

Prevalence of Reported Pain, Widespread Pain, and Pain Symmetry in Veterans of the Persian Gulf War (1990–1991): The Use of Pain Manikins in Persian Gulf War Health Research

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The reporting of pain was compared for U.K. Persian Gulf War veterans, veterans from the Bosnian conflict, and personnel employed in the military at the time of the Persian Gulf War but not deployed (era comparison group). Pain manikins were used to assess the prevalence of the reporting of pain in different body sites and the prevalence of the reporting of widespread pain, in relation to comparison samples. Data from >8,195 veterans were collected from a previously reported, cross-sectional, population-based, postal questionnaire survey. A greater proportion of Persian Gulf War veterans reported pain in the majority of the 25 areas of the body, compared with the Bosnia and era comparison groups. A greater proportion of Persian Gulf War veterans also fulfilled American College of Rheumatology criteria for widespread pain, compared with the Bosnia and era comparison groups (odds ratio, 1.82; 95% confidence interval, 1.51–2.20). Participants were much more likely to report pain in an opposite limb if pain was reported in the first limb (odds ratio, 36.9; 95% confidence interval, 31.7–43.0). Widespread pain was also more prevalent in the Persian Gulf War veteran sample compared to the comparison groups. Several years after the end of the Persian Gulf War, veterans still report pain. The mechanisms of this remain unclear. Implications for baseline monitoring of the health of military personnel are discussed.

Introduction

Since returning from the Persian Gulf War in 1991, veterans have reported experiencing a wide range of adverse health conditions. To date, Persian Gulf War health research has looked at a range of health outcomes, from concerns about possible adverse reproductive outcomes^{1,2} to medically unexplained symptoms such as fatigue³ and malaise to psychiatric disorders such as post-traumatic stress disorder.⁴ An additional area of research has been the reporting of pain. Persian Gulf War veterans have reported pain in numerous, and often multiple, body sites.^{5–9} Prevalence estimates for various body sites have been presented; however, there has been little research into the patterns of pain that the veterans are experiencing.

Pain has been defined as “an unpleasant sensory and emotional experience associated with actual or potential tissue damage, or described in terms of such damage.”¹⁰ There can be many different causes of pain, including injury and trauma to the

body, diseases such as cancers, and degenerative conditions such as arthritis. Pain is the “most pervasive symptom in medical practice, the most frequently stated ‘cause’ of disability, and the single most compelling force underlying an individual’s choice to seek or avoid medical care.”¹¹

Wall and Melzack¹² stated that pain is “always subjective,” and a study by the Royal College of Surgeons and College of Anesthetists¹³ concluded that there were no objective measures of pain, only subjective ones. This has led to difficulties in the measurement of pain.

There are several methods available to measure the experience of pain, including visual analogue scales, pain questionnaires, observational methods (aimed at recording pain behaviors), and pain manikins or drawings. Pain manikins offer the opportunity to study the pattern of pain experienced in the body and, because the whole body is presented, respondents are free to indicate wherever they feel their pain, rather than being limited to areas chosen by researchers. Pain manikins normally consist of pictures of the body (front and back) on which participants are asked to shade the areas in which they feel pain. Pain manikins are an established tool for the measurement of pain and have shown good test-retest reliability ($r = 0.85$, over an average time interval of 71 days) as a measure of both surface area of bodily pain and locations of pain.¹⁴

Attempts have also been made to define widespread pain. Widespread pain is thought to be more disabling than regional pain; therefore, by defining widespread pain, associations with functional disability can be determined. The American College of Rheumatology (ACR) defined widespread pain as part of its clinical diagnosis of fibromyalgia.¹⁵ To be considered as having widespread pain, participants had to indicate a site of pain in one upper limb, in the contralateral lower limb (which could include pain in the buttock), and in the axial skeleton. The widespread pain was considered to be chronic if it had been present for ≥ 3 months. Patients with widespread pain have also been shown to score more highly on questionnaires that measure affective symptoms, such as depression.¹⁶

The focus of this study is to look more specifically at the prevalence and patterns of reporting and pain in a military sample with the use of pain manikins. Veterans of both the Persian Gulf War and the Bosnian conflict were used to examine pain. Also, an era comparison group (military personnel who were serving at the time of the Persian Gulf War but who were not deployed) was used as a comparison group. An additional sample of veterans who were deployed to both the Persian Gulf War and the Bosnian peacekeeping mission were examined to determine whether being deployed to both the Persian Gulf and

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Bosnia resulted in personnel reporting more like the Gulf sample or like the Bosnia sample. This study uses data from the previously reported, cross-sectional, postal survey of the health of U.K. Persian Gulf War veterans.¹⁷

Methods

Participants

Target Population

The target population consisted of all male and female British Persian Gulf War veterans who had served in the Persian Gulf region between September 1, 1990, and June 30, 1991. This included a total of 53,462 military personnel. Special forces personnel were excluded for security reasons.

Gulf Sample

The Gulf sample was created by taking a stratified random sample of 4,246 (7.94%) of the 53,462 veterans who had served in the Persian Gulf War between September 1, 1990, and June 30, 1991. More specific details of the stratification procedure are available in the report by Unwin et al.¹⁷

Comparison Samples

Bosnia Sample

The Bosnia sample was created by taking a stratified random sample of 4,250 (10.84%) of the total of 39,217 personnel who had served in Bosnia between April 1, 1992, and February 6, 1997. The Bosnia sample was stratified according to age, gender, and rank. Only military personnel from the army served in Bosnia.

Era Sample

A random sample of 4,248 (1.70%) of the 250,000 personnel who were serving in the armed forces on January 1, 1991, but who were not deployed to the Persian Gulf region created the era sample. The era sample was stratified according to all of the stratification variables used to create the Gulf sample.

Gulf-Bosnia Sample

A fourth sample (Gulf-Bosnia) was created from the respondents to the questionnaire who had served in both the Persian Gulf region and Bosnia. Respondents previously in either the Gulf sample or the Bosnia sample were moved into the Gulf-Bosnia sample if they indicated that they had been deployed to both the Persian Gulf region and Bosnia. The number of veterans who responded to the questionnaire and stated that they had served in both the Persian Gulf and Bosnian conflicts was 570.

Procedure

A total of 12,592 questionnaires were sent out between August and September 1997. Additional information regarding the response to follow-up mailings can be found in the report by Unwin et al.¹⁷

Outcome Measures

Pain Manikins

On one page in the questionnaire, the veterans were presented with four blank manikins, representing the right side, left side, front, and back of the body. The veterans were asked to shade on the manikins where they felt or were currently feeling aches or pains. Responses were analyzed by placing a grid over the manikins, which divided them into 25 separate areas. The veterans did not see these areas.

Responses were then categorized into a binary variable. If there was shading in a specific area, then the area was coded as being painful; if there was no shading, then the area was regarded as not causing pain. Data from the pain manikins were then used to create three categories of widespread pain.

Widespread Pain

The information provided by the manikins was used to create the variables of widespread pain according to the ACR definition. The ACR created a definition of chronic widespread pain as part of the diagnostic criteria for fibromyalgia.¹⁵ To fulfill the criteria, pain must be reported in the axial skeleton and two contralateral quadrants for ≥ 3 months. Figure 1 illustrates a pattern of pain on a manikin that would fulfil the ACR definition of chronic widespread pain.

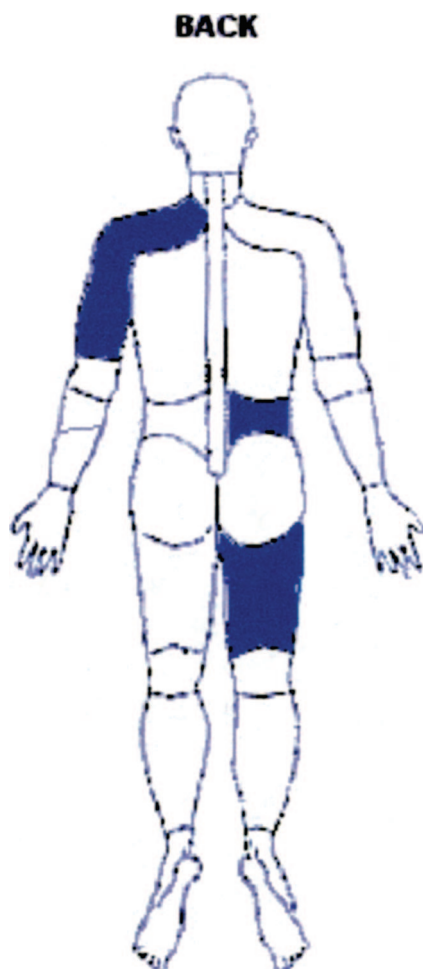


Fig. 1. Pattern of pain that would fulfill the ACR definition of widespread pain.

TABLE I
 SOCIODEMOGRAPHIC CHARACTERISTICS OF THE RESPONDERS IN THE FOUR MILITARY SAMPLES

	No. (%)				χ^2 (df)	p
	Gulf (n = 2,959)	Gulf-Bosnia (n = 570)	Bosnia (n = 2,052)	Era (n = 2,614)		
Gender						<0.001
Male	2,733 (92.4)	560 (98.3)	1,835 (89.4)	2,422 (92.7)	51.3 (3)	
Female	226 (7.6)	10 (1.8)	217 (10.6)	192 (7.4)		
Current age						<0.001
<20 years	0 (0)	0 (0)	6 (0.3)	0 (0)	1,975.8 (15)	
20–24 years	1 (0.03)	3 (0.5)	534 (26.3)	29 (1.1)		
25–29 years	746 (25.3)	237 (41.6)	708 (34.8)	556 (21.4)		
30–34 years	890 (30.2)	187 (32.8)	375 (18.4)	809 (31.1)		
35–39 years	613 (20.8)	91 (16.0)	233 (11.5)	581 (22.3)		
≥40 years	699 (23.7)	52 (9.1)	178 (8.8)	629 (24.2)		
Marital status						<0.001
Married/living with partner	2,229 (75.7)	398 (70.4)	1,173 (58.0)	1,963 (76.2)	384.7 (6)	
Never married	466 (15.8)	99 (17.5)	709 (35.0)	360 (14.0)		
Separated, divorced, widowed	248 (8.4)	68 (12.0)	144 (7.1)	254 (9.9)		
Education						<0.001
Lower than O levels	543 (19.0)	102 (18.3)	310 (15.6)	468 (18.5)	62.9 (6)	
O levels	1,667 (58.2)	383 (68.6)	1,229 (62.0)	1,395 (55.1)		
A levels or higher	656 (22.9)	73 (13.1)	444 (22.4)	668 (26.4)		
Currently in employment						<0.001
In work	2,743 (94.4)	544 (98.0)	1,961 (97.3)	2,381 (93.7)	45.2 (3)	
Not in work	163 (5.6)	11 (2.0)	54 (2.7)	159 (6.3)		
Alcohol intake						<0.001
None	275 (9.4)	33 (5.8)	138 (6.8)	239 (9.2)	145.5 (12)	
1–3 drinks per week	781 (26.6)	120 (21.2)	403 (19.8)	655 (25.2)		
4–10 drinks per week	892 (30.3)	186 (32.8)	565 (27.7)	821 (31.6)		
11–20 drinks per week	632 (21.5)	137 (24.2)	504 (24.7)	592 (22.8)		
>21 drinks per week	362 (12.3)	91 (16.1)	430 (21.1)	295 (11.3)		
Smoking status						<0.001
Currently smoke	1042 (35.4)	232 (41.1)	759 (37.3)	813 (31.4)	38.2 (6)	
Ex-smoker	711 (24.2)	125 (22.1)	415 (20.4)	661 (25.6)		
Never smoked	1,187 (40.4)	208 (36.8)	861 (42.3)	1,112 (43.0)		
Rank						0.031
Officer	395 (13.5)	54 (9.5)	277 (13.7)	367 (14.2)	8.9 (3)	
Soldier	2,537 (86.5)	513 (90.5)	1,745 (86.3)	2,216 (85.8)		
GHQ						<0.001
Case ^a	1,144 (38.7)	206 (36.1)	526 (25.6)	612 (23.4)	185.3 (3)	
Noncase	1,730 (58.5)	347 (60.9)	1,451 (70.7)	1,918 (73.4)		

^a GHQ case is defined as scoring ≥3 on the 12-item GHQ,²¹ a measure used to estimate current mental health status.

Symmetry of Pain

Data from the manikins were used to investigate whether there was any symmetry across the body in the reporting of pain. For example, if pain was present in the left arm, was it more likely that pain was then reported in the right arm?

Software

Stata (version 6.0; Stata, College Station, Texas) was used for all logistic regression analyses. Paint Shop Pro 6 (Corel, Ottawa, Canada) was used to present the manikin data.

Results

Rate of Responses to the Questionnaire

A total of 8,195 questionnaires were returned, which represents 65.1% of the veterans sampled. There were 2,959 responses from the Gulf sample (69.6%), 2,614 responses from

the era sample (61.6%), and 2,622 responses from the Bosnia sample (61.6%). A fourth sample of 570 veterans who had attended both the Persian Gulf and Bosnian conflicts was then created. This altered the size of the Bosnia sample to 2,052 responses. Table I presents the sociodemographic characteristics of the respondents.

Widespread Pain

Table II shows the sociodemographic characteristics of veterans who fulfilled the ACR criteria for widespread pain. Statistically significantly greater proportions of male veterans, veterans who were ≥35 years of age, veterans who were separated, divorced, or widowed, veterans with a lower level of education, veterans currently not in work, current smokers, veterans consuming no alcohol, and veterans classified as General Health Questionnaire (GHQ) cases fulfilled the ACR criteria for widespread pain. Table III shows a statistically significant increase in

TABLE II
SOCIODEMOGRAPHIC CHARACTERISTICS AND PROPORTIONS OF VETERANS FULFILLING ACR CRITERIA FOR WIDESPREAD PAIN

	No.	Proportion (%) (95% confidence interval)	χ^2 (df)	<i>p</i>
Gender				0.016
Male	7,550	12.0 (11.3–12.8)	5.8 (1)	
Female	645	8.8 (6.8–11.3)		
Age				<0.001
<35 years	5,107	10.7 (9.9–11.6)	15.3 (1)	
≥35 years	3,088	13.6 (12.4–14.8)		
Marital status				0.026
Married/living with partner	5,763	11.9 (11.0–12.7)	7.3 (2)	
Never married	1,634	10.2 (8.8–11.8)		
Separated, divorced, widowed	714	14.0 (11.5–16.8)		
Education				<0.001
Lower than O levels	1,423	15.7 (13.9–17.7)	36.9 (2)	
O levels	4,674	11.6 (10.7–12.6)		
A levels or higher	1,841	8.9 (7.6–10.2)		
Currently in employment				<0.001
In work	7,629	10.9 (10.2–11.6)	91.1 (1)	
Not in work	387	26.9 (22.5–31.6)		
Current smoker				0.000
Yes	2,855	15.3 (14.0–16.7)	54.9 (1)	
No	5,275	9.8 (9.0–10.6)		
Alcohol				<0.001
None	686	16.6 (13.9–19.6)	27.4 (2)	
1–10 drinks per week	4,422	12.3 (11.3–13.3)		
≥11 drinks per week	3,043	9.9 (8.8–11.0)		
Rank				<0.001
Officer	1,093	6.8 (5.4–8.4)	30.2 (1)	
Soldier	7,011	12.5 (11.8–13.3)		
GHQ				<0.001
Case ^a	2,488	23.2 (21.5–24.9)	441.0 (1)	
Noncase	5,446	6.7 (6.1–7.4)		

^a GHQ case is defined as scoring ≥3 on the 12-item GHQ,²¹ a measure used to estimate current mental health status.

TABLE III

PROPORTIONS, ODDS RATIO, AND ADJUSTED ODDS RATIO OF VETERANS FULFILLING ACR CRITERIA FOR WIDESPREAD PAIN, ACCORDING TO MILITARY SAMPLE

	No.	Proportion (%) (95% confidence interval)	Odds Ratio (95% confidence interval)	Adjusted Odds Ratio ^a (95% confidence interval)	Adjusted Odds Ratio ^b (95% confidence interval)
Gulf	2,959	16.8 (15.4–18.2)	2.16 (1.83–2.55)	2.13 (1.79–2.55)	1.82 (1.51–2.20)
Gulf-Bosnia	570	15.8 (12.9–19.0)	2.01 (1.54–2.62)	2.19 (1.65–2.90)	2.04 (1.52–2.73)
Bosnia	2,052	7.6 (6.5–8.8)	0.88 (0.71–1.09)	1.08 (0.85–1.38)	1.06 (0.83–1.36)
Era	2,614	8.5 (7.5–9.7)	1.00	1.00	1.00
χ^2 (df)		140.6 (3)	139.5 (3)	97.63	59.58 (3)
<i>p</i>		<0.001	<0.0001	<0.0001	<0.0001

^a Adjusted for gender, age, marital status, level of education, employment status, alcohol consumption, smoking, and rank.

^b Adjusted for gender, age, marital status, level of education, employment status, alcohol consumption, smoking, rank, and GHQ score (as a linear and quadratic term).

the odds of reporting widespread pain in both the Gulf and Gulf-Bosnia samples, which remained even after adjustment for potential confounders.

Prevalence of Pain in Each Body Site (Pain Manikins)

The pain manikins were used to compare the percentage of veterans in each of the military samples reporting pain in specific areas. The results are presented in Figure 2. Areas were

colored according to the percentages of veterans reporting that they had pain in the specific area.

The manikins indicate graphically that greater proportions of the Gulf and Gulf-Bosnia samples reported pain, compared with both the era and Bosnia samples. They also indicate pain “hot spots” in the knees and lower back regions, which were highly prevalent in all four military samples.

The manikin data were also used to consider symmetry of

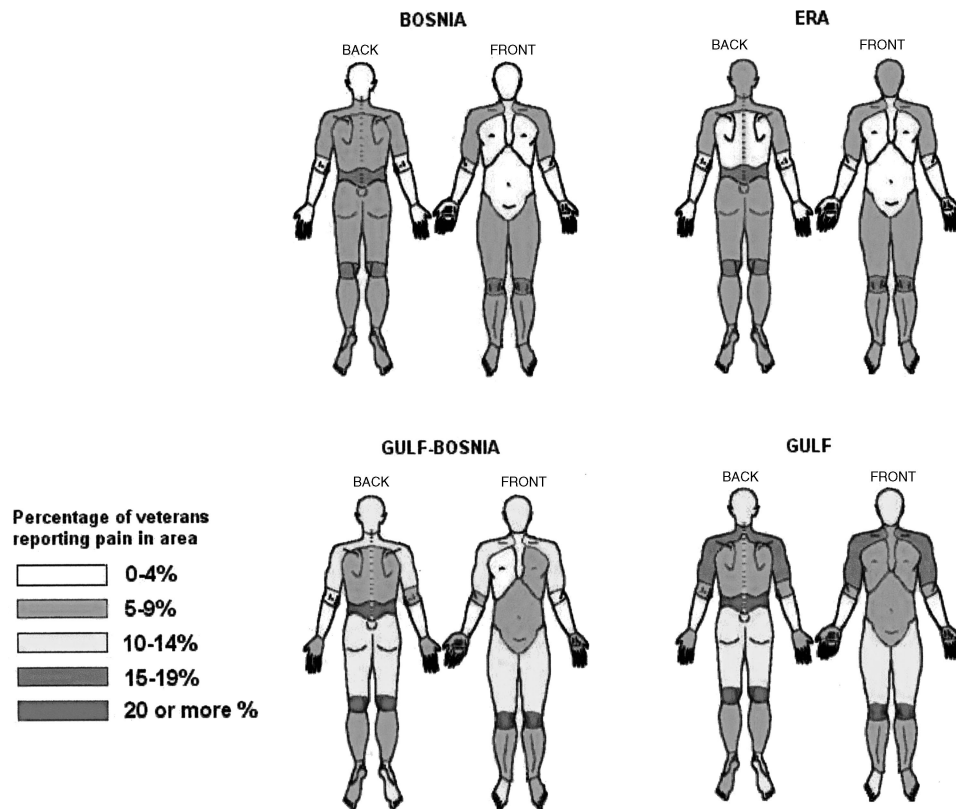


Fig. 2. Pain manikins showing the reported prevalence of pain in each body site.

pain reporting. Table IV shows the number of veterans reporting pain in a second limb if pain is present in a first limb. The results show that a greater proportion of veterans with pain in one limb reported pain in the symmetrically opposite limb, compared with reporting pain in a second limb on the same side of the body.

Table V shows the associations of having pain in one limb with having pain in another limb. For example, the odds ratio of having pain in the right leg if pain is present in the left leg was

32.95. Table V illustrates that the odds of having pain in one limb were greatly increased if pain was present in the opposite limb.

Discussion

The Persian Gulf War veterans had an increased prevalence of reporting pain, both before and after adjustment for potential confounders. The Gulf-Bosnia sample reported similar levels of

TABLE IV
PROPORTIONS OF VETERANS REPORTING PAIN IN A SECOND LIMB

Limb	No. Reporting Pain in Limb	No. with Pain in Second Limb (%)			
		Left Arm	Right Arm	Left Leg	Right Leg
Left arm	1,362	X	978 (71.8)	872 (64.0)	879 (64.5)
Right arm	1,419	978 (71.8)	X	874 (61.6)	914 (64.4)
Left leg	2,349	872 (37.1)	874 (37.2)	X	1817 (77.4)
Right leg	2,366	879 (37.2)	914 (38.6)	1817 (76.8)	X

TABLE V
ODDS RATIOS OF VETERANS REPORTING PAIN IN TWO LIMBS

	Odds Ratio (95% confidence interval)		
	Left Leg	Right Arm	Right Leg
Left arm	6.45 (5.70-7.31)	36.92 (31.70-42.99)	6.54 (5.77-7.41)
Left leg	X	5.76 (5.10-6.51)	32.95 (28.92-37.55)
Right arm	X	X	6.64 (5.87-7.51)

pain as did the Gulf sample, which suggests that, if veterans were deployed to both the Persian Gulf region and Bosnia, then they were more likely to respond like the Persian Gulf War veterans than like the Bosnian conflict veterans. The Bosnia sample reported similar levels of pain as did the era sample. The pain manikin data illustrated the distribution of pain for all of the military samples. The knees and back were very common sites of pain in all four samples, probably resulting from overuse injuries (and subsequent pain), which would be frequent events in military samples.¹⁸

The use of pain manikins illustrated that pain was reported in similar patterns across the military samples but at a higher level by the Persian Gulf War veterans. There was no evidence of a specific pattern of pain unique to the Persian Gulf War veterans.

The pain manikins were also used to illustrate the symmetry of pain. The finding that, if veterans reported pain in one limb, then the odds of them reporting pain in the symmetrically opposite limb were >30 times higher was surprising. This pattern of pain might be seen to indicate a more "systemic" type of pain, rather than pain from injury, because injury is more likely to affect one side of the body at a time. As yet, however, there is also no compelling evidence for damage to the peripheral nervous system.^{19,20} The pain might also be attributable to a bio-mechanical compensation that veterans are making. It could be suggested that, if veterans experience pain in one limb, then they might try to rest that limb and to compensate with the opposite limb. This could potentially lead to the overuse of the limb that is compensating for the injured limb, which could subsequently lead to pain in the compensating limb.

The findings on pain in this study are very much in keeping with the findings from other studies, that is, a pervasive, across-the-board increase in reporting of symptoms. It seems likely that this represents central and not local causation, although we cannot say whether this is the result of changes to the central nervous system, altered symptom perception, or bias in recall. Information was not available to compare potential differences in the time spent on their feet or the weight of load-bearing equipment between the cohorts, which could have influenced the development of pain. It is unlikely, however, that very accurate information on these variables could have been gathered to assess their effects. Information on whether any of the veterans were using pain-reducing medications was also unavailable. Understandably, this might have affected their perception and subsequent reporting of pain.

This study demonstrates that, even several years after returning from conflict, Persian Gulf War veterans report more pain than other veterans, even after adjustment for potential confounders. However, it remains unclear why this is the case. This study illustrates the importance of further research into pain, to help prevent this from occurring with veterans of future con-

flicts. This study also highlights areas that would benefit from further research and presents findings relevant to the future study of pain.

It can be concluded that pain is an unpleasant experience and can have a debilitating impact on a person's life. For this reason, the various mechanisms that lead to pain require continued research and further understanding.

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