

Sleep and Resilience: A Longitudinal 37-Year Follow-up Study of Vietnam Repatriated Prisoners of War

LT Francine Segovia, MSC USN; Jeffrey L. Moore, PhD; CDR Steven Linnville, MSC USN; Robert E. Hoyt, MD; Robert E. Hain, MD

ABSTRACT This study examined sleep histories associated with resilience after trauma defined as a continuous lack of psychiatric illness across 37 years. Data were drawn from a 37-year follow-up examination of the effects of the Vietnam prisoner of war (POW) experience. The Robert E. Mitchell Center for POW Studies is a unique institution holding the only longitudinal study of the effects of the American POW experience in existence. The study used a sample of 440 Vietnam repatriated prisoners of war (RPWs). Psychiatric disorders were assessed at repatriation (1973) and were continued annually by a psychiatrist or clinical psychologist. Sleep issues before, during, and after captivity were assessed upon repatriation during medical examinations. Odds ratios examining presence of sleep symptoms show resilient RPWs reporting fewer symptoms compared to nonresilient RPWs before, during, and after captivity. Logistic regression comparing before, during, and after indicates fewer reported sleep disturbance symptoms after captivity was the strongest predictor of resilience ($b = -0.82$, Wald $\chi^2(1) = 16.70$, $p < 0.000$). Reporting fewer sleep complaints, but not necessarily an absence of them before, during, and after the trauma predicts resilience across time.

INTRODUCTION

As the United States remains in prolonged military conflicts, reports of soldiers coming back from combat with psychiatric illness has been of growing concern. Efforts to understand the factors contributing to certain illnesses such as post-traumatic stress disorder (PTSD) have spurred considerable interest in identifying the factors involved in trauma exposure which put individuals at risk for psychiatric illness. One such factor is the relationship between sleep disturbance and psychiatric and physical disorders.¹⁻³ Sleep problems are common in patients with anxiety, depression, bipolar depression, attention-deficit hyperactivity disorder, and PTSD.⁴ Sleep difficulties before and after trauma predict psychiatric disorders. Studies find sleep disturbance in the period immediately before a traumatic event predicts development of subsequent psychiatric disorders. In a sample of traumatically injured patients, participants who displayed sleep disturbance before the injury were more likely to develop a psychiatric disorder 3 months later.⁵ Similarly, sleep disturbance after a traumatic event predicts future psychiatric and physical symptoms.⁶

The efforts to understand sleep's relationship to psychiatric illness have been guided by a disease model, the reigning paradigm in the study of most illnesses, in which the focus is on the elimination of the disease/disorder.⁷ In relation to sleep and psychiatric disorders, this paradigm has focused primarily on those who develop sleep problems after exposure to a stressor. The issue with focusing solely on illness, however, is that not all individuals exposed to trauma develop symptoms and/or illness after their traumatic experience(s). This is especially true when dealing with psychiatric illness. In this study, we use a positive health paradigm to examine the psychologically healthy.

Looking closely, at the rate of military personnel who develop PTSD indicates a large percentage of individuals do not develop it. The National Vietnam Veterans Readjustment Study,⁸ for example, indicated 31% of male and 27% of female Vietnam veterans suffered from lifetime PTSD. Rates of PTSD stemming from the Gulf War range from 9% to 18%.⁹ And, although the full impact of the conflicts in Iraq and Afghanistan are still underway, preliminary studies indicate lower incidents of PTSD (i.e., 18% and 11%).¹⁰

The positive health model encompasses a large array of different terms for describing the maintenance of health.¹¹ Resilience, exhibiting intact psychological functioning despite exposure to trauma,^{12,13} has drawn a lot of attention. In fact, the emphasis paid to positive health within the past couple of decades contributed to the growing research on resilience. But what resilience is and how to operationalize it is not clearly delineated. The literature indicates two conceptualizations: as process and as outcome. Reivich and Shatte¹⁴ define resilience as a set of abilities (i.e., emotion regulation, empathy, causal analysis). Others define resilience as an outcome conceptualizing it as an individual's ability to maintain stable psychological and physical functioning when exposed to an isolated traumatic event such as a life-threatening situation.¹⁵ Currently, there is no agreed upon conceptual framework or definition of resilience. Whether defined as process or outcome, researchers in neither field have incorporated sleep's pivotal role. Given the importance of sleep to psychological functioning, it is puzzling why there are few if any studies examining the relationship between sleep and resilience.

We conceptualized resilience as an outcome because we were interested in identifying whether sleep quality before, during, and after trauma exposure predicts resilient functioning later in life. To do this, we examined a military population exposed to extreme trauma. The Vietnam prisoner of war (POW) repatriate was exposed to prolonged captivity,

Robert E. Mitchell Center for Prisoner of War Studies, 220 Hovey Road, Pensacola, FL 32508.

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malnourishment, and physical and psychological torture. This population could help us further understand the relationship of sleep to maintenance of psychological functioning. These findings may provide valuable information for other personnel at risk of exposure to similar trauma (i.e., military on the front lines of combat, police, firefighter personnel) and may assist in determining whether sleep plays a role in effectively completing their missions and returning to baseline functioning without developing a psychiatric illness.

METHOD

Participants

The Robert E. Mitchell Center for Prisoner of War Studies is a unique institution, which holds the only longitudinal study of the long-term effects of the POW experience currently in existence. Repatriates from all services and recent U.S. conflicts (Vietnam, Gulf War, Somalia, Bosnia, and Iraq) are in this program. Participants travel from all over the United States and different parts of the world to receive annual evaluations at the Robert E. Mitchell Center for Prisoner of War Studies. The Department of Defense provides all repatriated prisoners of war (RPWs) full funding to cover trip expenses. To ensure uniformity in measurement technique, war-specific stressors, and to avoid uneven sample sizes, only data from the Vietnam-era participants, the largest, longest held group, were included in this retrospective study.

Six hundred and sixty-two military service personnel survived captivity in Vietnam and were repatriated. Of these, 568 men were repatriated in the spring of 1973, as part of Operation Homecoming, and 94 were repatriated early (1962–1972) after escaping or accepting early release; 88% of these repatriates were officers. Since 1973, these repatriates have been eligible for annual voluntary medical and psychological follow-up within programs provided by the Department of Defense and most have participated. As of July 2011, there have been 121 deaths (101 within the Operation Homecoming cohort). Therefore, recent medical/psychiatric outcome data are available on 440 of the living repatriates. Of these participants, we had 224 with complete sleep data available collected back then (1973) with outcome measures determined now (2010). Chi-square analysis indicated no statistically significant differences in their demographics between the RPWs with complete and the ones with incomplete data with the exception of service branch (Air Force personnel totaled 61% of this sample) and officer/enlisted status (officers totaled 91% of this sample). This is virtually identical to the overall Vietnam RPW group, which totaled 88% officers.

This research was reviewed by an institutional review board and all participants included in this report consented to be included in the study.

Procedure

When Vietnam-era repatriates were returned (1973), they were examined using the Initial Medical Evaluation Form (IMEF), a

29-section-477-page document. The IMEF included instructions for conducting a number of medical and psychological examinations and method of documentation. These examinations and debriefings were conducted over several weeks by a team of physicians and mental health specialists. Most of the repatriates have voluntarily been routinely medically and psychiatrically evaluated since 1973 to date. The latter evaluations have been conducted by a psychiatrist or clinical psychologist using the Diagnostic and Statistical Manual of Mental Disorders (DSM) criterion available for diagnosis at time of evaluation (i.e., DSM-II, DSM-III, DSM-IV).

Measures

Demographic Variables (Obtained in 1973)

Captivity duration was measured in number of months and was obtained in 1973. Solitary confinement was defined as a prisoner alone in a cell with minimal environmental stimulation and no meaningful social interaction. It was measured in weeks: short ($M = 2$ weeks, range 0–5), medium ($M = 13$ weeks, range 6–25), or long ($M = 81$ weeks, 26–390).

The torture variable was determined using a 25-item scale assessing exposure to incidents including withholding food and water, sleep deprivation, and specific physical mistreatments (e.g., punishment with torture devices). It also consisted of such items such as attempts to provoke guilt concerning military activities, threats of harm to fellow prisoners, and threats of nonrepatriation. Response options were 0 = “never” to 3 = “very often.” An average item score was used for analyses (Cronbach’s α 0.91).

Other demographic variables included education measured in number of years and age at time of capture.

Outcome Measure: Resilience (Obtained in 2010)

We categorize resilient Vietnam RPWs using a definition of resilience which entailed the traumatic event an individual was exposed to must entail a sufficient risk to which an individual shows resilience and must be demonstrated across a broad spectrum of outcomes and long time span.¹⁵ Vietnam RPW’s experiences of prolonged captivity, physical and psychological torture, and malnourishment go beyond sufficient risk. To be defined as resilient, RPWs must have never received any psychiatric diagnosis over a 37-year follow-up period.

Using this resilience criterion, 131 of the 224 RPWs were categorized as resilient by this definition, and 93 RPWs were nonresilient because they had received a psychiatric diagnosis at some point during the 37 years since repatriation. No diagnosis of PTSD was made before 1980, the year the DSM III was published.

Sleep Difficulties: Predictor Measures (Obtained in 1973)

All sleep difficulties were assessed during the IMEF assessment. For the “period before captivity,” RPWs were asked “Did you ever have a sleep problem before captivity?” to which they were given a “Yes” or “No” response option. If

“Yes” RPWs were asked to indicate how much of a problem any of the following were by checking off the appropriate answer to indicate how often they had the problem: “Trouble falling asleep,” “Trouble staying asleep,” “Wake up early in the morning and can’t get back to sleep,” “Bad dreams or nightmares.” Response options were “Never or almost never,” “Sometimes,” and “Always or almost always.” For the “period during captivity,” RPWs were asked “Did you ever have a sleep problem during captivity?” to which they were given identical response options as listed above.

For the “period after captivity” (1973), RPWS were asked to report about “Sleep and Dreams: (Check all applicable).” Response categories were as follows, “Difficulty falling asleep,” “early morning awakening,” “fragmented sleep,” and “nightmares.”

For analyses, two variables were generated. Presence or absence of sleep disturbance (0 or 1) regardless of number of symptoms reported and a score for total number of symptoms representing severity of symptoms.

Analyses

First, descriptive statistics were computed for all variables. Next, *t*-test analyses were used to conduct a covariate analysis examining whether there were any significant differences between resilient and nonresilient RPWs on captivity duration, solitary duration, torture, age at time of capture, and education. Only age at time of capture was a significant covariate. Two groups (younger and older RPWs), based on a median split, were created and an odds ratio analysis for each group examined, first, percent of resilient and nonresilient RPWs reporting presence of sleep disturbances before captivity, during captivity, and after repatriation and, second, subsequent odds of resilience. Because of negligible differences between the younger and older RPW group, the groups were merged and timing of sleep disturbance was further examined. Specifically, a regression analysis was conducted to determine whether severity of sleep disturbance symptoms across time epochs (i.e., before, during, or after) determined odds of resilience. Finally, because of the relative rarity of sleep disturbances reported before captivity, an odds ratio analysis was conducted examining only reports of sleep disturbance during and after captivity, allowing for an analysis of change in severity of symptoms across time epochs.

RESULTS

Descriptive Statistics

Table I provides descriptive information for captivity duration, solitary confinement duration, torture, age at time of capture, and education. A covariate analysis indicated no significant differences between resilient and nonresilience RPWs with the exception of age; older RPWs (*M* = 30.45, *SD* = 5.48) were more likely to be resilient than their younger (*M* = 27.86, *SD* = 5.46) counterparts (*t* (419) = -4.78, *p* < 0.000).

TABLE I. Group Mean Score Differences (M) and SD

Variable	Resilient			Nonresilient		
	<i>N</i>	<i>M</i>	<i>SD</i>	<i>N</i>	<i>M</i>	<i>SD</i>
Captivity Duration (Months)	253	53.13	30.66	187	52.36	29.04
Solitary Duration (Weeks)	253	29.43	43.35	187	38.45	58.21
Torture	219	29.79	12.31	148	30.39	13.03
Age at Time of Capture***	250	30.45	5.48	171	27.86	5.46
Education (Years)	217	16.16	1.70	128	16.13	1.79

****p* < 0.000.

Presence of Symptoms: Resilient vs. Nonresilient RPWs

Resilient RPWs are less likely to report presence of sleep disturbance at each stage (before, during, and after captivity) compared to nonresilient RPWs regardless of age (Tables II and III). Odds ratio analyses demonstrated the presence of sleep disturbances with the nonresilient RPWs indicating significant prevalence at each stage regardless of age. When examining the younger group (Table II), RPWs reporting presence of sleep disturbances before captivity were 2.40 times (95% confidence interval [CI] 0.68–8.52) less likely to be resilient. Similarly, RPWs reporting presence of sleep disturbances during captivity were 1.21 times (95% CI 0.65–2.25) less likely to be resilient. And lastly, RPWs reporting presence of sleep disturbances after repatriation were 2.36 times (95% CI 1.13–4.94) less likely to be resilient. A similar trend emerged when examining the older cohort: RPWs reporting presence of sleep disturbances before captivity were 13.13 times (95% CI 1.51–111.82) less likely to be resilient. RPWs reporting presence of sleep disturbances during captivity were 2.01 times (95% CI 1.04–3.87) less likely to be resilient. And lastly, RPWs reporting sleep disturbances after repatriation were 4.43 times (95% CI 2.2–8.91) less likely to be resilient.

Although results suggested sleep was a variable with slightly more predictive validity for the older age cohort (Tables II and III), effect size analysis indicated the following: younger group (Cohen’s *d* = 0.47, 95% CI 0.18–0.76) and older group (Cohen’s *d* = 0.82, 95% CI 0.49–1.15). The overlapping of CIs suggests the difference in odd ratios is not statistically significant. This confirms the general finding, at each stage (i.e., before, during, after), regardless of age, odds ratios performed between the two groups demonstrates the

TABLE II. Resilience and Time of Sleep Difficulty: Younger RPWs (24.8 ± 2.3)

Variable	Percent Reporting		Odds of Resilience	
	Resilient (%)	Nonresilient (%)	OR	95% CI
Before	4.0	9.1	2.40	0.68–8.52
During	36.1	40.5	1.21	0.65–2.25
After	13.6	27.1	2.36	1.13–4.94

OR = odds ratio.

TABLE III. Resilience and Time of Sleep Difficulty: Older RPWs (34.2 ± 3.8)

Variable	Percent Reporting		Odds of Resilience	
	Resilient (%)	Nonresilient (%)	OR	95% CI
Before	0.9	10.2	13.13	1.51–111.82
During	30.2	46.4	2.01	1.04–3.87
After	14.8	43.5	4.43	2.20–8.91

nonresilient RPWs were the most vulnerable to sleep difficulties particularly if reporting them after repatriation.

Severity of Symptoms: Resilient vs. Nonresilient RPWs

Despite odds ratio analysis, it remained unclear whether the timing of the sleep disturbance (before, during, or after captivity) determined its importance as a predictor of resilience. A logistic regression was conducted to predict resilience using total number of sleep disturbance symptoms reported before, during, and after captivity as predictors. A test of the full model against a constant-only model was statistically significant, indicating the predictors, as a set, reliably distinguished between resilient and nonresilient RPWs, χ^2 (3 df) = 36.51, $p < 0.000$. The results of the Hosmer and Lemeshow goodness-of-fit test demonstrated the observed data were reasonably approximated by the model, χ^2 (4 df) = 2.172, $p = 0.704$. The variance in resilience accounted for by the model was moderate with Nagelkerke's R^2 of 0.14. Prediction success overall was 66% (29.1 for nonresilient and 90.5 for resilient). The Wald criterion demonstrated fewer reported sleep disturbance symptoms after captivity was the strongest predictor of resilience, followed by sleep disturbance during, with reports of sleep disturbance before the trauma indicating marginal significance. Regardless of time epoch, RPWs become less resilient as sleep disturbance increases. EXP (B) values indicate the following: sleep difficulties before captivity ($b = -0.329$, Wald χ^2 (1) = 2.977, $p < 0.08$), during captivity ($b = -0.177$, Wald χ^2 (1) = 5.660, $p < 0.02$), and after captivity predict lack of resilience ($b = -0.82$, Wald χ^2 (1) = 16.69, $p < 0.000$). As RPWs report greater number of sleep disturbances, the odds of not being resilient compared to being resilient are 0.72 (before), 0.84 (during), and 0.44 (after).

Change in Symptoms Across Time Epochs: Resilient vs. Nonresilient RPWs

Because of the relative rarity of sleep disturbances reported before captivity (Tables II and III), an analysis was conducted examining only reports of sleep disturbance during and after captivity (Table IV). It indicated RPWs fell into four general sleep category groups: those who reported no sleep difficulties during and after captivity (N/N), those who reported sleep difficulties during but not after captivity (Y/N), those who did not report sleep difficulties before but did after captivity (N/Y), and those who reported sleep diffi-

TABLE IV. Reported Sleep Difficulties and Resilience

	Time Epoch (N*)		Resilient		OR	95% CI
	During	After	Yes	No		
A	N	N	125	51	4.28	2.08–8.68
B	Y	N	54	38	2.46	1.15–5.26
C	N	Y	14	22	1.10	0.044–2.78
D	Y	Y	15	26	1.00	—

N* = sample size; N = no sleep disturbance; Y = yes, report of sleep disturbance; During = reports of sleep disturbance during captivity; After = reports of sleep disturbance during captivity.

culties both during and after captivity (Y/Y). In looking at Table IV, odds ratio analyses indicate that the least resilient group was those who experienced sleep disturbances both during and after repatriation (Y/Y). The greatest resilience was for those who never experienced any sleep disturbance during or after captivity (N/N). In comparison of these two groups (i.e., A vs. D; Table IV), these RPWs (N/N) were 4.28 (95% CI 2.08–8.68) times more likely to be resilient than those reporting sleep disturbance during and after captivity (Y/Y). The next group most likely to be resilient was those that bounced back from sleep difficulties reporting them during captivity but not after repatriation (Y/N). In comparison of these two groups (i.e., B vs. D; Table II) these RPWs (Y/N) were 2.46 (95% CI 1.15–5.26) times more likely to be resilient than the group that reported sleep difficulties during and after captivity (Y/Y). All other odds ratio analyses were not significant (i.e., C vs. D; Table II).

DISCUSSION

The disease model paradigm literature suggests the following: for the average person, trauma leads to sleep problems and sleep problems in turn lead to psychiatric illness.¹⁶ The resilience literature, however, indicates different people react differently to the same event with a number of individuals maintaining intact psychological functioning. In this study, we provide a more detailed review of the sleep quality and psychiatric illness relationship providing a review of the sleep profiles of people who have suffered trauma and remained resilient. We learn their sleep is also affected. And we can provide support for the assumption the opposite is also true: better sleep quality is proportional to maintenance of positive health. None of these questions could be answered using solely the disease model paradigm.

This study helps provide a more complete picture of sleep and maintenance of health. Prior studies have indicated poor sleep can be used as a proxy for current bad health, or soon to be bad health,¹⁶ but whether the opposite was also true was not well understood. Neither was it understood if and to what degree the general trend of sleep and health remained consistent even in the most extreme of traumatic circumstances. This study provides insight into this line of inquiry. People who maintain positive health after a traumatic event are also the same individuals who are better sleepers before, during, and

after a traumatic event relative to their nonresilient counterparts. During times of extreme stress, they exhibit similar although fewer sleep disturbances than their less healthy counterparts, and after the trauma, they are less likely to report them.

Timing: Before, During, and After the Trauma

Understandably, during the trauma RPWs reported the most sleep difficulties and were at their highest for both resilient and nonresilient RPWs. The findings suggest resilient individuals do succumb to the stressor of the trauma, and their sleep reactions to abnormal circumstances indicate similar, albeit less-exacerbated patterns than their nonresilient counterparts. This study additionally indicates succumbing to these stressors during the trauma does not necessarily rule out an individual's ability to maintain positive health after trauma. Rather, reports of sleep disturbance during the trauma do not decrease individuals' chances of resilience as much as do reports of sleep disturbance after the trauma. In fact, statistically, the best predictors of resilience are fewer reported sleep disturbances before and after the traumatic event. As such, the study expands upon current literature by confirming the links between reports of sleep disturbance pre- and post-trauma, and expanding upon it in its demonstration that reports of sleep disturbance during the trauma are not as significantly related to psychiatric illness as is the post-trauma time epoch. It suggests if pressed for focus on a specific time epoch focus on reports of sleep issues during the trauma can tell us the least.

Additionally, the results are intriguing in terms of what they tell us about returning to base level sleep quality, that is, a number of individuals reporting sleep issues during the trauma did not report them after the trauma. In fact, RPWs who reported sleep problems during captivity and later no sleep problems were 2.5 times more likely to remain psychologically resilient 37 years later. This finding indicates awareness of when the sleep disturbance occurs in relation to the trauma is a variable of critical importance in provider care.

The findings on the "during" time epoch suggest an apparent importance to improving quality of sleep during prolonged stressors. Research indicates if someone is reporting sleep disturbances this might indicate current stress isolated from psychiatric illness¹⁷; however, if the reports occur after the traumatic event(s), sleep disturbance(s) might be an indicator of possible psychiatric illness.^{18,19} Either way, although the science is not completely clear, further studies would need to examine what some already suggest: successful early psychological and/or pharmacological intervention may ward off the development of certain psychiatric illness after the trauma.²⁰⁻²² These studies indicate during times of stress if an individual's environment cannot be changed (i.e., the stressor cannot be removed as is the case for U.S. service members deployed to war zones), coping styles can be corrected or enhanced to ensure an individual is able to maintain positive health.

Limitations

Assessing the reliability of self reports particularly under-reporting among participants indicating complete absence of sleep complaints during captivity is difficult. Recent studies comparing subjective to objective measures of sleep disturbance have addressed related issues. Studies with individuals afflicted with psychiatric illness associated with sleep disturbance (i.e., PTSD) have failed to find a significant relationship between objective measures of sleep disturbance (i.e., ambulatory monitoring, polysomnographic studies)²³ and subjective measures.²⁴ The failure to find such corroborations between subjective and objective measures has led some researchers to suggest it is the perception of sleep issues rather than actual sleep disturbance, which may be key to psychiatric issues.²³ Our study suggests the perception of sleep disturbance not only predicts resilience but also does so across time. Additionally, the mere presence or absence of a psychiatric diagnosis to define resilience is in itself an insufficient measure for capturing the multitude of responses to trauma. The study's definition of resilience as lack of psychiatric diagnosis can potentially ignore a whole subset of individuals that is emotionally affected but does not meet the diagnostic criteria for a diagnosis. It also ignores people that get a psychiatric diagnosis but recover; many of whom go on to live happy, functional lives. Other studies particularly ones that examine different reactions to trauma such as post-traumatic growth can address these issues. In fact some would argue that the falling apart and positively growing after a trauma, the trademark feathers of post-traumatic growth, make these individuals more resilient than those who do not experience psychological distress.

Implications for Screening People for Sleep Difficulties

The importance of sleep quality is beginning to gain salience in military settings as researchers find significant associations between sleep symptoms and mental health issues. A recent study, for instance, found 41% of U.S. service members recently deployed to Iraq and Afghanistan reported sleep problems at initial screening and those who had reported sleep issues, specifically insomnia, also reported significantly higher scores of PTSD severity at follow-up than did service members without sleep issues.²⁰ Such studies in addition to this current one may aid in assisting the military to design more effective pre- and postdeployment screening tools. It has been reported upon return from deployment, soldiers may not want to report their psychiatric problems because of shame, embarrassment, or fear it will have a negative impact on their career.²⁵ Sleep issues, however, are symptoms which may not be as stigmatizing and soldiers may be more likely to report. Research with military service members supports this. Service members appear to be better willing to report physical symptoms than mental health ones.²⁶ Mental health practitioners can better assist military service members by forming collaborations with primary health care physicians and vice versa.

More recently, the U.S. Army has started focusing on positive health, centering their training programs on maintaining health rather than focusing solely on assisting those who are physically or mentally ill.²⁷ To date, however, none of the Army's resilience programs have fully integrated improving sleep quality. This suggests sleep quality is an overlooked variable amenable to manipulation, which has not been given full attention.

CONCLUSIONS

Using a resilience framework, we are able to show self-reported sleep quality as a particularly promising area of study for identifying the sleep histories best associated with maintaining health despite trauma. From a prevention perspective, knowing ahead of time whether an individual has sleep problems may help clinicians and leaders identify those at risk for developing psychiatric issues, and from a post-trauma perspective, knowing the importance of sleep's relationship with psychiatric illness is also promising for there are many psychological and pharmacological treatments for alleviating sleep difficulties.

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