

Injuries and Illnesses of Vietnam War POWs Revisited: V. Combined Service Group Risk Factors

LT Saima Raza, MSC, USN, Jeffrey L. Moore, John P. Albano, and A. Fred Wells

Operation Homecoming (O/H), the negotiated release of 566 US Servicemen held as prisoners of war (POWs) in Vietnam for as long as nine years, began in February 1973. During the months that followed, enemy forces released 138 Navy, 26 Marine Corps, 77 Army, and 325 Air Force Repatriated POWs (RPWs).

As a part of O/H (Thirteenth Air Force, 1973), medical and psychological conditions of all repatriates were documented in the Initial Medical Evaluation Form (IMEF), a 400 page, 29 section, standard protocol. Berg and Richlin (1977a,b and c) described the procedures and findings of the medical teams that examined and treated Navy, Marine Corps, and Army RPWs at Clark Air Force Base (Republic of the Philippines) and at numerous stateside military medical treatment facilities. Where appropriate, information was also presented concerning symptoms and conditions which occurred during captivity (as described in the history section of the IMEF). There was no such similar report or publication from the Air Force.

In their 1977 Navy, Marine Corps, and Army publications, Berg and Richlin emphasized documentation of the specific injury and illness diagnoses. We were interested in identifying risk factors that predisposed the RPW to various injuries and illnesses. In view of the small sample size of individual diagnoses, we evaluated the effects of captivity from the perspective of ICD9-CM diagnostic categories (i.e., systems level). From this perspective, the relationship between medical conditions observed at repatriation and various risk factors, also recorded in the IMEF, could be analyzed. These risk factors included age at time of captivity, length of captivity (months), length of solitary confinement (weeks), self-reported captivity medical problems, reported torture severity, and subjectively determined weight loss. Using this approach, we have previously found that the typical Navy, Army and Marine Corps repatriate received slightly more than twelve IMEF diagnoses during O/H (Raza, et.al, 2016a, b and c), while Air Force repatriates received slightly less than six (Raza, et.al, 2017). Across the four services, there also appear to be similarities and differences in the number of subjectively reported medical problems during captivity, the duration of captivity duration and torture severity. It was common in all four services the most for the most prevalent conditions to be related to infections, injuries/trauma and conditions involving the nervous system or special senses. When predicting the presence/absence of a categorical diagnosis within each service, we typically found the contribution of length of captivity and the number of medical problems during captivity to be the most useful predictive risk factors.

In this final report on IMEF diagnoses among Vietnam repatriates, we will report the prevalence of categorically-defined diagnoses for the combined group, as well as group summary descriptive statistics for each of the risk factors. Since these data have never been previously combined, we will analyze group differences on both risk factors and the outcome measure (number of physician- made diagnoses at the time of O/H). We hypothesize that these risk factors would predict both the grand total of IMEF diagnoses across categories and the presence of any diagnoses within specific categories. We also hypothesize that length of captivity and number of medical problems during captivity, both of which were found useful in the prediction of categorical diagnosis in the separate services, would remain significant once all data were combined. Finally, we predicted that the difference between the numbers of IMEF diagnoses between Air Force and other repatriate groups would be statistically significant.

Methods

Data from all 566 Vietnam RPWs recorded in the IMEF, with the exception of 20 Air Force repatriates with incomplete data regarding the number of medical problems in captivity, were available for analysis. Complete data were available regarding diagnoses, age at time of captivity, length of captivity (months), length of solitary confinement (weeks), and reported torture severity. Each RPW diagnosis was coded to an ICD9-CM category and tabulated as described in our previous four reports.

Statistical analyses were performed using SPSS version 19. Pearson correlations with the six risk factors were obtained for the number of IMEF diagnoses and the number of reported medical problems during captivity. The relative contribution of the six risk factors to the prediction of the total number of IMEF diagnoses was explored using linear regression (complete entry and statistically-based forward entry). Similar linear regressions were performed to predict self-reported captivity medical problems using the other five risk factors. After identifying those ICD9-CM diagnostic categories with a prevalence of 25 to 60 percent (conditions that were neither rare nor ubiquitous), logistic regression was performed to evaluated the effectiveness of the risk factors in predicting presence or absence of conditions within these categories.

Each ANOVA assumption was assessed prior to analysis. The assumption regarding independence of error terms was met. After reviewing the data both graphically and statistically (Shapiro-Wilk and Levene test), there were concerns regarding the other assumptions and non-parametric methods were selected for the analysis of group differences. Specifically, the omnibus group difference was evaluated using the Kruskal-Wallis test, while post-hoc analysis of the three pair-wise differences were evaluated using the Length of captivity revealed bimodal curves (short duration and long duration), solitary confinement was extremely skewed (short duration was most common, but some repatriates had extreme durations), and outliers were common on most of the risk variables. In order to provide the decision was made report both the standard F test using the Tukey post-hoc test, as well as the Welch test using the Games-Howell test for pair-wise post-hoc analyses.

Results

The descriptive statistics for the combined group of 566 Vietnam repatriates, along with service-specific data, are presented in Table 1. These 497 Officers and 69 Enlisted men were, on average, nearly 30 years old at the time of capture and were held prisoner for approximately four and a half years, 30 weeks of which were spent in solitary confinement. During captivity, they were frequently tortured (mean = 30 on a 25-item IMEF scale with a maximum score of 75), and reported having concerns about nine medical problems during captivity (possible range 0 to 40).

These repatriates received between 0 and 36 diagnoses at the time of repatriation. The four ICD9-CM categories with the highest mean number of diagnoses within the combined cohort were Infectious, Injury/Poisoning, Neurological/Special Senses and Ill- Defined, (in descending order). For each of the fifteen categories, the prevalence of any diagnosis ranged from 87% to 3%. The prevalence of Mental Health diagnoses (25%) was similar to the prevalence of Circulatory (30%), Respiratory (27%) and Digestive (23%) disorder diagnoses.

As shown in Table 2, the total number of diagnoses at the time of repatriation varied significantly between the services as measured by the Kruskal-Wallis H statistic and there was no interpretive difference between that non-parametric test and parametric procedures. Post-hoc analysis (Mann-Whitney U statistic) revealed significant differences in all three pair-wise comparisons. The number of IMEF diagnoses among the Army repatriates (median = 14, semi-interquartile range = 3) was significantly greater than the USN/USMC repatriates (median = 11.5, semi-interquartile range = 3), which was significantly greater than the number of IMEF diagnoses among the USAF repatriates (median = 5, semi-interquartile range = 1.5).

All five primary analyses of group differences on the risk factors were also statistically significant, while post-hoc analysis demonstrated both similarities and differences between the three service groups. **Torture:** Reported torture severity was similar in the Army (median = 28, semi-interquartile range = 7.3) and USAF (median = 28, semi-interquartile range = 8.3), but significantly greater among the UNS/USMC (median = 35, semi-interquartile range = 7) repatriates.

Months of Captivity: The length of captivity was similar for the USN/USMC (median = 68 months, semi-interquartile range = 10.5) and USAF (median = 67 months, semi-interquartile range = 34.5) repatriates, but significantly less for the Army (median = 58 months, semi-interquartile range = 12.5) repatriates.

Weeks of Solitary Confinement: The duration of solitary was similar for the Army (median = 7 weeks, semi-interquartile range = 14.5) and USAF (median = 8 weeks, semi-interquartile range = 15) repatriates, but significantly longer for the USN/USMC (median = 23 weeks, semi-interquartile range = 28.9) repatriates.

Age at the Time of Capture: There was no significant difference between the age of USN/USMC (median = 29.5 years, semi-interquartile range = 4.5) and USAF (median = 30 years, semi-interquartile range = 4.5) repatriates, but Army repatriates were significantly younger than the other two groups (median = 22 years, semi-interquartile range = 3).

Subjectively Reported Medical Problems During Captivity: All three pair-wise service comparisons were significant, with Army repatriates (median = 13 problems, semi-interquartile range = 4.8) reporting more than USN/USMC repatriates (median = 10 problems, semi-interquartile range = 3.4). As a group, USAF repatriates reportedly having had significantly fewer medical during captivity (median = 7 problems, semi-interquartile range = 3).

The total number of IMEF diagnoses correlated significantly with five of the six risk factors and the number of captivity-related medical problems correlated significantly with three of the other four risk factors. All of these significant correlations were positive, demonstrating, for example, that number of IMEF diagnoses increased in conjunction with captivity-related medical problems ($r^2 = 0.25$). Age at time of capture did not correlate significantly with either total number of IMEF diagnoses or number of subjectively reported medical problems during captivity.

Approximately 26% of the variance in number of IMEF diagnoses was accounted for using standard linear regression that required retention of all five risk factors, but only length of solitary confinement and number of captivity-related medical problems made statistically significant contributions (the only two variables retained during statistical linear regression using forward entry). The contribution of each of the four risk factors used to predict the number of captivity-related medical problems were statistically significant and retained in both linear regression procedures. Analysis of the standardized beta weights obtained from linear regression for the combined group reveals that duration of captivity is the strongest predictor of the number of subjectively reported medical problems during captivity (beta = 0.29) and that, in turn, the number of subjectively reported medical problems during captivity is the strongest predictor of number of IMEF diagnoses (beta = 0.47). Despite the group differences in the number of captivity-related medical problems and the number of IMEF diagnoses reported above, the relative contribution of risk factor as measured by standardized beta weights was relatively consistent across service groups.

The ability of the risk factors to predict the presence or absence of diagnoses in all fifteen ICD9-CM categories was evaluated using two logistic regression methods; complete entry and forward likelihood ratio entry. Thirteen of the fifteen equations were significant, with forward entry retaining one to four of the five risk factors in each equation. For those equations obtaining statistical significance, variance accounted for ranged from 3% to 23%. The presence/absence of mental health and congenital conditions could not be reliably predicted and torture severity was never a significant predictor of condition presence/absence.

Discussion

Data from the entire cohort of Vietnam military repatriates have now been combined for analysis. Previous studies have reported service-specific individual disease frequencies, frequency of disease within broad ICD categories, and the relative contribution of various risk factors. Analyses of both subjective captivity-related medical problems and the results of comprehensive medical examinations with respect to those same risk factors were likewise completed separately for each military service. Questions regarding group similarities and differences arose from those studies that could only be directly answered by combining the data.

In the initial years following repatriation, each service was most keenly interested in the health of their own repatriates and separate five-year medical follow-up programs were mandated by the Department of Defense. Unlike prisoners of war from World War II and Korea, the vast majority of military POWs in Vietnam were officers and aviators with college degrees. Many of those aviators were senior in rank, had graduated from a service academy, had many military combat flight hours and had previously decided to remain on active duty for an entire career. Following shoot down, ejection, evasion and capture, nearly every aviator was transported to a prison in North Vietnam, such as the notorious "Hanoi Hilton." Once there, solitary confinement and torture were common, at least until the final two to three years of the war. Noteworthy is that military tactical and strategic changes resulted in a near absence of aviator POWs in

1969 and 1970, as well as the preponderance of Air Force POWs in 1971 and 1972. Two aviators were held in China.

Conversely, Army POWs in Vietnam were more likely to be enlisted and high-school educated, some of whom were draftees with a two-year service obligation. Few Army POWs were career-designated and most of the officers were not aviators. The typical Army POW spent all, or most of his captivity in the jungles of South Vietnam under active-combatant control. Often they were kept in cages or pits. Escapes and releases were possible in the south, but torture was less predictable and formal solitary confinement involved less isolation or sensory deprivation. The rates of mortality and malnutrition were high in the jungles of South Vietnam. A few POWs were also held captive in Laos and Cambodia.

Given these well-established facts regarding Vietnam repatriate, it was not surprising to find significant group differences on the four risk factors used in this study. The average Army POW was about six years younger than repatriates from other services and spent fewer months under enemy control. The average Navy/Marine Corps repatriate reported 20%-31% more torture than repatriates from other services and 65%-95% more time in solitary confinement. Despite these differences, all four risk factors predicting the number subjectively-reported medical problems during captivity and those subjective complaints were, in turn, provided the most reliable prediction of objective medical diagnoses. Although the lack of correlation between captivity-related risk factors and congenital disorders may not be unexpected, their lack of correlation with mental disorders merits further discussion. At the time of repatriation, some clinicians elected to include resolved conditions and other problems (occupational and marital) in a repatriate's problem summary list thereby insinuating a potential confound when compared to another repatriate with actual psychiatric illness requiring psychopharmacological or psychotherapeutic treatment. It is also possible that other intrapersonal and interpersonal risk factors not included in the present study would better predict mental disorders. Our previous research regarding the beneficial effects of dispositional optimism has suggested that, when predicting mental disorders and resiliency, the type of person who had the experience is perhaps more important than the type of experience had by that person (Segovia et. al, 2102, Segovia et. al, 2015).

Our hypothesis regarding the low rate of reported medical problems and actual diagnoses among Air Force repatriates was confirmed. All three pairwise comparisons on these two variables were significant, with the Army group obtaining the highest totals and the Air Force group obtaining the lowest totals. In view of differences in both pre-captivity medical standards and captivity location, it was not surprising to find higher totals in the Army group, where each repatriate had about one more diagnosis than complaint. Each Navy/Marine Corps repatriate had nearly two more diagnoses than complaints, while the average number of IMEF diagnoses in the Air Force group was fewer than the number of subjective medical problems reported in the group. Factors such as pre-captivity medical standards, age, career designation, captivity location and captivity duration cannot explain the difference between the Navy/Marine Corps and Air Force groups. As a result, we must attribute our findings to either group differences on the other two risk factors (torture severity and length of solitary confinement) or to differences in the fidelity of the initial medical examination. Although we tentatively conclude that the differences are attributed to the measured risk factors, additional data may help solidify this conclusion. Group differences in torture severity and solitary confinement may continue to reliably predict long-term medical morbidity, while captivity-related medical problems and IMEF diagnosis may not predict long-term medical morbidity if those factors were under-reported one of the repatriate groups.

This study had several limitations. Missing data from Air Force repatriates limited the total number of subjects used in some analyses, while both torture severity and captivity-related medical problems were assessed using a retrospective subjective self-report. Other risk factors, such as months of captivity and age at time of capture were objective and easily quantified. Although these findings may not be fully applicable to other military scenarios where the male aviator officer repatriates held captive and tortured for many years are less prominent, future researchers should remain mindful of environmental and demographic risk factors unique to future military operations when anticipating immediate post-repatriation medical problems. It remains to be seen what, if any relevance the same risk factor have in predicting long-term medical morbidity and mortality.

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Table 1
Summary Descriptive Statistics

		USN/USMC (n = 164)	USA (n = 77)	USAF (n = 325)	Combined (n = 566)
Torture	Mean	34.58	26.46	28.75	30.13
	Std Dev	11.93	11.24	13.27	12.95
LOC months	Mean	60.65	49.13	52.84	54.60
	Std Dev	26.40	19.12	32.50	29.54
LOS weeks	Mean	45.11	27.34	23.16	30.09
	Std Dev	57.78	48.97	38.48	47.21
Age TOC	Mean	30.01	24.53	31.01	29.84
	Std Dev	5.45	5.20	5.66	5.93
CapMedPrb	Mean	10.40	13.66	7.12	9.03
	Std Dev	5.49	6.03	4.66	5.64
IMEF Dx	Mean	12.27	14.38	5.58	8.71
	Std Dev	5.01	5.28	2.56	5.35
% Officer		93.3	36.4	97.2	87.8

(USAF CapMedPrb: n = 305)

Table 2
Group Differences

a. Primary Analyses

		Statistic	df	p
Torture	Kruskal-Wallis H	36.247	2	< 0.001
	ANOVA F	15.350	2, 563	< 0.001
	Welch F	17.184	2, 210.550	< 0.001
LOC months	Kruskal-Wallis H	23.657	2	< 0.001
	ANOVA F	5.424	2, 563	0.005
	Welch F	7.868	2, 246.586	< 0.001
LOS weeks	Kruskal-Wallis H	28.820	2	< 0.001
	ANOVA F	12.415	2, 563	< 0.001
	Welch F	9.635	2, 177.559	< 0.001
Age TOC	Kruskal-Wallis H	79.164	2	< 0.001
	ANOVA F	42.690	2, 563	< 0.001
	Welch F	46.888	2, 204.043	< 0.001
CapMedPrb	Kruskal-Wallis H	93.359	2	< 0.001
	ANOVA F	58.475	2, 543	< 0.001
	Welch F	51.139	2, 183.244	< 0.001
IMEF Dx	Kruskal-Wallis H	298.405	2	< 0.001
	ANOVA F	258.059	2, 563	< 0.001
	Welch F	210.412	2, 157.704	< 0.001

b. Post-Hoc Analyses

		COMPARISON*		
		USN - USAF	USN - USA	USAF - USA
Torture	Mann-Whitney U	< 0.001	< 0.001	0.170
	Tukey HSD	< 0.001	< 0.001	0.325
	Games-Howell	< 0.001	< 0.001	0.270
LOC months	Mann-Whitney U	0.185	< 0.001	< 0.001
	Tukey HSD	0.015	0.013	0.578
	Games-Howell	0.013	< 0.001	0.390
LOS weeks	Mann-Whitney U	< 0.001	< 0.001	0.541
	Tukey HSD	< 0.001	0.016	0.756
	Games-Howell	< 0.001	0.038	0.764
Age TOC	Mann-Whitney U	0.176	< 0.001	< 0.001
	Tukey HSD	0.141	< 0.001	< 0.001
	Games-Howell	0.139	< 0.001	< 0.001
CapMedPrb	Mann-Whitney U	< 0.001	< 0.001	< 0.001
	Tukey HSD	< 0.001	< 0.001	< 0.001
	Games-Howell	< 0.001	< 0.001	< 0.001
IMEF Dx	Mann-Whitney U	< 0.001	0.001	< 0.001
	Tukey HSD	< 0.001	< 0.001	< 0.001
	Games-Howell	< 0.001	0.011	< 0.001

* p-values for differences; shaded areas are non-significant

Table 3
Correlations and Linear Regression

a. Pearson Product-Moment Correlations

	Total IMEF Dx	CapMedPrbs
CapMedPrbs	0.502	N/A
Torture	0.183	0.304
LOSw	0.224	0.273
LOCm	0.223	0.396
Age_TOC	-0.053	-0.019

Bold = Statistically Significant

b. Linear Regression

	Total IMEF Dx	CapMedPrbs
Adjusted R ²	0.258	0.195
Std Error Est	4.629	5.059
CapMedPrbs	0.445	N/A
Torture	0.011	0.063
LOSw	0.012	0.017
LOCm	-0.001	0.056
Age_TOC	-0.064	-0.113
Constant	6.116	6.925

Bold = Statistically Significant

Table 4
Standardized Beta Weights

CapMedPrbs

	USN/USMC	USA	USAF	Combined
Torture	0.18	0.11	0.13	0.15
LOC_M*	0.33	0.40	0.37	0.29
LOS_W	0.04	0.14	0.06	0.14
Age_TOC	0.07	0.06	0.09	-0.12

Total Diagnoses

	USN/USMC	USA	USAF	Combined
Torture	0.04	0.25	-0.12	0.03
LOC_M	0.19	0.18	0.26	-0.01
LOS_W	-0.10	0.05	0.07	0.10
Age_TOC	0.23	0.14	0.14	-0.07
CapMedPrbs*	0.27	0.30	0.23	0.47

* = Most significant variable in the Linear Regression

Table 5
Significant Variables in the Logistic Regression Equation

Category	Prevalence	Age_TOC	LOC_M	LOS_W	Torture	CapMedPrb	R ²
Inf	87.3		X				0.08
inj	73.3					X	0.04
ns	71.2			X		X	0.16
ill def	55.1		X			X	0.04
skin	39.0	X				X	0.06
mus	35.2			X		X	0.09
circ	29.7		X			X	0.06
resp	26.7	X				X	0.09
mental	24.6						ns*
dig	22.8		X				0.07
end	17.1	X	X	X		X	0.19
gen	13.6					X	0.06
cong	10.6						ns*
Neo	7.4					X	0.03
blood	2.7	X	X			X	0.23

* = Non-significant Logistic Regression equation for this diagnostic category