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Post-conflict hospital admission rates of Marine Corps units deployed to the Gulf War were compared with the rates of similar units returning from the Vietnam Conflict. Overall, and in four of the five postdeployment years, the aggregated Gulf War veterans exhibited lower hospitalization rates than did their Vietnam counterparts. Separately, the infantry and service support units deployed to the Gulf War theater had lower postdeployment hospitalization rates than did the Vietnam veterans. There were no significant hospitalization rate differences between the cohorts of combat engineer and artillery units. Of the veterans that were hospitalized, personnel from both conflicts averaged 1.24 admissions. In comparing hospital admission categories, differences existed between the Vietnam and Gulf War veterans in their proportions of 'Infective and Parasitic' diseases, 'Genitourinary' disorders, and 'Musculoskeletal' disorders; Vietnam veterans had the higher proportions within the first two categories, and Gulf War veterans had a higher proportion of musculoskeletal disorders. The data suggest that Gulf War veterans are not at an increased risk of hospitalization when contrasted with veterans returning from a previous combat engagement, and that the categories of illnesses for which Gulf War veterans are hospitalized do not substantially differ from those incurred by a previously-deployed combat cohort.

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Christopher J. Blood 3/15/00

PI - Signature Date

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INTRODUCTION

A wide range of postdeployment health problems have been reported among Gulf War veterans. Often these problems are attributed to some yet-undefined environmental exposure that occurred during the veterans' deployment to the Gulf War theater of operations. The present study sought to investigate any differences or similarities between the post-war hospitalization experiences of Marines deployed to the Gulf War and those of a similar group of Marines deployed to an earlier combat engagement – the Vietnam Conflict. This investigation explored two different aspects of hospitalization incidence among the two cohorts. First, the study contrasted the postdeployment hospital admission rates of Marines serving in the two conflicts. Second, the various illness/injury categories of the hospital admissions were contrasted for the two groups of veterans. Hospitalization incidence was further analyzed by four types of troops deployed to both conflicts: infantry, artillery, combat engineer, and service support.

BODY

The statement of work outlined specific tasks necessary in order to perform the study:

- obtain Unit Diaries of Marine combat, combat support, and service support units deployed to Vietnam;
- examine Unit Diaries and any other relevant resources to determine combat activity levels of specific units;
- extract personnel identifiers of Marines in the Vietnam-deployed units and compile into data bases;
- extract personnel identifiers for selected Marine Gulf War-deployed units;
- determine activities of selected Gulf War units from all available sources;
- extract service and medical history data on study populations and compile into data bases
- define criteria for a single hospitalization
- determine total number of person-days within each of the combat, combat support, and service support groups by examining post-deployment lengths of service;
- compute rates of hospital admissions for each group by examining overall admissions and specific diagnostic category admissions;
- contrast and compare for statistical significance any rate differences between the study populations.
- Compile findings into technical report

All of the above tasks were accomplished and are documented in the report, *A Comparison of Postdeployment Hospitalization Incidence Between Vietnam and Gulf War Veterans*, which is included as Appendix A. One task – Compute incidence of medical disability discharge – could not be performed because of data unavailability for the Vietnam cohort.

KEY RESEARCH ACCOMPLISHMENTS

- Report compiled which compares and contrasts the postdeployment hospitalization experiences of Gulf War and Vietnam veterans.

REPORTABLE OUTCOME

The manuscript has been submitted to the American Journal of Epidemiology for publication consideration and will be published as a technical report by the local Defense Automated Printing Service.

CONCLUSIONS

The present study sought to investigate any differences or similarities between the post-war hospitalization experiences of Gulf War and Vietnam veterans. The overall hospital admission rates of the Gulf War and Vietnam veterans in this study are based on 9.6 million and 6.6 million postdeployment person-days respectively, and therefore provide considerable insights into the post-conflict experiences of two groups of veterans. The overall hospital admission rate of the Gulf War veterans of this study was significantly lower than the rate of troops deployed to the last ground conflict with sustained US involvement. Examined individually, the infantry and service support units deployed to the Gulf exhibited significantly lower hospitalization rates following the conflict than did their Vietnam counterparts; the rates of the engineer and artillery units deployed to the Gulf War did not differ significantly from similar units deployed to Vietnam.

Vietnam veterans had significantly higher percentages of their overall admissions accounted for by infective/parasitic disorders and genitourinary disorders than did the Gulf War veterans. In contrast, among Gulf War-deployed Marines the musculoskeletal disorder category represented a significantly higher proportion of their overall admissions than was observed among the Vietnam veterans. The types of musculoskeletal admissions incurred by Gulf War veterans, however, did not differ substantially from the types of musculoskeletal disorders incurred by their Vietnam counterparts. With the exception of these categories of hospital admissions, illness category percentages between the Gulf War and Vietnam veterans exhibited but minimal differences. Among

individuals who were hospitalized, the average number of admissions was the same for the Gulf War and Vietnam cohorts.

The lack of differences between the hospitalization rates of various Gulf War units (infantry, artillery, engineer, service support) performing different functions in varying locations on the battlefield, undercuts the notion that a specific environmental exposure is responsible for deleterious health effects on Gulf War veterans; any specific risk factor might have been expected to affect these very different groups disproportionately. Indeed, Marines deployed to the Gulf War theater exhibited rates of hospitalization that were lower or comparable to the rates incurred by Marines returning from a previous ground combat operation. Nevertheless, the potential psychological disruption associated with deploying a young man or woman across the globe to risk his or her life defending national or international interests, under sometimes harrowing battlefield conditions, is not insubstantial. All appropriate measures should be taken to adequately prepare such individuals before deployment, to monitor their mental and physical well-being during the deployment, and to provide any appropriate counseling or treatment following their return from war.

REFERENCES

References are included on pages 14 to 16 of the appended manuscript.

BIBLIOGRAPHY OF PUBLICATIONS AND MEETING ABSTRACTS

This section is not applicable to the current study.

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APPENDICES

Appendix A is the final manuscript, *A Comparison of Postdeployment Hospitalization Incidence Between Vietnam and Gulf War Veterans.* Appendix B is the Principal Investigator's curriculum vitae.

APPENDIX A

A COMPARISON OF POSTDEPLOYMENT HOSPITALIZATION INCIDENCE BETWEEN VIETNAM AND GULF WAR VETERANS

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A Comparison of Postdeployment Hospitalization Incidence Between Vietnam and Gulf War Veterans

Accounts of postdeployment health problems incurred by Gulf War veterans are many and varied. These accounts have reported a wide range of symptomatology, which have included fatigue, sleep disturbances, joint pain, muscle weakness, depression, inability to concentrate, dental anomalies, skin rashes, gastrointestinal disturbances, headaches, and other health problems.[1-8] Paralleling the numerous maladies attributed to Gulf War deployment are the many causes advanced as responsible for the medical irregularities. The causes put forth include exposures to chemical/nerve agents,[9-11] exposure to petrochemicals associated with the Kuwait oil fires,[12] exposure to depleted uranium rounds on the battlefield,[13] ingestion of pyridostigmine bromide,[14] contraction of an infectious disorder such as leishmaniasis,[15] multiple chemical sensitivities,[16,17] and combat stress.[18-20] In short, many Gulf War veterans report symptomatology that they attribute to their deployment to the Gulf War theater of operations.

However, large epidemiologic studies[21,22] have indicated that postdeployment hospitalizations and deaths among Gulf War veterans have been incurred at rates not statistically different than their nondeployed counterparts. These studies, examining more than one-half million soldiers, sailors, marines, and airmen deployed to the Gulf War theater of operations between August 1990 and mid-1991, and following them for two years after their return from the deployment, provide support to the notion that if a causal link does exist between a deployment-related exposure and ensuing medical anomalies, such a link is not manifested uniformly throughout the entire population of deployed individuals.

The present investigation seeks to shed light on two different aspects of hospitalization incidence among Gulf War Veterans (GWVs). First, while similarities in the 'syndromes' afflicting substantial numbers of veterans returning from various combat engagements have been documented,[23] a systematic contrast of postdeployment hospitalization rates from differing conflicts has not yet been conducted. The present

study compares the postdeployment hospitalization incidence of US Marine Corps (USMC) veterans returning from two different combat engagements – the Vietnam Conflict and the Gulf War. Second, any environmental exposures during the Gulf War having long-term deleterious health effects would be expected to disproportionately affect troops according to their duties or deployment locations – it is unlikely that all personnel deployed to a large theater of operations would have the same rate of exposure to a specific noxious agent. In an attempt to gain insights into the effects of potentially different exposures, the present study further analyzed the hospitalization incidence of Gulf War and Vietnam veterans by contrasting the admission rates for varying troop categories (infantry troops, artillery troops, combat engineers, and service support troops) that had differing duties and battlefield locations during their combat deployments.

METHODS

Data Sources – Personnel

Marine Corps units returning from Vietnam at the end of USMC involvement in that conflict (March – June, 1971 time frame) were first identified via a Marine Corps history,[24] and then diaries for these units were obtained from the Records Service Section, Headquarters USMC. The units returning in this time frame were all 1st Marine Division troops and included six infantry battalions (the 1st, 2nd, and 3rd battalions of both the 1st and 5th Marine Regiments); two artillery battalions (1st and 2nd battalions of the 11th Artillery Regiment); one engineer battalion (1st Engineer Battalion); and four service support battalions from the 1st Force Service Regiment (Headquarters and Service Battalion, Supply Battalion, Motor Transport Battalion, and Maintenance Battalion).

Diaries for these units identified 16,980 unique Service Numbers (SNs). Because Marine Corps medical records starting in the 1970s identify individuals by social security number (SSN) rather than SN, the service numbers from the unit diaries were then matched against a file maintained at the Defense Manpower Data Center (DMDC), Monterey Bay, California, that contained both SNs and their corresponding SSNs. Of the

16,980 SNs, social security numbers were ascertainable for 15,194 personnel (89.5%). Nonmatches were not systematically tied to any particular units but instead likely resulted from incomplete data as the military services transitioned from using SNs to SSNs at a time when many individuals were exiting the service.

The SNs and SSNs were then matched against Department of Defense (DoD) Loss Files, also maintained by DMDC, that indicated the date each individual separated from service. Of the 15,194 personnel whose SSN and SN were both ascertainable, 3300 were excluded from the study for the following reasons: 81 personnel were either officers or were members of another service branch whose medical histories were unavailable for this study; 1637 personnel showed a separation from service immediately upon return from Vietnam and therefore could not be medically tracked for any period of time; and service departure date was indeterminable on 1582 individuals.

Thus, 11,894 enlisted male Marines were identified who served in Vietnam, and who did not separate from military service immediately upon their return from South East Asia. These 11,894 men were comprised of 7009 Marines in infantry companies, 1174 Marines in artillery batteries, 640 Marines in engineering companies, and 3071 Marines in the service support companies.

The data indicating service in the Gulf War, demographic variables for Gulf War troops, and military separation dates for Gulf War veterans were also obtained from DMDC. Because the comparison group (Marines returning from Vietnam) was exclusively male, and the small number of non-enlisted personnel had been excluded, only enlisted male Marines were included in the Gulf War study population as well. Similarly, because only 1st Marine Division troops were active at the end of the Vietnam conflict, the Gulf War study population was restricted to troops of the 1st Marine Division. An historical monograph[25] of 1st Marine Division activities during Desert Storm was used to verify the presence on the battlefield of the combat units used in this study.

The Gulf War study population was limited to the same four troop categories present at the end of USMC involvement in the Vietnam conflict: infantry troops, artillery troops, combat engineers, and service support troops. Seven infantry battalions of the 1st Marine Division were identified from the monograph as having actively participated in the ground war. The units composing the infantry group were the 1st, 2nd, and 3rd Battalions of the 7th Marine Regiment; the 1st Battalion of the 1st Marine Regiment; the 1st Battalion of the 5th Marine Regiment; the 3rd Battalion of the 9th Marines; and the Detachment 3rd Light Armored Infantry Battalion. Similarly, the 1st, 3rd, and 5th Battalions of the 11th Marines were identified in the monograph as active in the ground war and formed the artillery group for the Gulf War population. The 1st Combat Engineer Battalion was identified as actively participating during the ground war and constituted the group for the Gulf War that paralleled the combat engineer unit in the earlier conflict. Lastly, the service support group for the Gulf War was composed of troops from the following Force Service Support Group (FSSG) units: the Headquarters and Service Battalion, the 1st Supply Battalion, the 1st Maintenance Battalion, the 7th Motor Transport Battalion, the 1st Landing Support Battalion, the 7th Engineer Support Battalion, the 1st Medical Battalion, Marine Service Support Group – 11, Marine Service Support Group – 13, and the Headquarters Service Detachment. These service support units were identified as having been in the theater and having strengths greater than 100 personnel.

Altogether then, there were 10,878 Marines who were identified as having served in the Gulf in 1st Marine Division units that paralleled the units that returned from Vietnam at the end of that conflict. These 10,878 men were composed of 4374 Marines in infantry companies, 1588 Marines in artillery batteries, 616 Marines in engineering companies, and 4300 Marines in service support companies. Table 1 contrasts the numbers and types of troops at the beginning of the Vietnam and Gulf War postdeployment periods.

Data Sources – Hospitalizations

Hospitalization data for enlisted Marines returning from the Vietnam conflict were extracted from inpatient records maintained at the Naval Health Research Center. Diagnoses accompanying the hospital admissions incurred by Vietnam veterans during the five-year postdeployment period of this study were recorded in *International Classification of Diseases, Eighth Revision* (ICD-8) format.

Hospitalization data for enlisted Marines returning from the Gulf War were obtained from DMDC. Diagnoses accompanying the hospital admissions incurred by Gulf War veterans during the five-year postdeployment period of this study were recorded in *International Classification of Diseases, Ninth Revision* (ICD-9) format.

Each hospitalization record could contain up to eight diagnoses for a single admission. Hospitalization admissions for each deployed individual from the time of his return from the combat theater until the date five years from that return, or until his date of exit from service if less than five years, were included in the analyses. Individuals with injury admissions coded as resulting from battle wounds were excluded (DoD injury cause codes 400-479) from this study. Because reporting of admissions to the treatment facilities aboard aircraft carriers ceased in 1990, the six admissions aboard carriers recorded for the Vietnam cohort were removed from the analyses.

To eliminate re-counts of admissions that might be viewed as the same illness incident, the following criteria were used to aggregate admission records: any two disease admissions or any two injury admissions occurring in the same 7-day period were considered a single admission; disease admissions with identical 3-digit ICD diagnoses and occurring within the same 21-day period were counted as a single admission, as were follow-up admissions within this time period with the diagnosis 'no need for further medical care'; injury admissions with identical 3-digit ICD diagnoses and occurring within the same 60-day period were counted as a single admission. These adjustments

resulted in a 3.7% reduction in the total admission records for the Vietnam cohort and a 3.5% reduction in records for the Gulf War cohort. The mean time intervals between the aggregated records were 6.3 and 9.2 days respectively. In addition to eliminating re-counts of the same medical incident, the adjustment also ensured that the postdeployment admissions truly were post-deployment problems and not continuing treatments for a disease or injury sustained during the deployment.

STATISTICAL ANALYSES

Crude rates of hospitalization during the postdeployment periods were calculated for each of the four troop categories. The rates were calculated per 1000 persons per day (person-days). An individual who remained in the service for more than 5 years after his return from the conflict would contribute 1825 person-days (365 x 5) to the denominator (exposure period); an individual leaving the Marines exactly four months after his return from combat would contribute 120 person-days to the denominator. In addition to overall rates for the 5-year postdeployment period, rates were computed individually for each postdeployment year.

As a preliminary analysis indicated that there was a statistically significant difference in the ages of the returning veterans (mean age at return for Vietnam veterans of 22.3 versus 24.5 for Gulf War veterans), the crude hospital rates were age-adjusted. Because of the relative youth of forces deployed to the military engagements, age stratification for the adjustments was by narrow, four-year intervals. Table 2 shows the frequencies and percentages of person-days in each age group across the postdeployment periods. Age-adjustment was performed with the direct adjustment method, using the combined Vietnam and Gulf War group as the standardized population.[26] Ninety-nine percent confidence limits were computed for the age-adjusted rates.

Hospital admissions of the combat veterans groups were also compared by their proportional distribution within the following diagnostic categories: infective and parasitic, neoplasms, endocrine, blood and blood-forming, mental, nervous system, circulatory, respiratory, digestive, genitourinary, skin and subcutaneous tissue,

musculoskeletal, congenital anomalies, symptoms and ill-defined, injuries, adverse effects, supplementary classifications, and multiple categories. All categories except Injuries, Adverse Effects, and Supplemental Classifications directly correspond to the ICD diagnostic categories. However, in order to compare the proportions of admissions corresponding to 'injuries' alone, the diagnoses in the ICD category of 'Injuries and Poisonings' for adverse effects of medicinals and other external agents (ICD-9 diagnoses 960 – 994, 909) were separated into their own unique category. Additionally, admissions in the 'Injury and Poisonings' category coded as complications of surgical care (996-999) were placed with the Supplemental Classifications category admissions. These two minor data adjustments allowed 'injuries' to be reported as a stand-alone category of hospital admissions. All hospitalizations having diagnoses that fell into two separate diagnostic categories were reported in the 'multiple category' percentage. After the proportions corresponding to each diagnostic category were determined, 99% confidence limits were calculated for each category percentage.[27]

RESULTS

Rate Comparisons

Figure 1 is a display of the age-adjusted hospitalization rates and confidence intervals of the four troop types composing the Vietnam and Gulf War veteran cohorts. For the Vietnam veterans, while there were no significant differences among the Artillery, Engineer, and Service Support groups, the rate of postdeployment hospitalizations for the Infantry troops was significantly higher when compared with those other three groups. Among Gulf War veterans, there were no statistically significant differences between any of the four troop categories.

Crude and age-adjusted hospitalization rates by post-conflict year for the Vietnam and Gulf War cohorts are presented in Table 3. Hospital admission rates for Vietnam veterans were significantly higher overall and for post-conflict years 1, 3, 4, and 5 when compared with the rates of Gulf War veterans. As can be seen in this table, there was a general decline in hospitalization rates among both groups in the years following the

conflicts. Of the veterans hospitalized, the Vietnam cohort and the Gulf War cohort both averaged 1.24 admissions.

Table 4 is a year-by-year comparison of postdeployment hospitalization rates for Infantry troops from the two conflicts. The rates of the Vietnam infantry troops were significantly higher than the Gulf War infantry troops across the five-year postdeployment period and in the first, fourth, and fifth post-conflict years. Table 5 is a display of the year-by-year comparisons between the Artillery troops serving in the Vietnam and Gulf War conflicts. There were no significant differences in postdeployment hospitalization rates among the artillery groups. Table 6 is a presentation of the yearly rate comparisons between the Combat Engineer groups serving in the two conflicts; there were no statistically significant differences between the hospitalization incidence incurred by the engineering groups active in the two conflicts. Table 7 contrasts the yearly postdeployment rates of the fourth study group -- Service Support troops. As can be seen in this table, the Service Support troops deployed to Vietnam exhibited a significantly higher rate of hospitalizations than Gulf War Service Support troops across the five-year post-conflict period, as well as significantly higher rates in the third and fifth postdeployment years.

Admission Type Comparisons

Table 8 contrasts the distribution of illness category types incurred by the Vietnam and Gulf War veterans across the five-year postdeployment period. Significant differences existed between the two groups of veterans in the proportions of 'Infective and Parasitic' diseases, 'Genitourinary' disorders, and 'Musculoskeletal' disorders, with the Vietnam veterans having the higher proportion within the first two categories and the Gulf War veterans having the higher proportion of musculoskeletal disorders. The specific three-digit ICD-9 diagnoses that were most prevalent among Gulf War veterans within the musculoskeletal category included: internal derangement of joint (30%), synovium tendon and bursa (16%), and other derangement of joint (14%). While slight differences exist in the coding between ICD-9 and ICD-8, the diagnoses of Gulf War veterans are

very similar to the types of musculoskeletal disorders incurred by Vietnam veterans: derangement of joint (25%), other unspecified disorder of joint (15%), synovitis bursitis tenosynovitis (12%), and intervertebral disc disorder (10%).

The difference in proportions of infective disorders was largely due to the considerably higher percentage of this category among Vietnam veterans in the very first year after their return from the combat theater. (Table 9). Similarly, it can be seen in Table 10 that the high percentages of infective disorders among the Vietnam veterans was largely due to those incurred by infantry and artillery troops. Because the percentages in Tables 9 and 10 are based on a large number of cells with frequencies of less than ten (50% and 48% respectively), confidence intervals were not computed for the proportions in these tables.

DISCUSSION

The present study sought to investigate any differences or similarities between the post-war hospitalization experiences of Gulf War and Vietnam veterans. Much controversy has surrounded the postdeployment illness incidence of Gulf War veterans, and the current study juxtaposed the hospital admission incidence of Marines deployed to the Gulf with the hospital incidence of a similar group of Marines deployed to an earlier military conflict. The strength of this study lies in the similarities of the comparison groups – hospitalization incidence of infantry, artillery, combat engineer, and service support units of the 1st Marine Division were contrasted for the years immediately following the veterans' return from two different conflicts. Similarly, both the Vietnam and Gulf War study groups were composed of troops that were in-theater at the end of USMC involvement in those conflicts. One caveat warrants mention here. The current investigation was only able to track the hospitalizations of Marines that remain in the service. Therefore, while the authors know of no evidence that suggests differences in hospitalization rates between veterans who remain in service and those that do not, the present study would not be able to track any such differences if they did exist.

Also, factors which might have been adjusted for if more recent data alone had been utilized, could not be adjusted for because of data unavailability within the Vietnam cohort; race and marital status are two such factors. Further, hospitalization rate differences could conceivably exist because of differences between the early 1970s and the early 1990s in preventive medicine techniques or in 'tendency to hospitalize' for certain conditions; those factors are likewise beyond the scope of this study. Nevertheless, the reported overall hospitalization rates of the Gulf War and Vietnam veterans in this study are based on 9.6 million and 6.6 million postdeployment person-days respectively, and therefore provide considerable insights into the post-conflict experiences of two groups of veterans.

Interestingly, while the infantry troops deployed to Vietnam showed the highest rate of hospital admissions among the four unit-types deployed to that conflict, there were no significant differences in hospitalization rates among the infantry, artillery, engineering, and service support units deployed to the Gulf War. Any hypothesized environmental exposure thought to have had a negative health effect on Gulf War veterans either affected the four troop types in a uniform fashion, or is not readily apparent through analyses of USMC hospitalizations.

Overall, and in four of the five postdeployment years, the aggregated Gulf War veterans exhibited lower hospitalization rates than did their Vietnam counterparts. Separately, the infantry and service support units deployed to the Persian Gulf had lower postdeployment hospitalization rates than did the Vietnam veterans. The combat engineer and artillery units deployed to the Gulf and Vietnam did not differ significantly in their respective rates of hospitalization. Also, among veterans who required hospitalization, the two cohorts did not differ in subsequent admissions; both the Vietnam and Gulf War groups averaged 1.2 hospital admissions among those who had at least one hospitalization.

The categories of illnesses incurred by the Gulf War veterans and the Vietnam veterans of this study were, by and large, not that dissimilar. The returning Vietnam veterans had

a higher percentage of their admissions comprised by infective/parasitic disorders and, to a lesser extent, genitourinary problems. The higher percentage of infectious disorders was largely due to the admissions in this category in the first year upon the veterans' return – a finding not unexpected given the tropical nature of the South East Asia theater of operations.[28] The Gulf War veterans had a higher proportion of their overall admissions comprised by musculoskeletal problems. However, the specific types of musculoskeletal disorders incurred by Gulf War veterans were not substantially different from their Vietnam counterparts. The prevalence of musculoskeletal complaints by Gulf War veterans in the DoD's Clinical Evaluation Program has previously been documented.[29]

SUMMARY

The overall hospital admission rate of the Gulf War veterans of this study was significantly lower than the rate of similar troops deployed to the last ground conflict with sustained US involvement. Examined individually, the infantry and service support units deployed to the Gulf exhibited significantly lower hospitalization rates following the conflict than did their Vietnam counterparts; the rates of the engineer and artillery units deployed to the Gulf War did not differ significantly from similar units deployed to Vietnam. Among Gulf War-deployed Marines, the musculoskeletal disorder category represented a significantly higher proportion of their overall admissions than observed among the Vietnam veterans. In contrast, Vietnam veterans had significantly higher percentages of their overall admissions accounted for by infective/parasitic disorders and genitourinary disorders. With the exception of these categories of hospital admissions, illness category percentages between the Gulf War and Vietnam veterans exhibited but minimal differences. Among individuals who were hospitalized, the average number of admissions was the same for the Gulf War and Vietnam cohorts.

The lack of differences between the hospitalization rates of various Gulf War units (infantry, artillery, engineer, service support) performing different functions in varying locations on the battlefield, undercuts the notion that a specific environmental exposure is

responsible for deleterious health effects on Gulf War veterans; any specific risk factor might have been expected to affect these very different groups disproportionately. Indeed, Marines deployed to the Gulf War theater exhibited rates of hospitalization that are lower or comparable to the rates incurred by Marines returning from a previous ground combat operation. Nevertheless, the potential psychological disruption associated with deploying a young man or woman across the globe to risk his or her life defending national or international interests, under sometimes harrowing battlefield conditions, is not insubstantial. All appropriate measures should be taken to adequately prepare such individuals before deployment, to monitor their mental and physical well-being during the deployment, and to provide any appropriate counseling or treatment following their return from war.[30]

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Table 1. Study Population by Troop Type and Cohort

USMC Troop Type	Vietnam	Gulf War
Infantry	7009	4374
Artillery	1174	1588
Engineering	640	616
Service Support	3071	4300
Total	**11894**	**10878**

Table 2. Person-days of postdeployment periods by Age-group and Cohort

Age (years)	Vietnam Veterans			Gulf War Veterans	
	Number of Person-days	Percent of Person-days		Number of Person-days	Percent of Person-days
18 - 21	2849217	43%		1822510	19%
22 - 25	1869323	28%		3665567	38%
26 - 29	603554	9%		1752292	18%
30 - 33	477639	7%		1093720	11%
34 - 37	465913	7%		717147	7%
38 - 41	207208	3%		383125	4%
42 - 45	95320	1%		153450	2%
46 - 49	34788	1%		46189	0%
> 50	14264	0%		12614	0%
All ages	6617226	100%		9646614	100%

Table 3 - Crude and Age-Adjusted Hospitalization Rates by Post-conflict Year and Cohort

Period of Observation	Vietnam Veterans			Gulf War Veterans		
	Crude Rate*	Age-Adjusted*	(99%CI)	Crude Rate	Age-Adjusted	(99% CI)
Year 1	0.327	0.312	(0.295, 0.330)†	0.230	0.233	(0.218, 0.249)
Year 2	0.250	0.243	(0.222, 0.263)	0.203	0.209	(0.190, 0.228)
Year 3	0.270	0.268	(0.241, 0.295)†	0.205	0.209	(0.186, .233)
Year 4	0.222	0.218	(0.190, 0.247)†	0.161	0.160	(0.136, 0.185)
Year 5	0.248	0.245	(0.212, 0.277)†	0.115	0.114	(0.092, 0.136)
Overall	0.286	0.272	(0.261, 0.282)†	0.199	0.206	(0.197, 0.215)

*Rates are computed per 1000 person-days.

† Rate is significantly higher than that of Gulf War cohort.

Table 4. Crude and Age-adjusted Hospitalization Rates for Infantry Units by Cohort and Post-conflict Year

	Time Period	Crude Rate*	Age-Adjusted Rate*	99% Confidence Interval	
				Lower	Upper
Vietnam Veterans	Year 1	0.382	0.371†	0.343	0.399
	Year 2	0.260	0.255	0.224	0.286
	Year 3	0.251	0.248	0.209	0.287
	Year 4	0.253	0.249†	0.201	0.298
	Year 5	0.274	0.273†	0.218	0.328
	Overall	0.318	0.305†	0.289	0.322
Gulf War Veterans	Year 1	0.241	0.243	0.220	0.265
	Year 2	0.193	0.201	0.174	0.229
	Year 3	0.229	0.239	0.200	0.277
	Year 4	0.144	0.147	0.110	0.185
	Year 5	0.140	0.134	0.096	0.173
	Overall	0.207	0.216	0.202	0.230

*Rates are computed per 1000 person-days.

† Rate is significantly higher than that of Gulf War cohort.

Table 5. Crude and Age-adjusted Hospitalization Rates for Artillery Units by Cohort and Post-conflict Year

	Time Period	Crude Rate*	Age-Adjusted Rate*	99% Confidence Interval	
				Lower	Upper
Vietnam Veterans	Year 1	0.238	0.235	0.191	0.279
	Year 2	0.181	0.184	0.135	0.232
	Year 3	0.216	0.221	0.153	0.288
	Year 4	0.188	0.167	0.097	0.237
	Year 5	0.163	0.139	0.070	0.207
	Overall	0.211	0.203	0.178	0.229
Gulf War Veterans	Year 1	0.237	0.240	0.195	0.284
	Year 2	0.275	0.277	0.217	0.338
	Year 3	0.186	0.182	0.121	0.243
	Year 4	0.185	0.187	0.113	0.261
	Year 5	0.086	0.085	0.031	0.139
	Overall	0.217	0.220	0.194	0.247

*Rates are computed per 1000 person-days.

† Rate is significantly higher than that of Gulf War cohort.

Table 6. Crude and Age-adjusted Hospitalization Rates for Combat Engineer Units by Cohort and Post-conflict Year

	Time Period	Crude Rate*	Age-Adjusted Rate*	99% Confidence Interval	
				Lower	Upper
Vietnam Veterans	Year 1	0.240	0.249	0.181	0.317
	Year 2	0.307	0.301	0.203	0.400
	Year 3	0.228	0.220	0.114	0.327
	Year 4	0.166	0.170	0.063	0.277
	Year 5	0.198	0.265	0.119	0.411
	Overall	0.242	0.242	0.199	0.285
Gulf War Veterans	Year 1	0.191	0.209	0.146	0.271
	Year 2	0.252	0.255	0.164	0.346
	Year 3	0.221	0.260	0.144	0.375
	Year 4	0.175	0.172	0.064	0.279
	Year 5	0.057	0.053	0.000	0.119
	Overall	0.195	0.209	0.169	0.248

*Rates are computed per 1000 person-days.

† Rate is significantly higher than that of Gulf War cohort.

Table 7. Crude and Age-adjusted Hospitalization Rates for Service Support Units by Cohort and Post-conflict Year

	Time Period	Crude Rate*	Age-Adjusted Rate*	99% Confidence Interval	
				Lower	Upper
Vietnam Veterans	Year 1	0.263	0.240	0.213	0.267
	Year 2	0.247	0.233	0.200	0.266
	Year 3	0.327	0.327†	0.280	0.375
	Year 4	0.196	0.195	0.153	0.237
	Year 5	0.244	0.240†	0.191	0.290
	Overall	0.260	0.246†	0.229	0.262
Gulf War Veterans	Year 1	0.223	0.224	0.198	0.250
	Year 2	0.179	0.182	0.153	0.212
	Year 3	0.188	0.189	0.153	0.226
	Year 4	0.164	0.165	0.127	0.204
	Year 5	0.112	0.113	0.079	0.147
	Overall	0.185	0.189	0.175	0.204

*Rates are computed per 1000 person-days.

† Rate is significantly higher than that of Gulf War cohort.

Table 8. Proportional Distribution of Hospitalizations by Diagnostic Category and Cohort

Diagnostic Category	Vietnam		Gulf War	
	Percent of admissions	99% CI	Percent of admissions	99% CI
Infectious & Parasitic Diseases	10.84	(9.05, 12.78)*	2.82	(1.91 , 3.97)
Neoplasm	1.06	(0.55, 1.82)	1.25	(0.68 , 2.06)
Endocrine, Metabolic & Immunity	0.53	(0.20, 1.13)	0.47	(0.16 , 1.04)
Blood & Blood Forming Organs	0.26	(0.06, 0.74)	0.21	(0.04 , 0.65)
Mental Disorders	10.20	(8.45, 12.05)	10.22	(8.35 , 11.72)
Nervous System & Sense Organs	2.54	(1.69, 3.61)	1.88	(1.17 , 2.85)
Circulatory System	3.12	(2.17, 4.29)	2.09	(1.35 , 3.07)
Respiratory System	6.03	(4.70, 7.54)	6.78	(5.26 , 8.27)
Digestive System	6.92	(5.49 , 8.50)	9.65	(7.87 , 11.16)
Genitourinary System	6.45	(5.07 , 7.99)*	3.60	(2.54 , 4.80)
Skin & Subcutaneous System	3.81	(2.75 , 5.06)	2.50	(1.66 , 3.61)
Musculoskeletal	9.36	(7.68 , 11.16)*	21.07	(19.24 , 22.59)
Congenital Anomalies	0.48	(0.17 , 1.05)	0.57	(0.23 , 1.18)
Symptoms, Signs, & Ill-Defined	2.54	(1.69 , 3.61)	1.41	(0.79 , 2.30)
Injuries	14.53	(12.50 , 16.65)	12.42	(10.56 , 13.96)
Adverse Effects	3.17	(0.23 , 1.20)	0.52	(0.19 , 1.11)
Supplemental	0.58	(2.22 , 4.33)	3.03	(2.05 , 4.25)
Multiple Categories	17.60	(15.32 , 19.91)	19.51	(17.65 , 20.94)

*Significant difference between Vietnam veterans and Gulf War Veterans diagnostic category proportions.

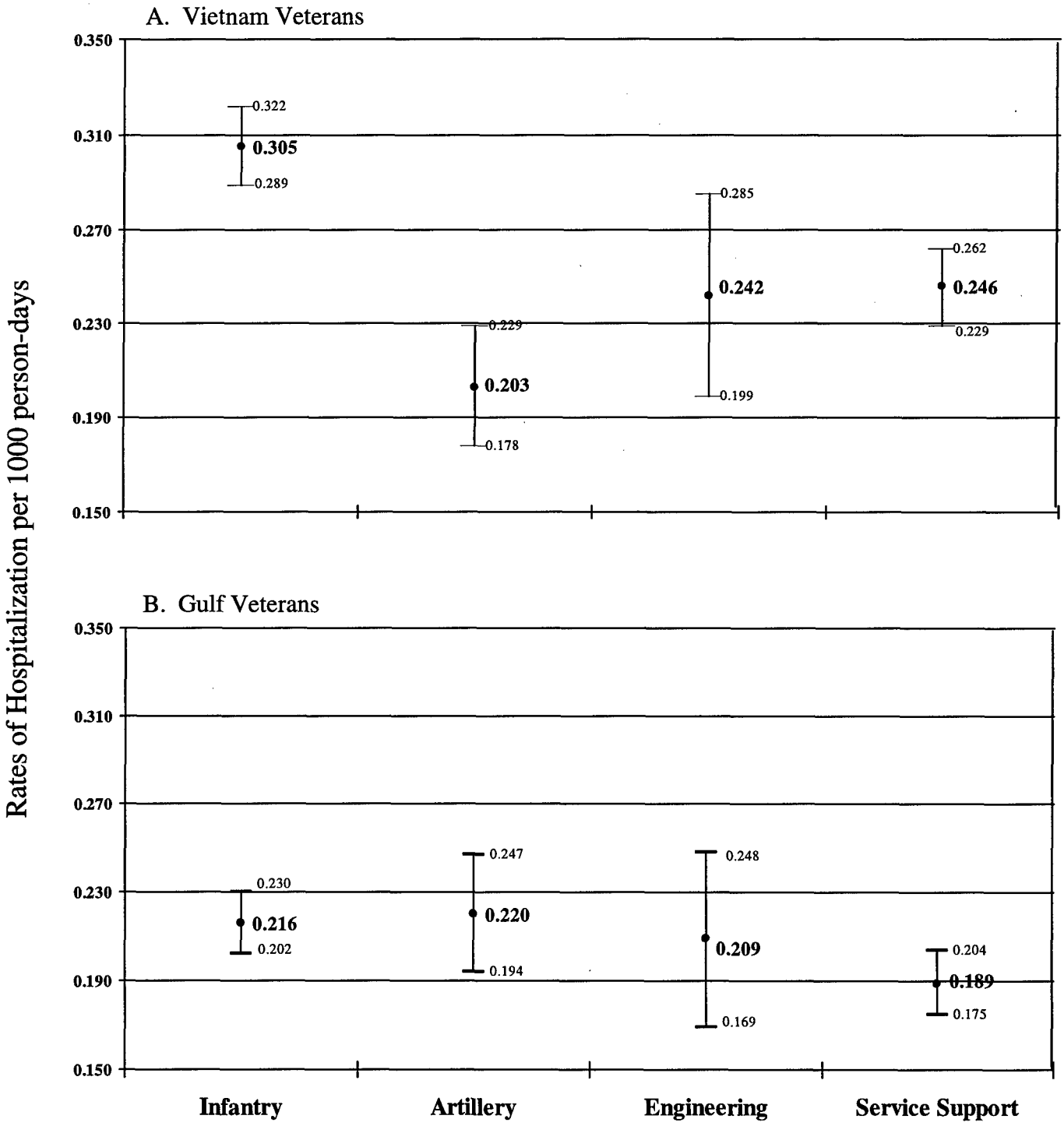
Table 9. Diagnosis Category Percentages by Year Across the Post-Deployment Periods

Diagnostis Category	Year 1		Year 2		Year 3		Year 4		Year 5	
	Vietnam %	Gulf %	Vietnam %	Gulf %	Vietnam %	Gulf %	Vietnam %	Gulf %	Vietnam %	Gulf %
Infectious & Parasitic Diseases	15.25	2.88	7.35	2.46	5.42	4.24	5.80	2.17	2.31	0.86
Neoplasm	0.80	1.38	1.84	1.44	0.83	1.21	0.00	0.54	2.31	0.86
Endocrine, Metabolic & Immunity	0.40	0.63	0.00	0.41	0.42	0.30	2.17	0.54	1.54	0.00
Blood & Blood Forming Organs	0.20	0.38	0.26	0.00	0.42	0.30	0.72	0.00	0.00	0.00
Mental Disorders	10.87	10.50	10.50	11.29	10.00	10.91	5.80	8.15	9.23	5.17
Nervous System & Sense Organs	2.59	1.75	3.15	2.26	1.25	0.91	3.62	2.72	1.54	2.59
Circulatory System	2.99	1.88	2.36	1.03	2.50	3.64	7.25	2.17	3.08	3.45
Respiratory System	5.28	7.88	7.87	6.37	5.83	7.27	7.25	4.89	5.38	2.59
Digestive System	6.18	9.63	6.56	9.45	8.33	8.48	6.52	10.87	11.54	12.07
Genitourinary System	6.68	3.50	3.94	2.26	8.75	4.85	7.25	3.26	6.92	6.90
Skin & Subcutaneous System	3.89	3.00	3.15	2.46	5.83	2.42	3.62	2.17	1.54	0.00
Musculoskeletal	6.98	17.25	8.92	20.12	13.33	24.85	14.49	24.46	16.15	35.34
Congenital Anomalies	0.30	0.63	1.05	0.82	0.00	0.61	0.72	0.00	0.77	0.00
Symptoms, Signs, & Ill-Defined	1.60	1.13	2.89	1.64	4.58	1.21	5.07	2.17	2.31	1.72
Injuries	13.36	15.75	17.59	13.96	16.67	6.97	11.59	10.33	13.85	1.72
Adverse Effects	0.30	0.38	0.79	1.23	0.00	0.30	1.45	0.00	2.31	0.00
Supplemental	3.59	3.00	3.15	3.70	1.67	3.03	2.90	1.63	3.08	2.59
Multiple Categories	18.74	18.50	18.64	19.10	14.17	18.48	13.77	23.91	16.15	24.14

Table 10. Admission Diagnosis Category Percentages by Unit Types

Diagnosis Category	Infantry		Artillery		Engineering		Service Support	
	Vietnam %	Gulf %	Vietnam %	Gulf %	Vietnam %	Gulf %	Vietnam %	Gulf %
Infectious & Parasitic Diseases	13.03	3.83	10.64	1.98	1.16	1.98	7.51	2.25
Neoplasm	0.69	1.45	2.13	0.66	2.33	0.00	1.38	1.46
Endocrine, Metabolic & Immunity	0.17	0.40	2.13	0.00	0.00	0.99	0.99	0.66
Blood & Blood Forming Organs	0.26	0.26	0.00	0.00	0.00	0.99	0.40	0.13
Mental Disorders	10.70	10.69	6.38	10.56	10.47	12.87	10.08	9.27
Nervous System & Sense Organs	2.59	1.72	4.26	1.65	1.16	2.97	2.17	1.99
Circulatory System	3.11	1.58	3.55	0.99	2.33	3.96	3.16	2.78
Respiratory System	5.61	6.60	9.93	8.25	6.98	8.91	5.73	6.09
Digestive System	6.13	9.10	9.22	9.90	8.14	6.93	7.91	10.46
Genitourinary System	6.99	4.49	6.38	4.29	5.81	0.00	5.34	2.91
Skin & Subcutaneous System	3.54	2.37	2.84	2.31	8.14	2.97	3.95	2.65
Musculoskeletal	8.11	20.05	9.22	19.47	12.79	20.79	11.66	22.78
Congenital Anomalies	0.52	0.79	0.71	0.66	0.00	1.98	0.40	0.13
Symptoms, Signs, & Ill-Defined	2.67	1.45	0.00	1.32	3.49	0.00	2.77	1.59
Injuries	14.84	14.12	12.06	11.22	15.12	11.88	14.43	11.26
Adverse Effects	0.78	0.79	0.71	0.33	0.00	1.98	0.20	0.13
Supplemental	2.59	3.69	4.26	3.30	3.49	0.00	4.15	2.65
Multiple Categories	17.69	16.62	15.60	23.10	18.60	20.79	17.79	20.79

Figure 1. Age-Adjusted Postdeployment Hospitalization Rates by Troop Type



APPENDIX B

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PERSONAL QUALIFICATIONS AND RESEARCH CONTRIBUTIONS

A. ACADEMIC BACKGROUND

1. J.D. in Law from Thomas Jefferson School of Law; expected graduation Aug 2001.

2. M.A. in Research Psychology from San Francisco State University, May 1981.

3. B.A. from University of California, Santa Barbara in Experimental Psychology, June 1979.

B. PROFESSIONAL EXPERIENCE

1. Operations Research Division, Naval Health Research Center, 1993 through present.

2. Research Psychologist, Naval Health Research Center May 1982 through present.

3. Member of *Scientific Planning and Review Council*, Naval Health Research Center; Council is responsible for reviewing the scientific merit of all research proposals and charting the direction of the Center, 1994 - 1997.

4. *Contracting Officer's Technical Representative* for Contract N66001-93-D-0021 (a 12 million dollar biomedical research support contract), June 1992 - January 1996. Was responsible for writing Request for Proposals, Statement of Work, setting evaluation criteria, evaluating proposals, and administering contract as the technical representative of Navy Contracting.

5. Member of the *Committee for the Protection of Human Subjects*, April 1988 - August 1992; CPHS is responsible for ensuring the safety and informed consent of all study participants.

C. RESEARCH CONTRIBUTIONS

Journal Publications

Derderian BR, Blood CG. Shipboard Medical Admissions During Peacetime and Combat Support Deployments. Military Medicine, Vol. 165 (3), 228-36, March 2000.

Walker GJ, Blood CG. The Patient Flow of Marine Disease and Non-Battle Injury Conditions Within a Multi-Echelon System of Care. Military Medicine, Vol. 164, 423-27, June 1999

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Conference Presentations

Blood CG. Chairperson of Battlefield Performance, Casualty Sustainment, and Medical Planning Working Group at 66th Military Operations Research Society Symposium held at the Naval Postgraduate School, Monterey, CA, 23-25 June, 1998.

Blood CG. Projections of Ground Casualties and Shipboard Casualties During Military Operations. Presented at 66th Military Operations Research Society Symposium held at the Naval Postgraduate School, Monterey, CA, 23-25 June, 1998.

Blood CG. Casualty Projections for Ground Forces. 65th Military Operations Research Society Symposium, Quantico, VA, 10 - 12 June 1997.

Blood CG. Casualty Estimation for Forces Afloat. 65th Military Operations Research Society Symposium, Quantico, VA, 10 - 12 June 1997.

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Blood CG. Simulation of Casualty and Illness Incidence Among Ground Troops and Forces Afloat. Presented at the Twelfth International Symposium on Military Operation Research (12 ISMOR) Royal Military College of Science, Swindon, U.K. 4-8 September 1995.

Blood CG. Using the FORECAS Projection System to Simulate Casualty and Illness Rates Among Ground Forces, 63rd Military Operations Research Society Symposium, Annapolis MD, 6-8 1995.

Blood CG. Using the SHIPCAS Projection System to Simulate Casualty and Illness Rates Among Ground Afloat, 63rd Military Operations Research Society Symposium, Annapolis MD, 6-8 June 1995.

Blood CG. The Battle for Hue: Casualty and Disease Rates during Urban Warfare. Presented at the Tenth International Symposium on Military Operation Research (10 ISMOR) Royal Military College of Science, Swindon, U.K. 7-10 September 1993.

Blood CG. Illness Incidence During Military Operations as a Soft OR Factor, 61st Military Operations Research Society Symposium, Dayton, Ohio, 22-24 June 1993.

Blood CG. The Relationship Between Battle Intensity and Disease Rates Among Combat and Support Units. Presented at the Ninth International Symposium on Military Operation Research (9 ISMOR) Royal Military College of Science, Swindon, U.K. 7-11 September 1992.

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REPLY TO
ATTENTION OF:

MCMR-RMI-S (70-1y) 19 Jan 01

MEMORANDUM FOR Administrator, Defense Technical Information Center, ATTN: DTIC-OCA, 8725 John J. Kingman Road, Fort Belvoir, VA 22060-6218

SUBJECT: Request Change in Distribution Statement

1. The U.S. Army Medical Research and Materiel Command has reexamined the need for the limitation assigned to technical reports written for Grant DAMD17-98-1-8010. Request the limited distribution statement for Accession Document Number ADB254366 be changed to "Approved for public release; distribution unlimited." This report should be released to the National Technical Information Service.

2. Point of contact for this request is Ms. Judy Pawlus at DSN 343-7322 or by email at judy.pawlus@det.amedd.army.mil.

FOR THE COMMANDER:

PHYLIS M. RINEHART
Deputy Chief of Staff for
Information Management