 1 September 2002 (in order that assessments of servicemembers who deployed in October 2002 were included in analyses). For summary purposes, pre-deployment responses included all assessments (DD Form 2795) completed after 1 September 2002, and post-deployment responses included all assessments (DD Form 2796) completed after 1 January 2003.

Results. From 1 September 2002 to 30 April 2004, 644,272 pre-deployment health assessment forms were completed at field sites, shipped to AMSA, and entered into the DMSS database.

In general, the distributions of self-assessments of "overall health status" were similar among pre- and post-deployment form respondents (figure 1). Relatively more pre-deployment (32%) than post-deployment (22%) respondents assessed their "overall health" as "excellent"; similar porportions of respondents to the pre- and post-deployment forms assessed their "overall health" as "very good"; and before and after deploying, fewer than 7% of respondents assessed their overall health as "fair" or "poor" (figure 1).

On post-deployment forms, approximately 21% of active and 37% of Reserve component respondents reported "medical/dental problems"; and approximately 4% of respondents overall reported "mental health concerns"(table 2). There was significant variability across services and components in percentages of post-deployment forms that reported that "referrals" were indicated (table 2). For example, 6% of active component Navy members and 26% of active and reserve component soldiers had indications for referrals (table 2).

Among servicemembers (n=287,634) who completed both forms, approximately half (46.3%) chose the same descriptor of their "overall health status" before and after deploying (figures 2, 3). Of those (n=154,513) who changed their health status assessments from pre- to post-deployment, more than three-fourths (76.5%) changed by a single category (on a five category scale) (figure 2,3); and of those who changed by more than one category, approximately 6-times more indicated a decrement (n=31,277) than an improvement (n=4,975) in their assessments of their overall health (figure 3).

Overall, 15.5% of all servicemembers who completed post-deployment forms reported deployment-related "exposure concerns." The likelihood of reporting an "exposure concern" increased monotonically with age (table 3). In general, reservists, members of the Marine Corps and Army, and officers were more likely to report

Figure 1. Percent distributions of self-assessed health status, pre- and post-deployment, US Armed Forces, September 2002-April 2004.

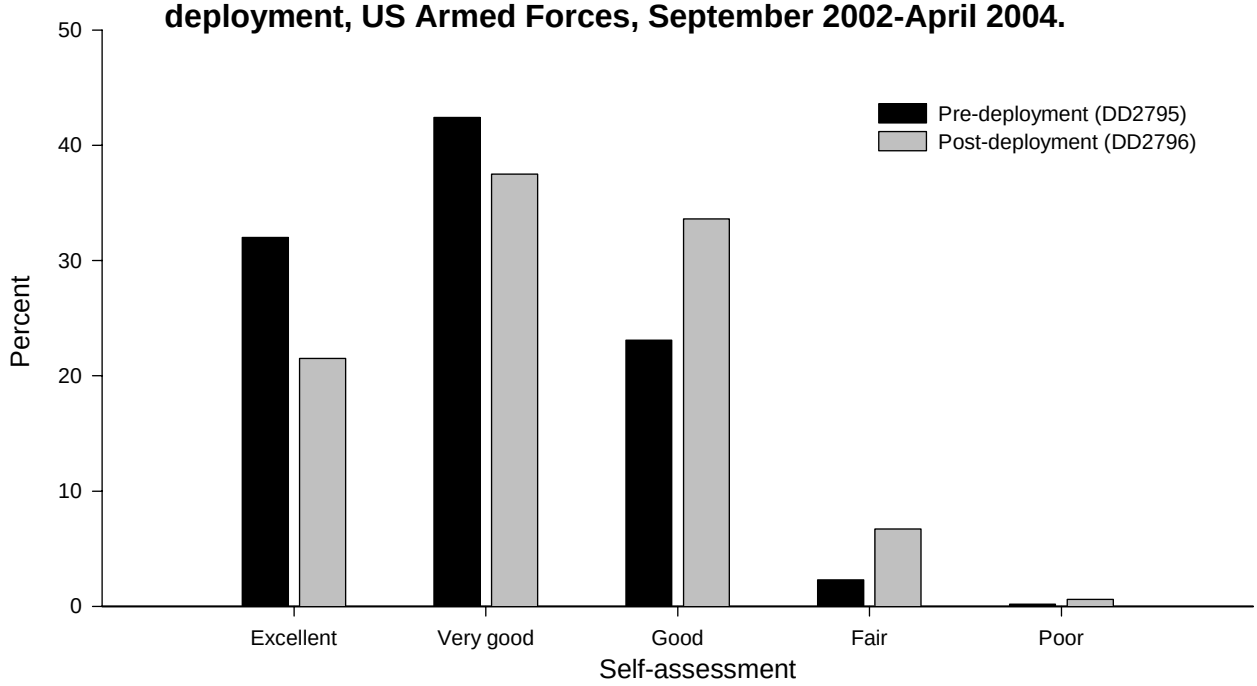

Table 1. Total pre-deployment and post-deployment health assessments, by month and year, US Armed Forces

	Pre-deployment *		Post-deployment **	
	No.	%	No.	%
Total	644,272	100.0	545,554	100.0
2002				
September	11,155	1.7	-	-
October	16,558	2.6	-	-
November	20,030	3.1	-	-
December	17,084	2.7	-	-
2003				
January	69,136	10.7	5,735	1.1
February	109,746	17.0	4,601	0.8
March	69,625	10.8	6,258	1.1
April	37,373	5.8	18,107	3.3
May	12,799	2.0	87,876	16.1
June	14,361	2.2	64,510	11.8
July	17,867	2.8	50,246	9.2
August	16,053	2.5	34,572	6.3
September	12,522	1.9	30,300	5.6
October	23,536	3.7	26,091	4.8
November	19,219	3.0	20,000	3.7
December	35,347	5.5	20,903	3.8
2004				
January	66,399	10.3	37,693	6.9
February	37,863	5.9	31,745	5.8
March	21,812	3.4	64,907	11.9
April	15,787	2.5	42,010	7.7

* Total pre-deployment assessments (DD form 2795) 1 September 2002-30 April 2004.
** Total post-deployment assessments (DD form 2796) 1 January 2003-30 April 2004.

"exposure concerns" than their respective counterparts (table 3).

Editorial comment. In general, servicemembers who have been mobilized/deployed since September 2002 have assessed their overall health as "good" to "excellent." The distributions of self-assessed health statuses are generally similar prior to and after returning from deploying; however, more servicemembers report declines than improvements in their overall health from pre- to post-deployment. This is not surprising considering the extreme physical and psychological stresses associated with mobilization, overseas deployment, and harsh and dangerous living and working conditions.[14,15] The deployment health assessment process is specifically designed to identify, assess, and follow-up as necessary all servicemembers with concerns regarding health and/or deployment-related exposures.

Overall, nearly one of every 7 servicemembers who completed post-deployment health assessments reported an "exposure concern." Of demographic factors, the strongest correlate of reporting an exposure concern was older age. The higher crude prevalences of exposure concerns among reservists (versus active component) and officers (versus enlisted), for example, may be related at least in part to differences in the age distributions of the respective groups. Trends in the numbers and natures of deployment-related "exposure concerns" will be monitored as more servicemembers return from overseas assignments and/or demobilize.

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Table 2. Reponses to selected questions from post-deployment forms (DD2796) submitted since 1 January 2003, by service and component, US Armed Forces*

Active Component	Army	Navy	Air Force	Marines	Total
SMs with DD 2796 at AMSA	160,199	51,859	49,859	47,683	309,600
DD 2796 enhanced version **	53%	0%	11%	2%	34%
General health("fair" or "poor")	9%	5%	2%	6%	7%
Medical/dental problems	28%	12%	11%	18%	21%
Currently on profile	10%	1%	2%	3%	6%
Mental health concerns	5%	2%	1%	2%	3%
Exposure concerns	17%	5%	6%	12%	13%
Health concerns	15%	6%	5%	8%	11%
Referral indicated	26%	6%	10%	10%	18%
Med. visit following referral***	88%	71%	87%	65%	82%
Post deployment serum**	87%	74%	91%	77%	85%
Reserve component					
SMs with DD 2796 at AMSA	127,570	10,060	20,887	11,730	170,247
DD 2796 enhanced version**	47%	1%	5%	1%	38%
General health("fair" or "poor")	11%	5%	3%	10%	9%
Medical/dental problems	40%	34%	18%	36%	37%
Currently on profile	15%	5%	2%	4%	12%
Mental health concerns	6%	2%	1%	3%	5%
Exposure concerns	22%	13%	11%	30%	21%
Health concerns	22%	18%	9%	24%	20%
Referral indicated	26%	15%	13%	25%	24%
Med. visit following referral***	79%	87%	64%	57%	76%
Post deployment serum**	91%	86%	70%	79%	88%

* As of 12 July 2004.

** Inpatient or outpatient visit within 6 months after referral.

*** Only calculated for DD2796 completed since 1 June 2003.

Note: Subgroup totals may not equal the overall total due to missing/unknown data.

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Figure 2. Self-assessed health status on post-deployment form, in relation to self-assessed health status pre-deployment, US Armed Forces, September 2002-April 2004.

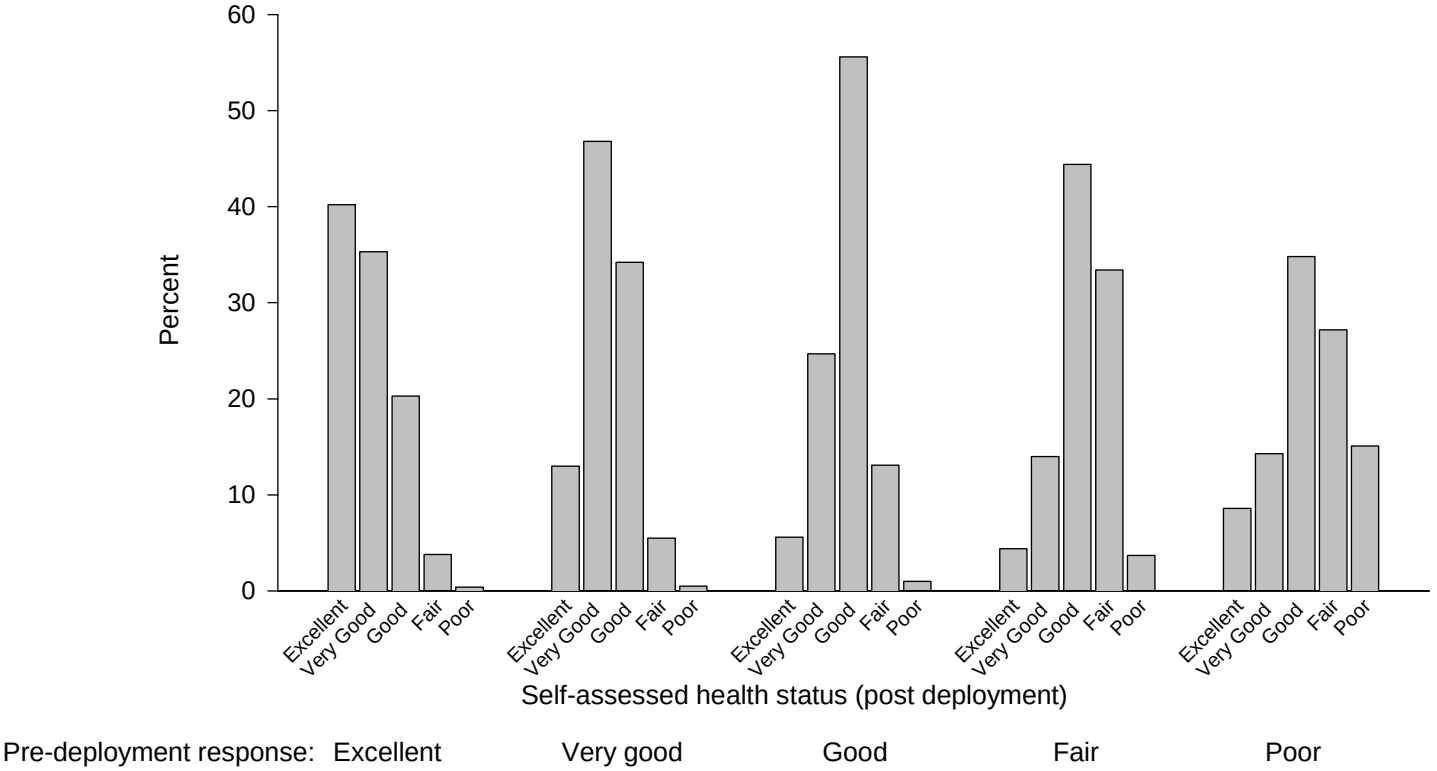
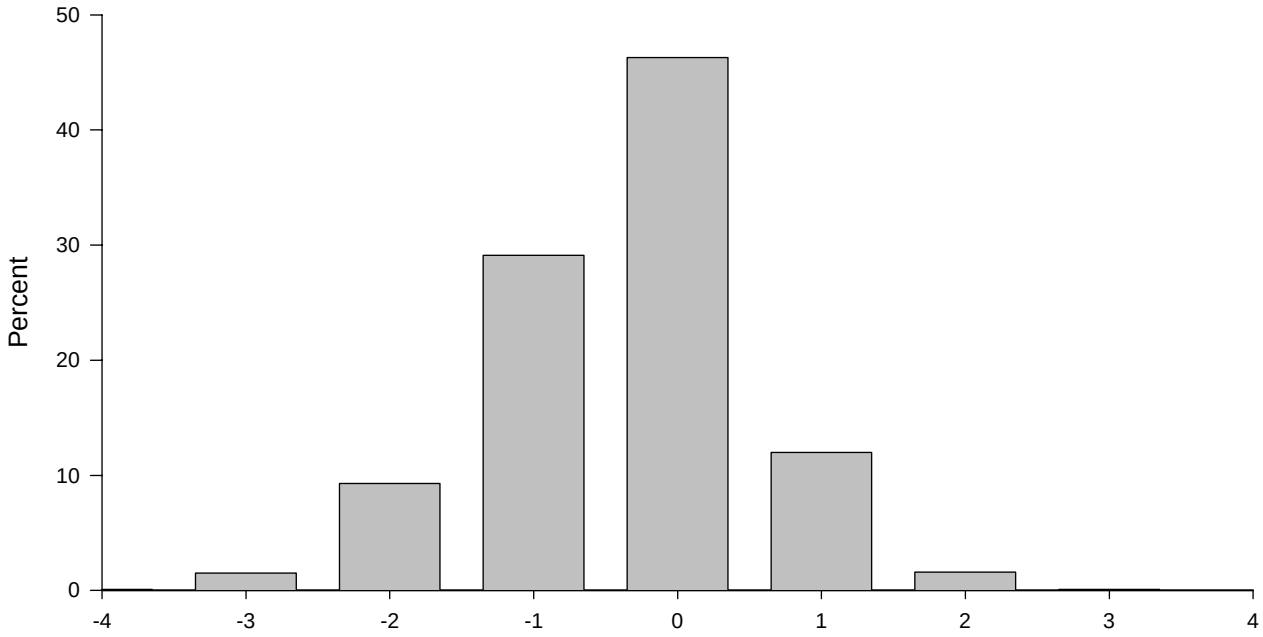


Table 3. Deployment-related "exposure concerns" reported on post-deployment health assessments*, US Armed Forces, January 2003-April 2004

	Total respondents	Exposure concerns no.	%
Total	448,332	69,450	15.5
Component			
Active	292,076	37,251	12.8
Reserve	156,256	32,199	20.6
Service			
Army	264,637	51,211	19.4
Navy	60,375	3,985	6.6
Air Force	65,220	5,038	7.7
Marine Corps	58,100	9,216	15.9
Age (years)			
<20	16,004	1,272	7.9
20-29	238,723	31,944	13.4
30-39	124,345	21,890	17.6
>39	69,255	14,343	20.7
Gender			
Men	398,113	60,870	15.3
Women	50,174	8,575	17.1
Race/ethnicity			
Black	81,853	13,309	16.3
Hispanic	44,813	7,418	16.6
Other	1,003	174	17.3
White non-Hispanic	292,158	44,271	15.2
Grade			
Enlisted	391,465	59,554	15.2
Officer	56,864	9,896	17.4

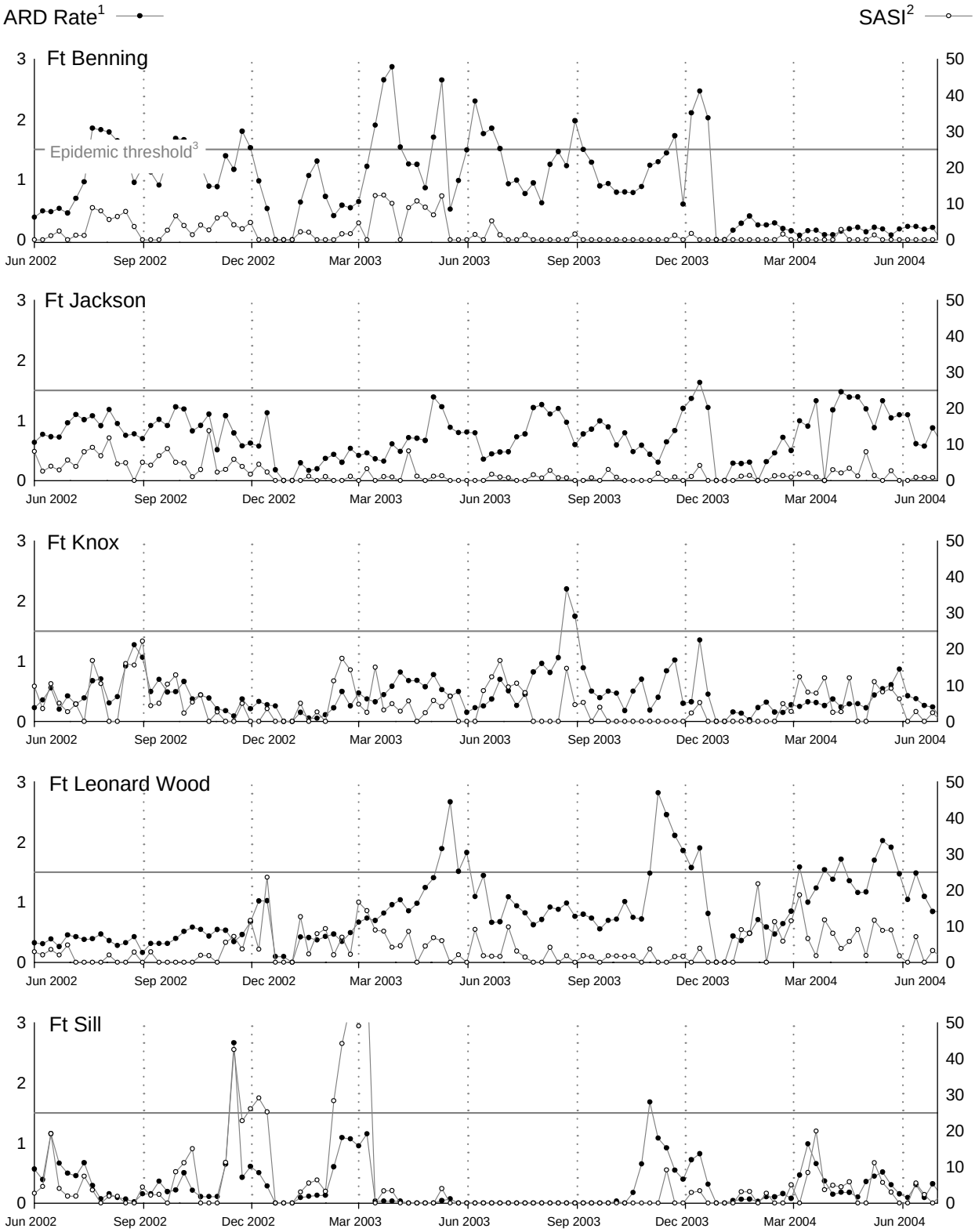
* Post-deployment health assessments (DD form 2796) with completion dates: 1 Jan 2003 - 30 Apr 2004.
Note: total does not reflect missing responses to "exposure concerns" or missing characteristics.

Figure 3. Distribution of self-assessed health status changes from pre- to post-deployment form, US Armed Forces, September 2002-April 2004.



Change in self-assessment of overall health status, pre- to post-deployment, calculated as: post deployment response - pre-deployment response, using the following scale for health status: 1= "poor"; 2="fair"; 3="good"; 4="very good"; and 5="excellent."

Acute respiratory disease (ARD) and streptococcal pharyngitis (SASI), Army Basic Training Centers, by week through June 30, 2004



[1]ARD rate = cases per 100 trainees per week

[2]SASI (Strep ARD surveillance index) = (ARD rate)x(rate of Group A beta-hemolytic strep)

[3]ARD rate >=1.5 or SASI >=25.0 for 2 consecutive weeks indicates an "epidemic"

Sentinel reportable events for all beneficiaries[1] at US Army medical facilities, cumulative numbers[2] for calendar years through June 30, 2003 and 2004

Reporting location	Number of reports all events3		Food-borne								Vaccine Preventable					
			Campylo-bacter		Giardia		Salmonella		Shigella		Hepatitis A		Hepatitis B		Varicella	
	2003	2004	2003	2004	2003	2004	2003	2004	2003	2004	2003	2004	2003	2004	2003	2004
NORTH ATLANTIC																
Washington, DC Area	143	122	.	.	4	.	2	1	3	1	.	.	.	.	2	3
Aberdeen, MD	43	26	.	.	.	.	.	.	.	.	.	.	.	.	.	.
FT Belvoir, VA	105	122	2	5	.	1	5	2	3	1	.	1	.	.	.	1
FT Bragg, NC	979	946	4	3	.	.	4	16	15	.	.	.	.	.	2	.
FT Drum, NY	94	57	.	.	.	.	.	1	.	.	.	.	.	.	1	.
FT Eustis, VA	128	120	.	.	.	.	1	.	.	.	.	.	.	.	2	.
FT Knox, KY	125	111	1	1	.	3	3	1	.	.	.	.	.	1	.	.
FT Lee, VA	91	92	.	.	.	.	.	.	.	.	.	.	.	.	.	.
FT Meade, MD	51	92	.	.	.	1	.	.	.	.	.	.	.	.	.	.
West Point, NY	26	27	2	1	.	.	1	.	.	.	1	.	1	1	.	.
GREAT PLAINS																
FT Sam Houston, TX	129	155	.	.	.	1	4	3	.	.	.	.	.	.	.	2
FT Bliss, TX	158	166	1	1	3	2	2	3	1	4	.	.	.	.	1	.
FT Carson, CO	277	276	1	1	2	.	2	1	.	1	3	.	.	.	1	.
FT Hood, TX	836	587	4	6	.	.	13	5	62	30	.	.	.	1	.	.
FT Huachuca, AZ	36	60	.	.	.	.	.	.	.	.	.	.	.	.	.	.
FT Leavenworth, KS	25	20	1	1	.	2	1	1	.	.	.	.	.	.	.	.
FT Leonard Wood, MO	120	134	1	1	.	.	.	1	.	.	.	.	1	.	3	.
FT Polk, LA	119	89	.	.	.	.	.	4	.	.	.	.	.	.	.	.
FT Riley, KS	112	127	2	1	1	1	.	.	.	.	.	1	1	.	.	.
FT Sill, OK	109	81	.	.	.	.	.	3	.	3	.	.	.	.	.	.
SOUTHEAST																
FT Gordon, GA	131	71	.	1	1	.	1	1	.	.	.	.	1	1	.	.
FT Benning, GA	237	199	.	.	1	4	4	4	4	1	.	.	.	.	.	.
FT Campbell, KY	253	413	3	2	.	1	3	3	.	1	.	.	.	.	.	3
FT Jackson, SC	56	161	.	.	.	.	.	.	.	.	1	.	.	.	.	3
FT Rucker, AL	29	33	.	.	.	1	1	1	.	.	1	.	.	.	.	1
FT Stewart, GA	166	211	.	2	.	1	4	2	2	3	.	.	.	.	.	.
WESTERN																
FT Lewis, WA	267	282	1	2	4	1	4	3	2	2	.	.	.	1	.	.
FT Irwin, CA	27	39	.	.	.	.	.	.	.	.	.	.	.	.	.	.
FT Wainwright, AK	58	123	.	.	.	.	.	1	.	.	.	1	.	1	.	.
OTHER LOCATIONS																
Hawaii	509	466	12	10	4	7	6	10	3	.	.	.	.	1	.	2
Europe	664	668	10	9	.	1	10	7	.	.	4	.	.	.	.	3
Korea	334	223	.	1	.	.	.	1	.	.	1	.	.	.	1	2
Total	**6,437**	**6,299**	**45**	**48**	**20**	**27**	**71**	**75**	**95**	**47**	**11**	**3**	**4**	**7**	**13**	**20**

1. Includes active duty servicemembers, dependents, and retirees.

2. Events reported by July 7, 2003 and 2004.

3. Seventy conditions specified by Tri-Service Reportable Events, Version 1.0, July 2000.

Note: Completeness and timeliness of reporting vary by facility.

Source: Army Reportable Medical Events System.

NOTICE OF CORRECTION: The current table is a corrected version of hard-copy and prior on-line versions that included counts of cases during current months rather than calendar years to date.

(Cont'd) Sentinel reportable events for all beneficiaries[1] at US Army medical facilities, cumulative numbers[2] for calendar years through June 30, 2003 and 2004

Reporting location	Arthropod-borne				Sexually Transmitted								Environmental			
	Lyme Disease		Malaria		Chlamydia		Gonorrhea		Syphilis[4]		Urethritis[5]		Cold		Heat	
	2003	2004	2003	2004	2003	2004	2003	2004	2003	2004	2003	2004	2003	2004	2003	2004
NORTH ATLANTIC																
Washington, DC Area	.	1	.	.	95	56	10	6	2	2	.	.	1	29	.	1
Aberdeen, MD	.	.	.	.	24	25	10	.	.	.	.	.	9	.	.	.
FT Belvoir, VA	.	.	.	.	78	98	17	10	.	3	.	.	.	.	.	.
FT Bragg, NC	1	.	4	8	692	654	153	148	4	1	60	61	4	3	35	46
FT Drum, NY	.	.	.	4	72	45	16	3	.	.	.	.	4	1	.	.
FT Eustis, VA	.	2	.	.	102	92	21	13	1	.	.	.	.	.	.	2
FT Knox, KY	.	.	.	.	108	96	12	6	.	.	.	.	.	.	.	3
FT Lee, VA	.	.	.	.	72	76	19	14	.	.	.	.	.	.	.	1
FT Meade, MD	.	.	.	.	43	74	8	16	.	.	.	.	.	.	.	.
West Point, NY	6	5	.	.	10	16	1	.	.	.	.	.	.	1	4	3
GREAT PLAINS																
FT Sam Houston, TX	.	.	.	.	98	117	25	18	1	1	.	.	.	.	.	.
FT Bliss, TX	.	1	.	.	113	115	23	22	2	1	.	.	.	.	1	.
FT Carson, CO	.	.	.	.	197	227	26	18	.	1	32	26	2	.	1	.
FT Hood, TX	.	.	.	2	448	343	144	94	1	.	110	89	5	.	8	2
FT Huachuca, AZ	.	.	.	.	34	56	2	4	.	.	.	.	.	.	.	.
FT Leavenworth, KS	.	.	.	.	20	12	2	4	.	.	.	.	.	.	.	.
FT Leonard Wood, MO	.	.	.	1	104	98	8	25	.	.	.	.	2	1	1	3
FT Polk, LA	.	.	.	.	88	71	31	13	.	1	.	.	.	.	.	.
FT Riley, KS	.	.	.	.	102	91	5	16	.	.	.	.	.	5	.	11
FT Sill, OK	.	.	.	.	72	63	15	6	1	1	21	.	.	2	.	1
SOUTHEAST																
FT Gordon, GA	.	.	1	.	110	48	11	16	3	.	.	.	.	.	.	.
FT Benning, GA	.	.	19	2	130	122	57	66	.	.	.	.	.	.	21	.
FT Campbell, KY	1	.	.	.	187	284	54	51	1	1	.	.	2	.	2	42
FT Jackson, SC	.	.	.	.	44	112	7	16	.	1	.	.	4	6	.	20
FT Rucker, AL	.	.	.	.	16	27	5	3	.	.	1	.	.	.	4	.
FT Stewart, GA	.	.	.	.	74	123	38	62	.	2	35	4	.	.	11	2
WESTERN																
FT Lewis, WA	.	1	1	.	151	188	44	26	.	.	53	46	.	1	.	2
FT Irwin, CA	.	.	.	.	21	33	5	5	.	.	.	.	.	.	.	1
FT Wainwright, AK	.	.	1	.	38	54	5	11	.	.	.	.	14	54	.	.
OTHER LOCATIONS																
Hawaii	.	.	.	1	341	329	54	77	.	.	.	.	.	.	7	6
Europe	1	.	2	2	500	490	124	108	2	2	1	.	3	1	.	1
Korea	.	.	1	1	274	182	42	25	2	3	4	.	3	6	1	1
Total	**9**	**10**	**29**	**21**	**4,458**	**4,417**	**994**	**902**	**20**	**20**	**317**	**226**	**53**	**110**	**96**	**148**

4. Primary and secondary.

5. Urethritis, non-gonococcal (NGU).

Note: Completeness and timeliness of reporting vary by facility.

Source: Army Reportable Medical Events System.

Commander
U.S. Army Center for Health Promotion
and Preventive Medicine
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