

Gulf War Illness classifications and changes in subjective health among Reserve Component veterans who had deployed to the Persian Gulf

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Abstract

Data from 644 Reserve Component Persian Gulf War veterans were analyzed to compare changes in subjective health with classification status as having Gulf War Illness (GWI) by either the Centers for Disease Control definition or a slightly modified version of the Kansas (Steele, 2000) definition. Recall bias has sometimes been cited as a reason to challenge the validity or meaningfulness of self-reports of illness, including Gulf War illnesses. If recall bias, as a random variable, was entirely responsible for variance in self-reports of illness or subjective ratings of personal health, then associations between self-reported ratings of personal health and GWI classifications based on systematic evaluation of health symptoms and conditions should be minimal, even non-significant. However, our results indicated relatively strong associations between both current subjective health and changes in subjective health since the first Persian Gulf War with GWI classifications. Associations between GWI and subjective health are only slightly lower for health issues recalled during the war than for current health issues, suggesting minimal changes in any impact of recall bias over different retrospective time periods. Nevertheless, such associations were far from perfect. Small percentages of veterans with GWI symptoms reported having both excellent health currently and before the war, while others not classified with Gulf War illness did report either currently poor subjective health or substantial declines in subjective health. Because classification of GWI depends on having symptoms in multiple areas, veterans whose symptoms are more concentrated may be among those overlooked by current GWI classifications and yet among those veterans who report declines in personal health status. Implications for the search for causal factors responsible for the health problems of many Persian Gulf War veterans are discussed.

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1. Background

One of the challenges in conducting research on Gulf War illnesses is the constant risk that one's results will be dismissed, or at least threatened by, the risk of recall bias [1, 2, 3]. However, because of the lack of clinical records for veterans, researchers often have no other choice than to rely upon self-reports of Gulf War risk factors or retrospective reports of personal subjective health or health symptoms or conditions. Unfortunately, the recall bias argument can tend to support self-serving arguments against government culpability in any significant associations that might be found between military medical interventions and reports of health problems among veterans. Recently, for example, the Institute of Medicine [4] essentially dismissed the findings of any "non-clinical" (i.e., survey) research in its evaluation of the safety of anthrax vaccine, largely because of their concerns about recall bias. For example, Captain Tanner's research on anthrax vaccine at Dover Air Force Base was dismissed by the IOM Committee [4: 126, 132-133, 152] as if it had relatively little value. Yet, it was later demonstrated that her data did indeed have value as it showed some degree of patterning of symptom severity when using the CDC and Kansas classifications of Gulf War illnesses [5]. In fact, their report went so far as to not even mention the

existence of much of the "non-clinical" research, completely overlooking research by numerous scholars [6-8]. No doubt human memory is far from perfect. Since many veterans were given vaccines that were not recorded in their shot records, nor were they told at the time what the vaccines were, many *may never* be sure about which vaccines they did or did not receive. Other veterans may be unsure about how many ciproflaxin or pyridostigmine bromide tablets they may have consumed during the first Gulf War [9].

However, no research conducted is ever free from some types of error. In fact, random error is essential for our ability to assess relationships among variables with most statistical techniques. Systematic error can present more of a problem, but its suspected existence should not deter researchers from asking and/or investigating difficult or politically charged questions. If recall bias could be measured and introduced into statistical models, its magnitude could be both assessed and controlled. However, we are not aware of a clear way to measure recall bias when objective measures are not available for comparison purposes. To us, it was almost amusing that Mahan *et al.* [10] felt obliged to negate survey data (which indicated a strong relationship between anthrax vaccination and health problems) from their sample of 11,441 veterans (of whom 4,601 reported anthrax vaccination) because of neutral findings (of no relation-

ship between vaccination and health problems) obtained from a subsample of 352 veterans (3.1%) who had available hard-copy shot records indicating anthrax vaccination. Yes, the survey data might have had error, but the total loss or elimination of as many as 97% of the actual shot records can hardly be declared to have been a more error-free process – especially when it is now known that many of the actual records failed to record many of the veterans' vaccinations, due to security concerns.

2. Objectives of the study

We recognize that personal reports of health are subjective; what seems like “excellent” health to one person may seem like only “very good” health to another. However, current classifications of Gulf War illnesses are derived in a complex fashion from combinations of medical conditions or symptoms from different types or clusters of concerns (e.g., respiratory versus gastrointestinal) and represent perhaps the best “gold standard” of the assessment of GWI that we have at present. Therefore such GWI classifications represent a standard against which to evaluate the concurrent or predictive validity of individual measures of self-reported personal (subjective) health. The stronger the association between current personal subjective health or changes in subjective health with GWI classifications, the lower the possible impact of recall bias. For example, if nonsignificant correlations were obtained between subjective health measures and GWI, then clearly one would have to question the validity of the subjective health measures and consider recall bias as a likely cause for the problems with validity. If, on the other hand, significant correlations were obtained between subjective health and GWI, then the validity of the measures of subjective health would have been supported. Such support would not eliminate the potential role of recall bias but would suggest that either its contributions were minimal or, at worst, not much greater for measures of subjective health than for our current, more objective methods of assessing GWI.

Therefore, one objective of this study was to assess the predictive validity of subjective measures of personal health among Gulf War veterans against measures that classify those veterans into GWI and non-GWI groups. Greater evidence of such validity would infer lesser evidence for large effects of recall bias, though we know of no sure way to rule out possible recall bias effects without having concurrent clinical medical records for comparison purposes. Thus, by inference, a second objective of our study was to assess, in a limited way, the possible impact of recall bias or other sources of invalidity on the relationship between subjective health and GWI classifications.

3. Methods

As discussed in detail previously [11–13], in 1996, the state of Ohio commissioned an independent study of the post-war health of Ohio's Gulf War veterans, through the Center for the Study of Veterans in Society (CSVS), who contracted with Kansas State University researchers to conduct the study among a random sample of veterans who had lived in Ohio as of August 1990 or as of March 1996, a study that came to be

known as the Ohio Desert Storm Survey Project. The Defense Manpower Data Center provided a list of such veterans, along with current, accurate addresses for about a third of the veterans on the list.

In our survey, veterans were asked to report their level of subjective health at several times, including before Desert Storm (prior to August 1990), during Desert Storm (August 1990 to June 1991) and during the past year (which ranged between late 1995 and late 1997, depending on when they received their survey). Responses available for each time frame included five levels – poor, fair, good, very good, and excellent.

One way to assess predictive validity between subjective health and GWI would be to perform cross-tabulations between both measures, estimating the association by both chi-square tests and Pearson or Spearman correlations. That was performed for both measures for both time frames, using the Statistical Package for the Social Sciences (SPSS)[14].

A second way to assess predictive validity would be to introduce the element of change in subjective health since before the war, evaluating the association between subjective health and GWI in terms of the perceived change in subjective health. That was accomplished by repeating the previous analyses, controlling for levels of subjective health prior to the war. Since almost no veterans reported having only poor or fair health prior to the war, we only controlled for three levels of prior subjective health – good, very good, and excellent. In some cases, it was found that during or after the war, none of the veterans reported having excellent health; therefore, the degrees of freedom associated with some of the chi-square tests varied slightly.

Because our data never included a measure of intensity of symptoms or data on hospitalization, we depended on having at least two (mild) symptoms rather than having one severe symptom, which was considered equivalent for scoring purposes in the original Kansas scoring protocol. When preexisting diseases were reported, we eliminated the case from consideration for (Kansas) GWI. Veterans (including those who eventually developed GWI and those who didn't, respectively) were excluded from the final Kansas definition of Gulf War illness because of the following preexisting or concurrent medical conditions: malaria, coronary heart disease, diabetes, chronic fatigue syndrome, GWI symptoms prior to the war, stroke, hepatitis, mycoplasma infection, Epstein-Barr virus infection, prolonged dysentery, hypothyroidism, cancer other than skin cancer, chronic mononucleosis, kidney/renal disease, leishmaniasis, and tuberculosis.

Preexisting conditions ruled out an individual symptom from being counted towards a GWI classification, but a veteran with four CDC symptoms in one area would still be credited with a problem in that area even if one or two of those had pre-existed, because there were still at least two new symptoms. If a veteran reported one symptom over two adjacent time periods, then the symptom was counted toward GWI classification under the CDC approach at the second consecutive time of occurrence (where only one continuous symptom was needed to qualify any one area towards a GWI classification).

5. Results

Results shown in Table 1 and graphed in Figure 1 confirm the hypothesis that subjective health and GWI classification would be significantly associated, as reflected by both chi-square tests and Pearson zero-order correlations. The lower the self-reported subjective health, the greater the chance that the veteran would report a constellation of medical symptoms and conditions that would classify him or her as having Gulf War illness. The association between subjective health and GWI classification was significant at both times assessed, though it was stronger for the 1996–1997 time frame. Using the Kansas GWI classification yielded fewer GWI cases at all levels of subjective health (because it is a more selective approach to classifying GWI), but the differences with the CDC method were perhaps most notable at higher levels of subjective health. Among those reporting very good to excellent health, very few veterans were classified with GWI by the Kansas definition.

Results shown in Tables 2 and 3 reveal a similar, but stronger pattern of association between GWI classification and subjective health. While the correlations in Table 1 ranged between $-.22$ and $-.53$, the correlations in Tables 2 and 3 ranged between $-.37$ and $-.56$. It is of interest that when veterans reported no change or an improvement in their health from 1991 to 1997, no more than 33.3% were ever classified with GWI in Tables 2 or 3. Among those veterans who reported a decline of three or more levels in their health in Tables 2 or 3, no fewer than 55.8% and usually over 80% were classified with GWI. Among those veterans who reported a decline of two levels in their health in Tables 2 or 3, no fewer than 32.4% and usually near 60% or more were classified with GWI.

Results shown in Table 4, as selected from data in Table 1 for 1997, indicate that the correspondence between subjective health and GWI classification is not perfect and appears to shift in the type of non-correspondence depending on the method used to classify GWI. The Kansas approach to GWI classification makes fewer “errors” among those who report excellent health but may leave more “room” for non-GWI conditions that could account for poor subjective health.

6. Implications

Recall and other methodological biases. The lack of perfect correspondence between GWI classification and subjective health and the stronger association between GWI and health for the more recent time frame lend support to the possible role of memory effects or recall bias [1,2,3]. Thus, our results do not “disprove” or rule out such effects. However, our results do suggest that such effects are not sufficient to entirely explain nor entirely negate the expected association between perceived and self-reported subjective health and a more objective assessment of a relatively complex constellation of health and medical symptoms, now labeled as Gulf War illness. Therefore, it seems reasonable to exercise due caution about such effects but not to automatically dismiss any research findings, without clear supporting evidence, as “undoubtedly” due to methodological errors, such as recall bias. Our results do suggest that the most accurate recall for GWI symptoms may occur for the most

recent time period as opposed to time periods associated with the Gulf War itself or later, but not current, time periods.

Searching for Causes of GWI. If there are causal factors behind the ill health of Gulf War veterans [15], researchers must keep in mind that GWI might not be the total picture of the health status of veterans. The lack of 100% overlap between GWI classification and declines in subjective health may mean that some causal factors might account for GWI symptoms while other factors might account for symptoms not captured by GWI classifications but perhaps better captured by either (1) the more global assessment of subjective health or (2) subsets of GWI symptoms (e.g., neurological symptoms by themselves, even when a veteran does not meet GWI classification protocols by having symptoms in a second or third area of symptoms at the same time). For example, someone might find no relationship between a certain toxic exposure and GWI. However, one should not rule out that type of toxic exposure as a contributing factor for veterans’ ill health until one has also tested that factor against both subjective health and against each individual subset of GWI conditions (e.g., testing against neurological, respiratory, body pain and joint, fatigue, skin, and gastrointestinal conditions, separately).

Careful and thorough statistical analysis will be required to ensure that possible causal factors are not overlooked because of dependence on an overly narrow definition of ill health or Gulf War illness symptoms, even if such definitions were widely accepted.

Dedication

This article is dedicated to the memory of Ms. Diane Sanders, who passed away January 19, 2007 after a long illness. As one of the two primary graduate research assistants for the Ohio Desert Storm Project, Diane played a significant role in the success of that project. This is her seventh refereed publication. Her talents and caring heart will be missed by all who worked with her at Kansas State University and in the Manhattan, Kansas area.

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Table 1. Changes in mean scores (standard deviations) for self-reported subjective health across four time periods as a function of mobilization status among Persian Gulf War veterans

	CDC		Kansas	
	1990-1991	1996-1997	1990-1991	1996-1997
Poor	80.0 (5)	93.3 (45)	50.0 (2)	83.3 (24)
Fair	39.2 (51)	83.7 (172)	24.3 (37)	56.3 (128)
Good	24.9 (209)	58.6 (198)	12.2 (164)	30.4 (168)
Very good	10.4 (230)	23.8 (151)	4.9 (203)	8.6 (139)
Excellent	5.2 (153)	17.3 (81)	2.3 (133)	6.3 (79)
N	648	647	539	538
Chi-Square test	64.11	190.34	30.76	126.43
df	4	4	4	4
p	< .001	< .001	< .001	< .001
Pearson correlation (r)	-.30	-.53	-.22	-.47
(p)	< .001	< .001	< .001	< .001

Table 2. Percentage of Gulf War veterans classified as of 1996-1997 with Gulf War Illness (GWI) by CDC case definition as a function of subjective health before the war and subjective health over the past year

Subjective health past year	Subjective health before war		
	Good	Very good	Excellent
Poor	100.0 (7)	100.0 (18)	85.0 (20)
Fair	90.0 (78)	84.6 (78)	81.9 (72)
Good	32.4 (37)	59.0 (78)	69.9 (83)
Very good	25.0 (4)	18.8 (85)	31.1 (61)
Excellent	0 (0)	33.3 (6)	16.0 (75)
Good and above	31.7 (41)		
Very good and above		19.8 (91)	
N	68	265	311
Chi-Square test	24.77	89.21	94.86
df	3	4	4
p	< .001	< .001	< .001
Pearson correlation (r)	-.56	-.56	-.53
(p)	< .001	< .001	< .001

Table 3. Percentage of Gulf War veterans classified as of 1996/1997 with Gulf War Illness (GWI) by Kansas case definition as a function of subjective health before the war and subjective health over the past year

Subjective health past year	Subjective health before war		
	Good	Very good	Excellent
Poor	80.0 (5)	81.8 (11)	87.5 (8)
Fair	50.0 (16)	59.3 (59)	55.8 (52)
Good	20.6 (34)	33.3 (63)	32.4 (71)
Very Good	25.0 (4)	6.3 (80)	11.1 (54)
Excellent	0 (0)	16.7 (6)	5.5 (73)
Good and above	21.1 (38)		
Very good and above		7.0 (86)	
N	59	219	258
Chi-Square test	9.42	57.45	62.18
df	4	4	4
p	< .05	< .001	< .001
Pearson correlation (r)	-.37	-.50	-.48
(p)	< .01	< .001	< .001

Table 4. Examples of unexpected classifications of Gulf War veterans discovered when comparing subjective health and GWI classifications, 1996-1997 period

	CDC Classification	Kansas Classification
Excellent subjective health but classified with GWI	17.3% (14/81)	6.3% (5/79)
Poor subjective health without GWI	6.7% (3/45)	16.7 (4/24)

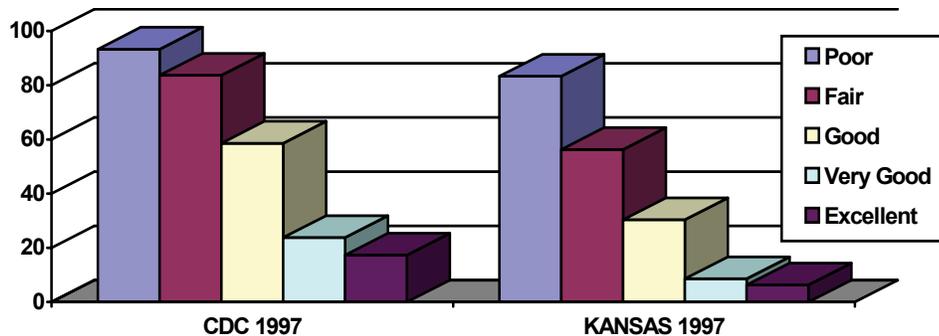


Figure 1. Percentage of Gulf War veterans classified with Gulf War Illness as a function of subjective health status