Injuries and Illnesses of Vietnam War POWs Revisited: II. Army Risk Factors

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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, 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 (1977) described the procedures and findings of the medical teams that examined and treated Army RPWs at Clark Air Force Base (Republic of the Philippines) and at 8 mainland Army hospitals. Where appropriate, information was also presented concerning symptoms and conditions which occurred during captivity (as described in the history section of the IMEF).

Berg and Richlin emphasized documentation of the specific injury and illness diagnoses. The overwhelmingly most common diagnoses in the group were helminthiasis (77%), followed by avitaminoses (55%), hearing impairment (40%), peripheral nerve injury (39%), and malaria (34%). They noted that the consensus of physicians involved in O/H found that the Army RPWs were generally in good health, in fact, much better than the "worst case" actually planned. They also found limited evidence of either neuroses or "premature aging," both of which have been noted among repatriates from previous wars.

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.

The purpose of this present study is to look at the relationship between the number of diagnosis at repatriation (i.e., IMEF) and various risk factors. We hypothesized that these risk factors would predict both the grand total of IMEF diagnoses across categories and the presence of any diagnoses within specific categories. This report, which addresses the Army RPWs, is the second in a series of four reports. The first report dealt with Navy RPWs and subsequent reports will be devoted to the Marine Corps and to a combined analysis of all three RPW groups for direct comparison.

Methods

Data from all 77 Army RPWs recorded in the IMEF were available for analysis. Prior to conducting our analyses, the completeness of the electronic database was verified by referring to individual microfiche copy of the original 400 page IMEF on each repatriate. All available information regarding diagnoses, 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 were verified. Next, each RPW ICDA-8 coded diagnosis was converted to an ICD9-CM category. We then tabulated the number of diagnoses per category, excluding diagnoses relating to Pregnancy and Certain Conditions Originating in the Perinatal Period (i.e., ICD9-CM codes 740-779), which were non-existent in our sample. All diagnoses were categorized and the sum across categories was equivalent to the number of diagnoses reported by Berg and Richlin (1977). The presence or absence of diagnoses within a category was also tabulated for each of the repatriates.

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14. ABSTRACT

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 POWs. The purpose of this present study is to look at the relationship between the number of diagnosis at repatriation (i.e., IMEF) and various risk factors. We hypothesized that these risk factors would predict both the grand total of IMEF diagnoses across categories and the presence of any diagnoses within specific categories.

15. SUBJECT TERMS
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Statistical analyses were performed using SPSS version 19. Pearson correlations were obtained between the number of IMEF total diagnoses and the six risk factors, while Spearman correlations were obtained between risk factors and the non-normally distributed number of diagnoses within each category. 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 53 to 69 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.

Results

The descriptive statistics for the Army repatriates are presented in Table 1. These 28 Officers and 49 Enlisted men were, on average, less than 25 years old at the time of capture and were held prisoner for more than four years, 27 weeks of which were spent in solitary confinement. During captivity, they were frequently tortured (mean = 26 on a 25-item IMEF scale with a maximum score of 75), lost an average of 27% of their pre-captivity body weight and reported having concerns about fourteen medical problems during captivity (possible range 0 to 40).

Army repatriates received between 5 and 36 diagnoses at the time of repatriation (Table 2). The four ICD9-CM categories with the highest mean number of diagnoses within the Army cohort were Injury/Poisoning, Infectious, Nervous and Special Senses, and Skin (in descending order). The prevalence of any diagnosis in each of these categories ranged from 99% to 65% (Table 4). No Army repatriate had more than two diagnoses in four of the categories, to include the Mental category (overall prevalence of any Mental diagnosis was 39%).

As shown in Table 3, the total number of diagnoses at the time of repatriation was significantly correlated with only two of the six risk factors, with the number of captivity related medical problems explaining the highest percent of the variance (9%). Length of solitary confinement was not significantly correlated with the total number of diagnoses ($r = 0.203$, $r^2 = 0.041$). Age at the time of capture was significantly correlated only with the number diagnoses within the Digestive category. The number of self-reported captivity medical problems was significantly correlated with the number of actual IMEF diagnoses in three of the fifteen diagnostic categories, but the correlation was negative correlation for Congenital category. A significant negative correlation was also observed between Length of Captivity and the number of diagnoses in the Blood category. Significant correlations, accounting for 6% shared variance, were for Torture severity (Nervous and Special Senses) and Weight Loss (Infectious).

Complete linear regression analysis predicting the number of IMEF diagnoses using all six risk factors (Table 5a) resulting in a significant equation that accounted for 18.4% of the variance. Statistical linear regression allowing the forward addition of predictors (Table 6a) accounted for 11.4% of the variance using only two of the risk variables (Age at Time of Capture, Length of Captivity, Length of Solitary, and Estimated Weight Loss). In each of these two regression equations, the relative contributions of self-reported Captivity Medical Problems and Torture Severity were equivalent as demonstrated by the part correlations.

A similar approach was utilized to predict the number of self-reported captivity medical problems using the remaining five risk factors. For this prediction, complete linear regression analysis resulted in a highly significant equation that accounted for 25.8% of the variance (Table 5b). Follow-up statistical linear regression allowing the forward addition of predictors (Table 6b) accounted for 22.3% of the variance using Length of Captivity as the sole predictor. In each of these two regression equations, the relative contribution as demonstrated by the part correlation coefficient was greatest for Length of Captivity.

The ability of the risk factors to predict the presence or absence of diagnoses in those five ICD categories with midrange condition prevalence: endocrine (END: 69%), skin (SKN: 65%), congenital (CON: 57%), ill-defined (ILL: 57%) and respiratory (RES: 53%), was evaluated using logistic regression analysis (Table 7). A significant model was only obtained for the END category ($p = 0.032$, Nagelkerke R-Square = .231). Although this equation resulted a more accurate classification than the base rate (76.6% versus 68.8%), the positive and negative predictive values were only 77% and 75%, respectively. At the level of individual predictor, both length of captivity ($p = 0.005$; Exp(B) = 0.948, with a 95% confidence interval from 0.913 to 0.984) and captivity-related medical problems ($p = 0.047$; Exp(B) = 1.113, with a 95% confidence interval from 1.001 to 1.237) contributed significantly to the prediction of END condition presence. The logistic regression model for CON approached statistical significance, accounting for approximately 18% of the variance and accurately categorizing 74% of the USA repatriates (base rate accuracy = 75.3%). For CON, only number of the subjective number of captivity-related medical problems approached statistical significance as an individual predictor ($p = 0.068$; Exp(B) = 0.893, with a 95% confidence interval from 0.790 to 1.009).

Discussion

To our knowledge, this study represents the first attempt to utilize captivity-related risk factors to predict repatriated POWs injury and illnesses, as measured by the number of diagnoses and the existence of categorical diagnoses. The strength of this study is a direct result of our access to the all of the original data obtained in 1973 (i.e., the IMEF). Early published reports described the observed illnesses and injuries in great detail, but did not attempt to exploit concurrently obtained risk factors to illness and injury.

The Army RPWs were, indeed, healthier than expected despite their lengthy and torturous captivity. After 49 months of captivity, an average of nearly 14 captivity-related medical problems were subjectively reported by these men, while 14 diagnoses were made as a result of an extensive examination upon their repatriation. Berg and Richlin reported the most common diagnoses. When we categorized the 1107 different diagnoses, the 4 most common ICD9-CM categories were consistent with Berg and Richlin's top diagnoses. The order of frequency, however, was slightly different.

Nearly all of the risk factors correlated significantly with the total number of objective diagnoses at the time of repatriation. As expected, the total number of captivity-related medical problems subjectively reported by the Army RPWs was the best predictor of the number of physician-made diagnoses, followed closely by duration of captivity and age at the time of capture. Army repatriates who were tortured more and had more subjective complaints demonstrated a wider range of illnesses and injuries following extensive objective evaluation. Likewise, the number of captivity-related medical problems increased with captivity duration. Despite our unique approach, there appear to be several limitations to this study, such as the small sample size, the restricted range of pathology, and the lack of comparison to repatriates from other services. We will attempt to address these issues in future studies.

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Table 1

USA Demographics

(n = 77)

Variable	Min	Max	Mean	StdDev
Age_TOC	19	40	24.53	5.20
LOCm	10	108	49.13	19.12
LOSw	0	234	27.34	48.97
IMEF_tort	4	55	26.46	11.24
Weight Loss %	1.7	54.2	26.97	12.75
CapMedProbs	3	30	13.66	6.03
Percent Officer			36.40	

Table 2

USA IMEF ICD Descriptives

(n = 77)

Variable	Min	Max	Mean	StdDev
Total # Diagnoses	5	36	14.38	5.28
Infectious	0	11	3.14	1.71
Neoplasms	0	2	0.13	0.38
Endocrine	0	5	1.08	1.00
Blood	0	2	0.17	0.41
Mental	0	2	0.49	0.68
Nervous & Senses	0	5	1.57	1.09
Circulatory	0	3	0.38	0.67
Respiratory	0	3	0.84	0.96
Digestive	0	3	0.40	0.71
Genitourinary	0	5	0.38	0.76
Skin	0	5	1.09	1.05
Musculoskeletal	0	4	0.84	1.00
Congenital	0	2	0.27	0.50
Ill Defined	0	4	0.88	0.99
Injury Poisoning	0	12	3.01	2.58

Table 3

USA Correlations

(n = 77)

Variable	Age_TOC	LOCm	LOSw	IMEF_tort	Weight Loss %	CapMedProbs
Total # Diagnoses	0.184	0.078	0.203	**0.296**	0.142	**0.301**
Infectious	-0.013	0.020	0.212	0.097	**0.244**	0.116
Neoplasms	0.025	0.086	0.081	-0.018	-0.121	0.043
Endocrine	0.116	-0.064	**-0.298**	0.065	0.027	0.121
Blood	-0.025	**-0.297**	0.061	-0.170	0.084	-0.180
Mental	-0.065	0.084	-0.056	0.203	0.187	0.028
Nervous & Senses	-0.021	0.180	0.207	**0.252**	-0.031	**0.269**
Circulatory	0.020	-0.063	-0.005	0.048	-0.131	0.185
Respiratory	-0.039	0.059	-0.019	0.124	0.021	-0.110
Digestive	**0.247**	-0.037	0.144	**0.234**	-0.003	-0.016
Genitourinary	0.071	0.148	0.140	0.115	-0.005	**0.277**
Skin	-0.148	0.080	0.017	0.139	-0.086	0.204
Musculoskeletal	0.154	0.213	0.028	-0.077	0.019	0.180
Congenital	-0.008	-0.185	-0.023	-0.054	-0.168	**-0.268**
Ill Defined	-0.068	0.154	-0.127	-0.059	-0.032	0.198
Injury Poisoning	0.131	-0.101	0.097	0.112	0.144	0.180

BOLD = Significant

Table 4

USA IMEF Any Categorical Diagnosis

(n = 77)

Variable	Presence (%)
Infectious	98.7
Neoplasms	11.7
Endocrine	68.8
Blood	15.6
Mental	39.0
Nervous & Senses	87.0
Circulatory	28.6
Respiratory	53.2
Digestive	29.9
Genitourinary	28.6
Skin	64.9
Musculoskeletal	53.2
Congenital	24.7
Ill Defined	57.1
Injury Poisoning	84.4

Table 5
USA Complete Regressions
(n = 77)

a. IMEF $R^2 = 0.184$ SEE = 4.97 p = 0.023

	B	Std Error	Beta	p	part
(Constant)	6.620	3.554	n/a	0.067	n/a
Age_TOC	0.140	0.117	0.138	0.237	0.129
LOCm	-0.049	0.036	-0.177	0.180	-0.146
LOSw	0.006	0.013	0.051	0.677	0.045
IMEF_tort	0.116	0.062	0.248	0.064	0.204
Weight Loss %	-0.002	0.050	-0.006	0.963	-0.005
CapMedProbs	0.260	0.110	0.297	0.021	0.255

b. CapMedProbs $R^2 = 0.258$ SEE = 5.37 p = 0.001

	B	Std Error	Beta	p	part
(Constant)	6.349	3.771	n/a	0.097	n/a
Age_TOC	-0.060	0.127	-0.052	0.636	-0.049
LOCm	0.129	0.036	0.409	0.001	0.369
LOSw	0.016	0.014	0.129	0.268	0.114
IMEF_tort	0.040	0.067	0.075	0.549	0.062
Weight Loss %	0.036	0.054	0.075	0.510	0.068

Table 6

USA Forward Regressions

(n = 77)

a. IMEF $R^2 = 0.114$ SEE = 4.97 p = 0.004

	B	Std Error	Beta	p	part
(Constant)	8.786	1.727	n/a	<0.001	n/a
CapMedProbs	0.204	0.099	0.233	0.043	0.222
Torture	0.106	0.053	0.225	0.050	0.215

b. CapMedProbs $R^2 = 0.223$ SEE = 5.35 p < 0.001

	B	Std Error	Beta	p	part
(Constant)	6.350	1.691	n/a	0.108	n/a
LOCm	0.149	0.032	0.472	<0.001	0.472

Table 7
USA Logistic Regression

	END	SKN	CON	ILL	RES
Baseline % Correct	0.688	0.649	0.753	0.571	0.532
Equation % Correct	0.766	0.714	0.740	0.597	0.610
% Difference	0.078	0.065	-0.013	0.026	0.078
False Positives	15	16	3	23	21
False Negatives	3	6	17	8	9
PPV	0.77	0.73	0.40	0.61	0.60
NPV	0.75	0.65	0.76	0.56	0.63
Model Significance (p)	0.032	0.083	0.121	0.861	0.870
Nagelkerke R-Square	0.231	0.186	0.182	0.044	0.042