# Causal Attribution of Stress in Gulf War Veterans

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There has been much speculation about the causes of an unexplained cluster of symptoms associated with deployment in Operations Desert Storm and Desert Shield. To what do the affected veterans themselves attribute their symptoms—and could such beliefs further diminish their quality of life?

An unexplained cluster of symptoms associated with service in the Gulf War (Operations Desert Storm and Desert Shield) has sparked concern among clinicians and prompted a number of VA- and DoD-sponsored studies.[1] While the existence of a specific Gulf War illness or syndrome has not been demonstrated, the fact that substantial numbers of Gulf War veterans have health-related symptoms and concerns cannot be denied.[2] These concerns, often referred to as Gulf War illness, include fatigue, headache, skin rash, muscle and joint pain, memory problems, and other cognitive impairments. In the absence of a scientifically determined etiology of Gulf War illness, there has been much public conjecture about such possible causes as exposure to chemical weapons, biological agents, radiation, insecticides or oil well fires, and adverse reactions to inoculations.

While scientists deliberate, those who are more directly affected are left with uncertainty. This and the speculation that it breeds are potential stressors in the lives of Gulf War veterans that may additively combine with other life stressors, such as the symptoms themselves, and detract from quality of life.

In this article, we report on a research project that was based in the theory of causal attribution and focused on the beliefs Gulf War veterans hold about the causes of their stress symptoms. After describing the study methods and presenting our results, we discuss the practical implications our findings have for those who treat Gulf War veterans.

## THE IMPORTANCE OF CAUSAL ATTRIBUTION

Causal attribution refers to the way in which ordinary people—nonscientists—form inferences about the causes of their experiences. When stress rises to a level at which troublesome symptoms are felt, it motivates the stressed person to take action to ameliorate the stress. Equally important—and perhaps instrumental in determining the specific actions a person will take—is causal attribution, that is the individual's perceptions of the causes of the stress.[3–6] According to Fritz Heider, perception of cause involves a dynamic interplay between person and environment. As he put it, "Our reaction to a disagreeable experience is greatly influenced by the attribution to a source, which we may see in another person, in the workings of chance, or in ourselves. The same datum may mean aggression, misfortune, or a stupid mistake."[7]

The individual's causal attributions encompass the self as well as the external world of political, physical, and economic forces that impinge upon the self. Since a person has the human ability to contemplate self as object, it's possible to attribute stress to causes lying within the self. The opposite is also possible: to view the self as a victim of circumstance rather than as a competent individual who actively interacts with and manipulates his or her world.[8]

Causal attribution is also subject to consensual influences. Social groupings—whether defined by common circumstances of work, geography, occupation, or ethnicity—may share common beliefs and ideas with respect to the attribution of experienced stress. Nowhere is this more apparent than in cases of hysterical contagion.[9] From a practical vantage point, understanding stress levels and their attributive causes within a population or population subgroup may form the basis for providing appropriate supportive or preventive interventions.[10] What a group believes about the causes of its distress or discomfort may have political and social consequences that render its beliefs far more important than the actual causes of its distress.[7,9]

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## ASSESSING CAUSAL ATTRIBUTION AND STRESS LEVELS

In mounting this research study, we were interested specifically in the relative importance of the Gulf War experience as a causal attribution for stress among veterans of the Gulf War. Our study was premised in Heider's assumption that what a person "believes to be true…directly influences his reactions, the actuality having significance only indirectly if at all."[7]

We were fortunate to have available to us the Life Stress Questionnaire (LSQ), a device created in the 1970s that permits the assessment of stress symptoms, stress levels, and the causes to which they are attributed.[11] Also fortuitous was the fact that the primary symptoms of Gulf War illness appear as stress symptoms on the LSQ.

The LSQ was designed to apply causal attribution theory to the study of psychological stress for purposes of epidemiologic survey research.[10,11] The LSQ operationally defines psychological stress through a 52-item psychiatric symptom checklist[12] that was translated into layman' s language. The total number of psychiatric symptoms an individual checks off on the list operationally defines his or her level of psychological stress. The LSQ operationally defines causal attribution through 13 items corresponding to Murray's categories of environmental press,[13] which represent external determinants of behavior, along with one additional item: alcohol and other types of substance abuse, which Murray had not conceptualized as potential external sources of stress.[11]

The LSQ, in its original form, was carefully researched to ensure that readability was at a tenth-grade level and that the causal attribution items

**Table 1. Stress symptom checklist used in trial, replication, and combined groups**

| Symptom | Trial group (n = 57) | Replication group (n = 57) | Total (n = 114) |
|---|---|---|---|
| Tinnitus | 28 | 32 | 60 |
| Fatigue | 36 | 42 | 78 |
| Dizziness | 13 | 30 | 43 |
| Blushing | 5 | 5 | 10 |
| Sweating | 23 | 19 | 42 |
| Numbness | 29 | 27 | 56 |
| Paresthesia | 7 | 12 | 19 |
| Sex problem | 20 | 12 | 32 |
| Stiffness | 48 | 46 | 94 |
| Lower gastrointestinal problem | 8 | 24 | 32 |
| Upper gastrointestinal problem | 20 | 25 | 45 |
| Breathing problem | 18 | 22 | 40 |
| Itching | 17 | 20 | 37 |
| Urinary problem | 7 | 11 | 18 |
| Visual problem | 15 | 15 | 30 |
| Pain | 24 | 26 | 50 |
| Nervous mannerisms | 28 | 27 | 55 |
| Awkwardness | 13 | 11 | 24 |
| Restlessness | 35 | 28 | 63 |
| Speech problem | 12 | 10 | 22 |
| Tearfulness | 6 | 6 | 12 |
| Tremor | 9 | 8 | 17 |
| Weight problem | 13 | 11 | 24 |
| Forgetfulness | 35 | 40 | 75 |
| Indifference | 10 | 16 | 26 |
| Argumentativeness | 20 | 23 | 43 |
| Irritability | 33 | 24 | 57 |
| Things I can't help doing | 10 | 23 | 33 |

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**Table 1. Stress symptom checklist used in trial, replication, and combined groups (continued)**

| Symptom | Trial group (n = 57) | Replication group (n = 57) | Total (n = 114) |
|---|---|---|---|
| Confusion | 16 | 5 | 21 |
| Crying spells | 3 | 14 | 17 |
| Troublesome thoughts | 21 | 4 | 25 |
| Trouble concentrating | 19 | 18 | 37 |
| Drinking too much | 9 | 29 | 38 |
| Abuse of drugs other than alcohol | 1 | 5 | 6 |
| Fearfulness | 9 | 1 | 10 |
| Guilt | 10 | 7 | 17 |
| Hallucinations | 6 | 11 | 17 |
| Homicidal thoughts | 6 | 5 | 11 |
| Ideas of reference (belief that others are talking about you) | 13 | 8 | 21 |
| Paranoia | 11 | 11 | 22 |
| Feeling inadequate | 13 | 10 | 23 |
| Indecisiveness | 12 | 18 | 30 |
| Insecurity | 9 | 16 | 25 |
| Insomnia | 25 | 14 | 39 |
| Nightmares | 17 | 28 | 45 |
| Recurrent ideas | 10 | 22 | 32 |
| Panic | 5 | 15 | 20 |
| Blocking of thinking | 16 | 8 | 24 |
| Suicidal ideas | 9 | 21 | 30 |
| Suspiciousness | 9 | 6 | 15 |
| Feeling detached | 10 | 6 | 16 |
| Withdrawing | 12 | 20 | 32 |
| | | | |
| SSL* mean | 13.2† | 15.8† | 14.5 |
| SSL SD | 10.7 | 10.8 | 10.7 |

*SSL = stress symptom level. †Note that the difference between SSL means for trial and replication groups is not significant.

were understood by subjects to mean something very similar to what the authors intended. A factor analysis supported interpreting the total number of symptoms endorsed by the respondent as the respondent's stress symptom level (SSL). Test-retest reliability (at a three-week interval) and internal consistency were found to be in the mid 0.70s.[11]

Using multiple regression techniques, it's possible to develop equations that predict stress levels from attributive causes. Multiple regression analysis provides a sort of metanalyis of the relationships between stress level and attributive causes. When statistically significant equations result from a survey, they provide weighted descriptions of the convictions of a particular respondent group about the causes of its stress.[11] This statistical methodology applied to LSQ data provides a practical and efficient procedure for determining the stress levels and causal attributions within particular segments of a population. The LSQ has been used in this manner in a number of settings including a large urban university;[11] a suburban police department;[14] an urban Milwaukee, WI community;[15] a VA medical center;[15] and an associate-degree nursing program.[16]

## STUDY METHODS

The intent of this study was to determine the causal attributions of SSLs in a sample of Gulf War veterans drawn from the Gulf War Illness Registry of the Louis A. Johnson VA Medical Center in Clarksburg, WV. While the LSQ defines stress level in terms of the total number of listed symptoms endorsed by respondents, we also were interested in identifying the specific symptoms endorsed most frequently. These symptoms then could be used to determine whether SSL as defined herein is compa-

rable to Gulf War illness as defined elsewhere.

Our research methodology used multiple regression analysis to determine whether a reliable prediction of SSL from the attributive causes could be generated from a trial subsample. We then attempted to replicate this prediction in a separate subsample. Reliability was defined not only by statistical significance of equations in each group but by the degree to which the contents of the equations were similar in the two groups.

At the time the study was initiated, there were 300 veterans in the medical center's Gulf War Illness Registry. Veterans on this roster were self-selected in that they had asked to be evaluated by the medical staff because of symptoms they had developed after serving in the Gulf War.

Initially, 200 randomly selected male veterans were mailed a letter requesting their participation through the completion of the LSQ. It was hoped that an 80% return rate would be achieved by repeated mailings. An unexpected problem was the fact that a large number of potential subjects (51) had relocated without providing forwarding addresses. As each such problem was discovered, a replacement subject was drawn at random from the registry. After nine months and eight follow-up mailings, 114 questionnaires had been returned. It was determined that continued attempts to collect data would be fruitless and the return rate of 57% was accepted.

Originally, we had planned to randomly assign questionnaires to either trial or replication groups. When it became evident that the study would be prolonged beyond four follow-ups, however, we alternately assigned respondents to the two groups in order to minimize any biases that might be associated with the passage of time.

## Adapting the LSQ

The LSQ consists of two separate portions. The first includes 52 stress symptoms derived from a psychiatric symptom checklist and expressed in layman's language (Table 1). These symptoms are used to produce a score for SSL, which consists of the total number of symptoms endorsed by the respondent.

The second portion of the LSQ consists of 14 potential attributive causes, which are rated by the respondents on a 5-point Likert-type scale. Some are heteronomous (environmental) causes and others are autonomous (arising from within the self) causes. For the purposes of this study, we modified the second portion of the LSQ by adding a fifteenth attributive causation item: aftereffects of military experience. With this adaptation, it became possible to inquire into the relative strength of the aftermath of the Gulf War experience in relation to other possible attributive causes of a subject's stress symptoms (Table 2).

Descriptive statistics for age, marital status, stress symptoms, stress symptoms levels, and attributive causes were generated for trial, replication, and combined groups. Multiple regression analysis was used to test the predictability of SSL from the potential attributive causes. To analyze the relationships among the 24 variables included in the multiple regression analysis, we used Statistica (StatSoft, Inc., Tulsa, OK), a statistical package designed for personal computers.

## OUR FINDINGS

The mean SSL was 13.2 (SD = 10.7) for the trial group and 15.8 (SD = 10.8) for the replication group. Means for the two groups were not significantly different. An inspection of the data concerning frequency of symptoms revealed that six symptoms were endorsed by 50% or more of the respondents in the combined group, indicating that symptoms of Gulf War illness were salient in both trial and replication groups (Figure). These symptoms, mentioned in order of frequency of endorsement were: stiffness, fatigue, forgetfulness, restlessness, tinnitus, and irritability.

A comparison of causal attribution ratings in the trial and replication groups suggests similarities in terms of the rank order of the mean ratings. Spearman's rank-order correlation coefficient for mean attributive causes in the trial and replication groups was tested and found to be 0.92 ($P < .01$). In both groups, aftereffects of military experience was ranked first with the mean for both groups falling between ratings of "some" and "very much." Other important concerns were: not enough money; health of self; demands of job, work; and conflict with family.

Results of the multiple regression analysis for the trial group are reported as a succession of equations that progressively winnow nonsignificant from significant predictors (Table 3). The intent of this process is to arrive at a maximally parsimonious and efficient equation that will predict SSL from the attributive causes. Equation 1 yielded a highly robust and significant multivariate correlation coefficient (R) of 0.91 ($P < .0001$). Nine variables, however, had nonsignificant beta weights and, therefore, were dropped as predictors. The next attempt to predict SSL using only variables having significant beta weights resulted in Equation 2, with an R of 0.85 ($P < .001$). Of the six variables used, two were notably less significant ($P < .05$) and, thus, dropped. As Equations 3 and 4 indicate, we could predict quite adequately from the following variables:

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conflict with authority, religious conflicts, and aftereffects of military experience ($R = 0.83$, $P < .001$).

When multiple regression analysis was conducted for the replication group, Equation 1 yielded an $R$ of 0.85 ($P < .001$). Of the 15 variables included in Equation 1, five were significant predictors. These, in order of their beta weights, were: aftereffects of military experience, not enough friends, conflict with society, not enough money, and substance abuse (including alcohol). Aftereffects of military experience was a very significant predictor ($P < .01$), and the other predictors were less significant ($P < .05$). When these five predictors were included in an attempt to refine the equation, the variable not enough money fell to nonsignificance. Dropping that variable yielded a set of four statistically significant predictors—aftereffects of military experience, substance abuse (including alcohol), not enough friends, and conflict with society—which had an $R$ of 0.78 ($P < .0001$). A comparison of the final equations in trial and replication groups would reveal that the two groups have in common aftereffects of military experience but no other variable.

## DISCUSSION

Although we felt comfortable that in alternately assigning subjects to trial and replication groups we had compensated for any temporal bias, the numbers of subjects in trial and replication groups were marginally adequate for our purposes since multiple regression analysis treats variance in an inductive fashion, necessitating a large and representative sample. That issue notwithstanding, we can say that the more frequent symptoms reported by each of the two groups have parallels with Gulf War illness as defined through our

**Table 2. Causal attribution in trial and replication groups**

| Attributive causes* | Trial mean | Group SD | Replication mean | Group SD |
|---|---|---|---|---|
| Conflicts with society | 2.15 | 1.34 | 2.11 | 1.29 |
| Conflict with family | 2.22 | 1.25 | 2.31 | 1.38 |
| Health of self | 2.52 | 1.33 | 2.92 | 1.49 |
| Health of parent, friend, others | 1.57 | 1.07 | 1.78 | 1.18 |
| Inadequacy of living arrangements | 1.76 | 1.19 | 1.51 | 0.91 |
| Conflict with authority | 1.69 | 1.11 | 1.65 | 1.21 |
| Weakness of spouse, mate, friend | 1.59 | 0.94 | 1.74 | 1.28 |
| Not enough money | 2.78 | 1.59 | 2.52 | 1.34 |
| Not enough friends | 1.81 | 1.29 | 1.53 | 0.95 |
| Demands of school, classwork | 1.33 | 0.73 | 1.35 | 0.95 |
| Separation, conflict with spouse or mate | 1.74 | 1.19 | 1.52 | 1.19 |
| Religious conflicts | 1.29 | 0.74 | 1.44 | 1.01 |
| Substance abuse (including alcohol) | 1.28 | 0.79 | 1.34 | 0.94 |
| Demands of job, work | 2.26 | 1.38 | 2.24 | 1.36 |
| Aftereffects of military experience | 3.44 | 1.45 | 3.73 | 1.39 |

*Note that Spearman's rank-order correlation coefficient for mean attributive causes in the trial and replication groups was tested and found to be 0.92 ($P < .01$).

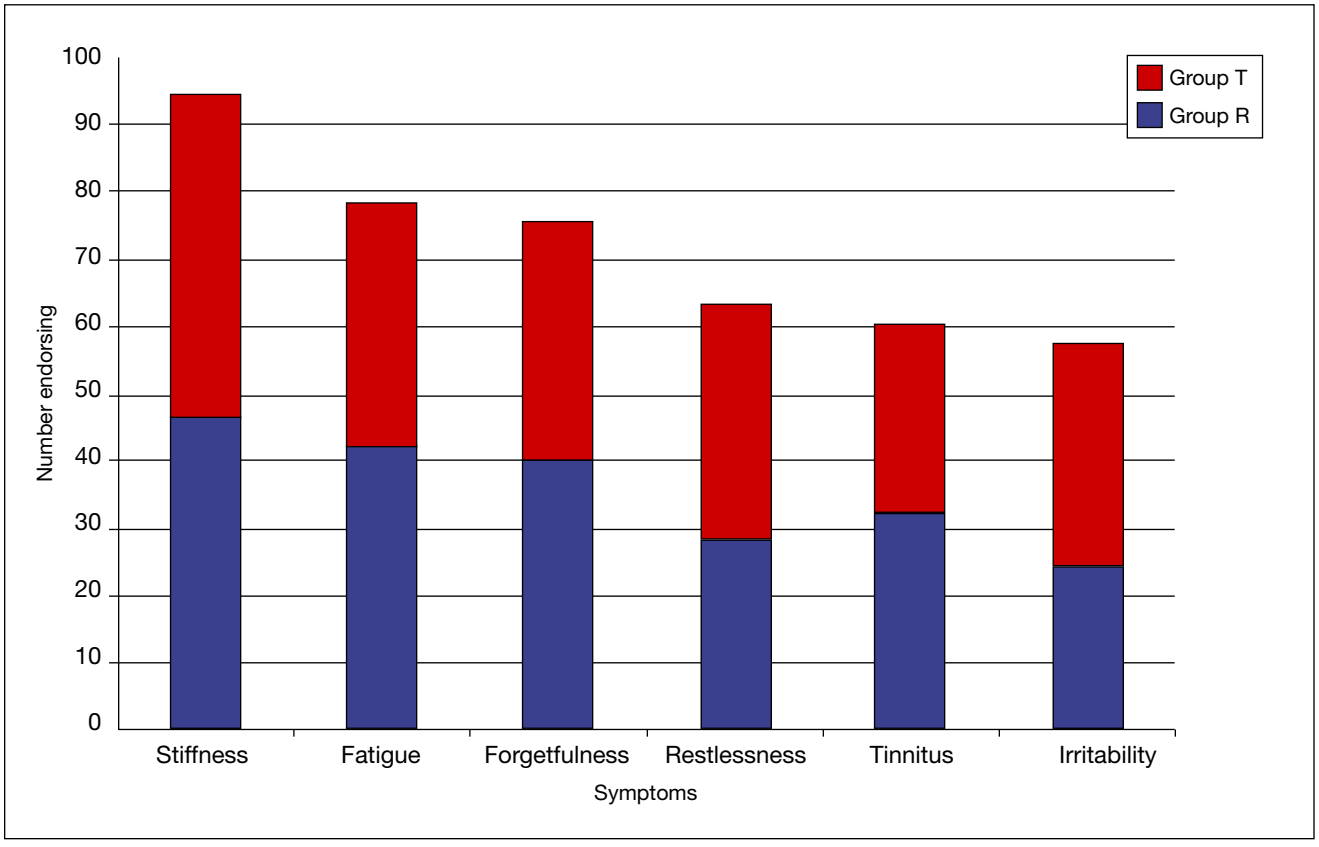


Figure. Frequently endorsed symptoms in trial (T) and replication (R) groups.

review of medical literature—specifically, stiffness and pain in muscles and joints, fatigue, and forgetfulness. The trial and replication groups appeared to be quite similar in terms of their symptom distributions and in terms of SSL. In using SSL as a predictive target, we feel that we were dealing with an entity akin to Gulf War illness. We also showed that the two groups had similar profiles with respect to the relative strength of attributive causes.

In both groups, aftereffects of military experience was the most popular attributive cause. In both groups, it proved possible to generate multiple regression equations of considerable strength and statistical significance, with an *R* of 0.85 for the trial group 0.78 in the replication group, which were both significant ($P < .001$). The composition of the equation for the trial group included attributions to conflict with authority, religious conflicts, and aftereffects of military experience. In the replication group, the equation included conflict with society, not enough friends, substance abuse (including alcohol), and aftereffects of military experience.

Multiple regression equations for the trial and replication groups logically reflect differences in the covariance of the attributive causation variables and the SSL between the two samples. Aftereffects of military experience is the one variable that makes an appearance in the predictive equations for both the trial and replication groups. From this, it would be expected that an LSQ study involving a broader sample of veterans with Gulf War illness would find aftereffects of military experience among the predictors of SSL.

It would seem that our Gulf War illness registrants were not narrowly preoccupied with aftereffects of military experience as the sole cause of their stress. Aftereffects of military experience, along with other stressors, were viewed by them as conjointly determinant. A future study, one with large and representative samples in both trial and replication groups, would be likely to yield an equation that includes one or more attributive variables in addition to aftereffects of military experience. A carefully executed study should yield very similar predictive equations for both trial and replication groups.

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Such a study, of course, would tell us nothing more about the scientific causes of Gulf War illness. Our causal attribution model, however, might provide information of some social significance. Although the etiology of Gulf War illness may remain uncertain, the contents of our weighted equations suggest various means of alleviating at least a portion of the distress Gulf War veterans experience. Even for veterans whose trust in government has diminished, we might be able to suggest interventions to alleviate stress.

## STUDY LIMITATIONS

Since the completion of this study, the VA has published an opinion that the Gulf War did not produce a new illness.[2] The VA report states that veterans deployed during the Gulf War have higher rates of stress-related illnesses—including fatigue syndrome, dermatologic problems, fibromyalgia, and gastrointestinal disorders—than do veterans who were not deployed during the Gulf War. Stress-related illness, however, is said to be associated with deployments in all wars, not just the Gulf War. Not surprisingly, then, the symptoms endorsed by Gulf War veterans from all nations (excluding the Iraqi army) are similar. We do not know how this consensus, had it emerged prior to our survey, would have affected the beliefs of our subjects about the causes of their symptoms.

Although the equations that were generated as a result of our study are highly reliable, their generality is limited in several ways. The sample from which the trial and replication groups were drawn, a convenience sample of self-selected veterans who were part of a Gulf War registry, was not representative of Gulf War veterans in general. Self-selection factors might include anxiety concerning unex-

**Table 3. Multiple regression analysis: Predicting stress symptom level from potential attributive causes in the trial group (n = 57)**

| **Equation 1: Multiple *R** = .91, *df*† 15, 38 (*P* < .0001)**<br>**Attributive causes** | β‡ | ***P*<** |
|---|---|---|
| Conflict with society | 0.1928 | |
| Conflict with family | 0.2474 | 0.05 |
| Health of self | –0.3031 | 0.05 |
| Health of parent, friend, others | 0.0592 | |
| Inadequacy of living arrangements | 0.2468 | |
| Conflict with authority | 0.4195 | 0.01 |
| Weakness of spouse, mate, friend | 0.1084 | |
| Not enough money | –0.2359 | |
| Not enough friends | 0.3146 | 0.01 |
| Demands of school, classwork | –0.0851 | |
| Separation, conflict with spouse or mate | –0.1653 | |
| Religious conflicts | 0.2535 | 0.05 |
| Substance abuse (including alcohol) | 0.0749 | |
| Demands of job, work | 0.1251 | |
| Aftereffects of military experience | 0.2764 | 0.01 |
| **Equation 2: Multiple *R* = .85, *df* 4, 49 (*P* < .001)**<br>**Attributive causes** | β | ***P*<** |
| Conflict with family | 0.2546 | 0.01 |
| Health of self | 0.2324 | 0.05 |
| Conflict with authority | 0.3435 | 0.01 |
| Not enough friends | 0.1889 | 0.05 |
| Religious conflicts | 0.3348 | 0.01 |
| Aftereffects of military experience | 0.3831 | 0.01 |
| **Equation 3: Multiple *R* = .85, *df* 4, 49 (*P* < .001)**<br>**Attributive causes** | β | ***P*<** |
| Conflict with family | 0.2497 | 0.05 |
| Conflict with authority | 0.2921 | 0.01 |
| Religious conflicts | 0.3371 | 0.01 |
| Aftereffects of military experience | 0.3502 | 0.01 |
| **Equation 4: Multiple *R* = .83, *df* 3,50 (*P* < .001)**<br>**Attributive causes** | β | ***P*<** |
| Conflict with authority | 0.3886 | 0.01 |
| Religious conflicts | 0.4203 | 0.01 |
| Aftereffects of military experience | 0.3711 | 0.01 |

*Multiple *R* = multivariate correlation coefficient. †*df* = degrees of freedom. ‡β = beta weight.

**Table 4. Multiple regression analysis: Predicting stress symptom level from potential attributive causes in the replication group (n = 57)**

| Equation 1: Multiple *R** = .85, *df*† 15, 41 (*P* < .001) Attributive causes | β‡ | *P*< |
|---|---|---|
| Conflict with society | 0.2673 | 0.05 |
| Conflict with family | 0.0571 | |
| Health of self | 0.1195 | |
| Health of parent, friend, others | 0.1536 | |
| Inadequacy of living arrangements | 0.2027 | |
| Conflict with authority | –0.1114 | |
| Weakness of spouse, mate, friend | –0.2018 | |
| Not enough money | –0.2669 | 0.05 |
| Not enough friends | 0.2924 | 0.05 |
| Demands of school, classwork | 0.0159 | |
| Separation, conflict with spouse or mate | –0.0333 | |
| Religious conflicts | –0.0853 | |
| Substance abuse (including alcohol) | 0.2477 | 0.05 |
| Demands of job, work | 0.1806 | |
| Aftereffects of military experience | 0.4595 | 0.001 |
| **Equation 2: Multiple *R* = .78, *df* 5, 51 (*P* < .0001) Attributive causes** | **β** | ***P*<** |
| Conflict with society | 0.2385 | 0.05 |
| Not enough money | 0.0956 | |
| Not enough friends | 0.2348 | 0.05 |
| Substance abuse (including alcohol) | 0.2377 | 0.05 |
| Aftereffects of military experience | 0.4984 | 0.001 |
| **Equation 3: Multiple *R* = .78, *df* 4, 52 (*P* < .0001) Attributive causes** | **β** | ***P*<** |
| Conflict with society | 0.2129 | 0.05 |
| Not enough friends | 0.1969 | 0.05 |
| Substance abuse (including alcohol) | 0.2601 | 0.05 |
| Aftereffects of military experience | 0.4874 | 0.001 |

*Multiple *R* = multivariate correlation coefficient. †*df* = degrees of freedom. ‡β = beta weight.

plained symptoms, anxiety about the possibility that Gulf War-related symptoms might develop in the future, or compensation seeking. The sample was barely adequate to support multiple regression analysis. Furthermore, the discrepancies between findings that were generated from the trial and replication groups suggest that this study should be viewed as exploratory and its findings considered tentative and preliminary.

Having mentioned compensation seeking, it should be noted that this term is not used with any pejorative implications. If an individual is harmed, it is logical for him or her to seek a remedy or remedies, among them, financial compensation. We do not know whether drives for financial compensation or other forms of remediation were factors in determining the consensus that was detected in this research. These should be considered unknown factors in this study. In future research into the epidemiology of Gulf War illness, it would be useful—and perhaps revealing—to assess motivational factors, including compensation seeking, and to consider them in multiple regression analyses.[17]

## IMPLICATIONS FOR PRACTICE

It was not surprising that Gulf War veterans in our study attributed unexplained symptoms to their war experience. This supposition is based on the human tendency to attribute causation to the dramatic, the availability heuristic.[18] The war experience is vivid in memory and unexplained symptoms and problems are likely to be attributed to it. In fact, the availability heuristic might explain the consensus we found in both the trial and replication groups that aftereffects of military experience had a causal relationship to stress symptoms. The fact that we found a statistically strong relationship between aftereffects of military experience and SSL implies only that there was consensus and not that any individual or group has a firmly entrenched or unyielding, politicized opinion about the cause of their stress symptoms; this might be the case, but we do not know it to be so. Nevertheless, it might be prudent for practitioners who treat Gulf War veterans to avoid challenging veterans' convictions about the causes of

their problems when such challenges can be avoided.

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