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BRIEF REPORT

Veteran Beliefs About the Causes of Gulf War Illness and Expectations for Improvement

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Abstract

Background Individuals' beliefs about the etiology of persistent physical symptoms (PPS) are linked to differences in coping style. However, it is unclear which attributions are related to greater expectations for improvement.

Method and Results A cross-sectional regression analysis ($N = 262$) indicated that Veterans with Gulf War Illness (GWI) who attributed their GWI to behavior, (e.g., diet and exercise), had greater expectations for improvement ($p = .001$) than those who attributed their GWI to deployment, physical, or psychological causes (p *values* $> .05$).

Conclusions Findings support the possible clinical utility of exploring perceived contributing factors of PPS, which may increase perceptions that improvement of PPS is possible.

Trial Registration ClinicalTrials.gov Identifier: NCT02161133.

Introduction

Persistent physical symptoms (PPS) are associated with impairment and disability due to significant pain, burdensome treatment demands, and higher rates of comorbid anxiety and depression [1]. Compounding this, PPS are often complex, and their etiology is not fully understood [2, 3]. Nearly one-third of Veterans deployed to the Persian Gulf during Operations Desert Shield/Desert Storm continue to have complex physical, cognitive, and affective PPS [4] characterized by chronic fatigue, pain, neurocognitive and mood disturbances, gastrointestinal symptoms, and

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respiratory problems, also collectively referred to as Gulf War Illness [5].

Illness beliefs, particularly causal attributions, or the cognitive process through which the origins of physical symptoms are explained [6], have long been theorized as key to improve care for PSS. This hypothesis aligns with the Common-Sense Model (CSM), which suggests that illness beliefs drive behavioral self-management, which leads to either positive or negative health outcomes [7, 8]. In particular, an individual's attribution of PPS to a physical cause may lead to excessive treatment seeking, poorer self-management behavior, and result in poorer outcomes including worse disability [9, 10]. While there is evidence that supports the hypothesis that patients' attribution of PPS to a physical cause leads to worse outcomes [11, 12], there are also findings to suggest that these relationships are more complex than once assumed [13].

A recent meta-analysis of the connection of illness representation to outcomes for patients with PPS found the relationship of causal attributions to health outcomes was small with significant heterogeneity [11]. Further, the evidence for changing patients' causal attributions of PPS from physical to psychological is low [14], leading some to suggest that changing causal attributions of PPS from physical to psychological may not be key to improving outcomes [34]. While existing literature has focused on binary physical vs. psychological causal attributions, what may be of greater importance in optimizing health and functioning is a greater range of attributional beliefs that suggest symptom improvement for PPS is possible.

Some causal attributions may impact expectations for improvement. This is important because expectations for improvement influence physiological and neurological functioning [15]. For instance, individuals with chronic pain who expect positive outcomes show greater reductions in pain and perceptions of change at the end of treatment [16]. Further, a meta-analysis showed that brief expectation interventions, particularly verbal suggestion, can reduce a patient's chronic and acute pain [17], and these expectations can change with a single session [18, 19]. Individuals with PPS have complex explanations for their symptoms [20]; external attributions emphasize historical, situational, or environmental factors, while internal attributions focus on malleable characteristics about the person's traits, abilities, or behavior. Closer examination of these attributions may explain variations in illness-related coping. Expectations for improvement may be influenced by the individual's attribution of the cause of their PPS.

PPS is common among US Veterans, especially those deployed to combat areas [21], and is among the more challenging conditions to manage in primary care [13]. Emphasis on a biopsychosocial approach, including illness-related attributions, may elucidate additional pathways for symptom and functional improvement. Further, limited insight about what causes and perpetuates a patient's symptoms may impede their ability to effectively manage these symptoms [22]. What remains unclear is *which* specific causal attributions increase expectations for improvement and treatment outcomes. Previous literature has largely focused on physical and psychological explanations for PPS [11], while beliefs about behavior and deployment-related exposures have received less attention. The aim of the present study was to understand *which* attributions would be related to expectations for improvement among Veterans with PPS, specifically Veterans who met case criteria for GWI. We hypothesized that internal attributions, such as personal behavior, would show a relationship to greater expectations for improvement; and external attributions, such as environmental explanations, specifically military deployment-related exposure, would be related to worse expectations, independent of depressive symptoms and physical symptom load.

Method

Design

Participants were recruited from three Veteran Affairs Medical Centers for a trial of Problem-Solving Therapy to reduce disability for Veterans with Gulf War Illness [23]. Informed consent was obtained, and inclusion criteria and data collection procedures were previously described [10]. All Veterans had deployed to Operation Desert Shield/Desert Storm and met criteria for Gulf War Illness, which requires moderate to severe symptoms that started during or after deployment in at least three of the following six domains: chronic fatigue, bodily pain, neurological concerns, gastrointestinal symptoms, respiratory problems, or skin problems [5].

Veterans Affairs Institutional Review Boards at East Orange, NJ, Canandaigua, NY, and Bedford, MA independently reviewed and approved this study. The current study analyzed the baseline data from the clinical trial.

Measures

Demographic variables including age, sex, race and ethnicity, disability status, employment, household income, and marital status were self-reported by participants. Due to the homogenous nature of the sample [23], race was collapsed into two categories (White or Non-African American, African American).

Illness attributions were assessed with the Illness Perceptions Questionnaire-Revised (IPQ-R) [24]. Questions were adapted to assess what the patient believed may have caused their GWI along a 5-point Likert scale (from "strongly disagree" to "strongly agree") to rate how four possible causes ("deployment exposures," "psychological stress," "physical," and "my behavior, including diet and exercise") contributed to symptoms. Attributions were assessed as individual items.

Expectations for improvement were assessed from questions developed by Philips et al. 2017 [3]. Participants were asked along a 5-point Likert scale ("no improvement," "little," "some," "quite a bit," and "great improvement"), "Do you expect to see improvement in any of the following over the next 6 months?": number of physical symptoms; severity of physical symptoms; how bothered by physical symptoms; experience of general pain; and mood or stress levels, with scores ranging from 0 to 20. Higher scores indicated greater expectations of improvement. Internal reliability for this scale was high (Cronbach's alpha = .89).

Patient Health Questionnaire-8 (PHQ-8), a brief self-report measure, assessed the frequency of depressive symptoms (anhedonia, sadness, sleep problems, change in appetite, etc.) over the past 2 weeks. The ninth item of the PHQ-9, related to suicidal ideation, is omitted [25]. Scores range from 0 to 24, with high internal reliability for the current sample (Cronbach's alpha = .86).

Patient Health Questionnaire-15 (PHQ-15) was developed to briefly measure self-reported severity of somatic symptoms in clinical settings including gastrointestinal symptoms, pain, shortness of breath, etc. over the last 7 days [26]. The item assessing menstrual pain was removed due to lack of applicability to the majority of the sample. Scores range from 0 to 28. Internal reliability for this scale was acceptable (Cronbach's alpha = .78).

Statistical Analyses

Descriptive statistics, Spearman correlations, and a hierarchical linear regression, with race, physical symptoms, depressive symptoms, and each attributional style entered as covariates, were completed to assess relationships among each attributional style and expectations for improvement. Nonparametric bivariate correlations were chosen after comparison to parametric correlations due to negative skew of deployment-related causes. We excluded six participants who did not have sufficient data on the IPQ-R. Race was collapsed into two categories (0 = White or Non-African American, 1 = African American). Plots of residuals were examined for normality. Given its association with worse treatment outcomes, physical symptoms were examined as moderators of the relationship between illness attributions to behavior, military deployment, and treatment expectations using Hayes PROCESS analysis. All analyses were conducted with SPSS version 25.

Results

Descriptive Analyses

The sample consisted of $N = 262$ Veterans of Operation Desert Shield/Desert Storm deployed to the Persian Gulf region in 1990–1991 who met Kansas screening criteria for GWI [4]. Twelve percent of the sample ($n = 31$) were women. Mean age was 52.9 years ($SD = 7.3$) with slightly under three-fourths (71.8%) identifying as White and about one-fifth (21.4%) identifying as African American. Under half (45%), the sample was working full time, while 83.2% received some form of disability. Almost 80% reported a household income over $40,000. Nearly two-thirds (63.7%) were married, and 86% were service connected for an injury or illness incurred or exacerbated through military service. Veterans reported a moderately high level of physical symptoms (PHQ-15 M[SD] = 14.7[4.7]) and moderate range of depressive symptoms (PHQ-8 M[SD] = 10.1[5.0]).

Nearly three-fourths (74.4%) strongly agreed that their military deployment-related exposure was a cause of GWI (18.3% agreed [A], 5.3% neither agreed nor disagreed [N], 0.4% disagreed [D], and 1.5% strongly disagreed [SD]). Conversely, only 9.6% strongly agreed [SA] that behavior was a cause of GWI (13.0% A, 33.7% N, 22.2% D, and 21.5% SD). Slightly less than one-third (32.8%) of the sample strongly agreed that psychological stress (31.7% A, 19.1% N, 8.8% D, and 7.6% strongly disagreed SD) was the cause of the GWI, while slightly less than one-quarter (23.4%) strongly agreed that physical causes (26.4% A, 30.3% N, 12.9% D, and 6.9% SD) contributed to GWI.

Bivariate Analyses

Overall, African American Veterans reported higher expectations for improvement ($M = 7.2$, $SD = 4.6$) than non-African American Veterans ($M = 4.7$, $SD = 4.2$; $t(260) = -3.90$, $p < .001$). Bivariate analyses showed that attribution of GWI to deployment-related exposure was related to worse expectations for total improvement ($\rho = -.14$, $p = .03$). Further, greater attribution of symptoms to deployment resulted in significantly lower expectations for improvement in the number of physical symptoms ($\rho = -.13$, $p = .04$) and mood/stress levels ($\rho = -.17$, $p = .005$). In contrast, attribution of GWI to behavior was related to better total expectations ($\rho = .26$, $p < .001$), greater expectation for improvement in the number of physical symptoms ($\rho = .21$, $p = .001$), severity of physical symptoms ($\rho = .23$, $p < .001$), bothered by physical symptoms ($\rho = .26$, $p < .001$), and mood/stress levels ($\rho = .22$, $p = .001$). Neither psychological nor physical causes of GWI were significantly related to any expectations for improvement (ps > .05). Greater

Table 1 Regression model of attribution of GWI symptoms and expectations for improvement (N = 261)

Predictor	β	*p* value	R^2
Race[a]	**.19**	**.002**	.11
Military deployment	-.06	.350	
Psychological stress	-.01	.913	
Physical cause	-.07	.279	
Behavior	**.23**	**.001**	

p <.05 are in bold

[a] Race was collapsed into African American vs. White

depressive symptoms were related to lower expected improvement ($\rho = -.22$, $p = .001$) and higher attribution to psychological cause ($\rho = .21$, $p = .001$). Greater physical symptoms were associated with greater attribution to deployment cause ($\rho = .15$, $p = .01$), lower attribution to behavior ($\rho = -.15$, $p = .01$), and lower expectations for improvement ($\rho = -.25$, $p < .001$).

Regression Analyses

Sex, age, and marital status were not significantly related to expectations for improvement and thus were not included in the multivariable regression model. Table 1 illustrates the influence of each of Veterans' attributions of GWI symptoms and race upon expectations for improvement. When all causes were entered together in a regression model ($R^2 = .11$, $p < .001$), only the individual's attribution of GWI to behavior ($\beta = .23$, $p < .001$) and race (African American vs. not; [$\beta = .19$, $p < .002$]) retained their significance.

We also explored if severity of depression and physical symptoms influenced outcomes. Inclusion of depressive and physical symptoms into the regression model (not shown), accounted for an additional 3.9% and 3.4% of variance, respectively, in expectations of improvement. Neither severity of physical symptoms nor depressive symptoms significantly influenced the strength of the relationship between attribution (i.e., behavior and military deployment) and expectations for improvement (*p*s > .05). When entered together, only depressive symptoms ($\beta = -.14$, $p < .04$) and behavior ($\beta = .21$, $p = .001$) retained their significance. PROCESS analysis supported neither physical symptoms nor depressive symptoms as moderators of the relationship between behavioral symptom attribution and expectations for improvement.

Discussion

These findings emphasize an under-investigated relationship between PPS attributions and expectations for improvement among Veterans with GWI. Our hypothesis that internal attributions, such as personal behavior, would be related to greater expectations for improvement was supported. Unexpectedly, external attributions, such as deployment-related exposures, were not consistently related to worse expectations. While Veterans who attribute their GWI to military deployment did show worse expectations for improvement at the bivariate level, this relationship did not persist at the multivariate level. Veterans who attribute their GWI to a psychological or physical cause did not show significant relationships to expectations for improvement at either the bivariate or multivariate level. When all attribution styles are entered into the same model, only attribuions to behavior retained its significance to expectations for improvement. The relationship between attributions to behavior and expectations persisted in the presence of additional covariates including depressive and physical symptoms, indicating its independent relationship to perceived possibility of improved health.

This new evidence expands on previous literature examining the relationship between Veterans' attributions of GWI and their health outcomes, which has not found consistent relationships. The CSM postulates that illness beliefs or attributions influence health outcomes. For example, Veterans who attribute their symptoms to external factors such as deployment and environmental factors tend to have worse health outcomes [27] and more pervasive symptoms [20, 28] than those who do not attribute their symptoms to external factors. In contrast, findings from a study of Australian Gulf War Veterans found that psychological attribution was associated with more persistent impairments [29]. That study, however, did not explore military deployment exposures or individual behavioral attribution styles. Given these discrepancies, the relationship between causal attributions and health outcomes necessitates further clarification to describe pathways for potential symptom improvement.

While previous research has shown that threat-related illness-beliefs — the view that an illness is harmful and enduring with severe consequences and negative emotional responses — have a greater association with disability compared to causal attributions [10, 30], our results suggest that internal attribution may also affect outcomes, specifically expectations for improvement. This may reflect the fact that causal attributions were examined as an aggregate in previous studies, rather than as individual modes of attributions. Our study extends the literature by demonstrating the multiple causal illness attributions and supports the theory that individuals are open to coexisting explanations for their PPS [12].

Results from this study demonstrate that expectations of improvement are multifaceted. Multiple attribution styles appear to underscore the importance of addressing the spectrum of individual perspectives about PPS causes. Understanding patients' causal attributions of PPS may facilitate validation of PPS and development of shared treatment goals. Past research illustrates that expectations are an important focus: surgical patients' expectations prior to medical procedures were found to be more predictive of health outcomes than illness severity or other medical factors [31, 32]. Patient-provider rapport may benefit from conversations which focus on acknowledging causal attribution, working together to optimize health and functioning, and prioritizing aspects of care within the patient's control [33, 34]. For PPS, discussion of the multiple attributions, including the role of individual health behaviors, may help to improve treatment engagement, promoting self-care and symptom relief. Discussions about differences between precipitating factors, i.e., factors that trigger the onset of the PPS (e.g., environmental exposure), and perpetuating factors, i.e., factors that maintain PPS (e.g., dietary choices), may be particularly helpful because they provide a model of PPS with multiple explanations for symptoms.

Limitations of the present analyses include cross-sectional study design and generalizability of the sample. Observational analyses cannot confirm directionality. Past mental health and medical treatment experiences were not assessed and may influence attribution style. Further, the skewed distribution of deployment attribution may make significant differences difficult to detect in a parametric model. Physical and psychological causes are also broad response choices and could comprise a range of beliefs. Complex psychological and physical comorbidities in this cohort of Veterans [35] may make it hard to decipher symptom etiology. Our sample was presented with only four options for symptom attribution style, potentially missing other explanations. Lastly, this was a self-selected sample of Veterans with GWI participating in an interventional trial of psychotherapy, which limits the ability to make inferences about other PPS samples, or those not seeking treatment.

Future research should address how symptom attribution changes over time in conjunction with options for and goals of treatment. Initial research suggests greater concordance of these beliefs between patients and providers influences treatment adherence [33]; future research may examine how providers' attributions of PPS to lifestyle behavior or military deployment influences this concordance. Greater elucidation of these parallel attribution processes may help to explain satisfaction and engagement with care. Results here suggest that for Veterans with GWI, exploration of GWI attribution, including diet and physical activity, may help to increase hope that symptom improvement is possible.

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Data Availability Data is available only with permission from the Veterans Affairs.

Declarations

Ethical Approval All procedures performed in studies involving human participants were in accordance with the ethical standards of the institutional and/or national research committee and with the 1964 Helsinki declaration and its later amendments or comparable ethical standards. This article does not contain any studies with animals performed by any of the authors.

Informed Consent Informed consent was obtained from all individual participants included in the study.

Conflict of Interest The authors declare no competing interests.

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