

The Health Effects of Peacekeeping (Bosnia, 1992–1996): A Cross-Sectional Study—Comparison with Nondeployed Military Personnel

Guarantor: Matthew Hotopf, PhD

Contributors: Matthew Hotopf, PhD; Anthony David, MD; Lisa Hull, BSc; Khalida Ismail, MRCPsych; Catherine Unwin, MSc; Simon Wessely, MD

Objective: Our goal was to test the hypothesis that United Kingdom soldiers who were deployed to Bosnia had worse health than a nondeployed control group. **Methods:** We used data from a cross-sectional study designed to examine the health effects of service in the Persian Gulf War, which collected data in 1997 to 1998. We compared the two control groups—(personnel who were deployed to Bosnia and a nondeployed control group of military personnel (Era))—on a number of health-related outcomes, including physical functioning, symptoms and ailments, psychological health, fatigue, and post-traumatic stress reactions. **Results:** The response rate for the Bosnia cohort was 62.9% and for the Era group 61.9%. A proportion of the Bosnia group had served in the Persian Gulf War and was found to have considerably worse health outcomes than the remaining Bosnia group or the Era group. The Bosnia group who had not served in the Persian Gulf War had broadly similar health outcomes to the Era group. The main differences were that the Bosnia-only group consumed more alcohol and reported more fatigue, hay fever, weight gain, irritability, avoidance, and night sweats. Apart from heavy alcohol consumption, the magnitude of these differences was small. The Bosnia-only group had slightly better physical functioning than the Era group, and there were two other symptoms and one ailment which were less common in the Bosnia-only group than in the Era group. **Conclusions:** This study indicates that the health of United Kingdom military personnel who served in Bosnia from 1992 to 1996 was generally good in 1997 to 1998. However, further surveillance of veterans of the Balkan's War is required in the light of recent concerns.

Introduction

There has been an escalation of media interest in the potential harmful effects of deployment by military personnel to the former Yugoslavia on peacekeeping duties. Early reports suggested increased physical and psychological symptoms following deployment to Croatia among Canadian troops, which were allegedly caused by contact with soil contaminated with toxins such as polychlorinated biphenyls.¹ Belgium and Spanish troops who were deployed to Gulf-Bosnia have reported similar illnesses. In January 2001, there was growing concern over the use of depleted uranium in weapons used in the former Yugoslavia, and a series of cases of leukemia and other malignant diseases were reported from Italian, Dutch, French, and Belgium peacekeepers.² Alongside this, there have been growing fears that a "Balkan's War syndrome" (a syndrome perhaps akin

to the Persian Gulf War illness) is emerging as a serious problem for veterans.³ These reports have not yet been substantiated by sound epidemiological studies.

As well as the specific urgent questions raised by recent publicity, the deployment of troops to Bosnia is of broader interest as an example of an increasingly common military operation, namely, peacekeeping. While peacekeeping may be associated with risk of combat injury, such risks may be less severe as in conventional conflicts. This might tempt the view that peacekeeping was less "stressful." However, reports from Bosnia and other peacekeeping operations indicate that this view is far from the truth.⁴ Personnel deployed to Bosnia witnessed atrocities perpetrated by the warring parties on each other as well as atrocities perpetrated on civilians. In the early stages of the campaign, the operation was inadequate both in terms of its levels of force and its mandate and many soldiers reported frustration and guilt in their inability to prevent atrocities.^{5,6} Peacekeeping involved a multinational force and chains of command were often complex. Such complexity may have led to confusion and a lack of confidence in the command structure. As well as such psychological stressors, there have also been reports that Bosnian veterans were exposed to depleted uranium,⁷ and it has been suggested that this may cause a range of symptoms.

This article aims to test the hypothesis that individuals who were deployed to Bosnia had a worse outcome than nondeployed military controls. We use data from our previously published survey on the health of Persian Gulf War veterans in which two control groups were included: one group that had been to Bosnia and the other group that was not deployed either to the Persian Gulf or Bosnia but was in the military at the time of the Persian Gulf War (Era). Although some of these results have been published in our previous analysis of Persian Gulf War veterans, we did not make direct comparisons between Bosnia and Era control groups. We also found that some of the veterans who we believed had only been to Bosnia had in fact been deployed in the Persian Gulf as well. Further articles will address (1) specific risk factors for psychiatric disorder in Bosnia veterans and (2) cancer registration rates in those who served in Bosnia.

Methods

This study was established to describe the health of service personnel who had served in the Persian Gulf War in 1990 to 1991. The sampling for this study is described in a previous article.⁸ A random stratified sample of 4,250 Persian Gulf War veterans was identified. Any military personnel who had served in the Persian Gulf were eligible, apart from Special Forces who were excluded for security reasons. Two comparison groups

Gulf War Research Unit, Guy's King's and St. Thomas' School of Medicine, King's College, London, United Kingdom.

This manuscript was received for review in May 2002 and accepted for publication in June 2002.

Reprint & Copyright © by Association of Military Surgeons of U.S., 2003.

Peacekeeping in Bosnia

409

were identified. The first consisted of personnel who were deployed in Bosnia, the second consisted of personnel who were not deployed in either the Persian Gulf or Bosnia (Era). The two comparison groups were selected to recreate as far as possible the demographic structure of the Persian Gulf group. Random stratified sampling was used to generate the Era group stratified on age, rank, service (Royal Navy, Army, Royal Air Force), gender, fitness, and reservist status. The force deployed to Bosnia was exclusively from the regular army and therefore the match with the Persian Gulf group could not be so precise. In this study, comparisons are made between the Bosnia and Era groups. Since only soldiers were included in the original Bosnia group and there were no reservists, we excluded personnel from the Royal Navy and Royal Air Force and reservists from the Era group.

We obtained addresses from the Ministry of Defense. For personnel still in service, we obtained current addresses; for those who left the forces (discharged), we obtained the last known addresses in the United Kingdom or overseas. We used multiple tracing mechanisms for nonresponders. For personnel who had left the services, we used the National Health Service central registry to obtain health authority ciphers and current addresses. We used the electoral register to check for current addresses. For those still in service, various service bodies provided regularly revised addresses, including discharge and pension address sources. Several media appeals were made by the research teams with additional support from the Ministry of Defense and we posted a study web site on the Internet. We had three mailings and in the third, for participants who were still serving, we sent questionnaires in batches to unit commanding officers with a letter asking them to facilitate the delivery of the questionnaires to service men and women. After 1 month, we again approached the commanding officers with the highest nonresponse rates.

Once questionnaires were returned, it became clear that a minority of service personnel who were identified in the Bosnia group had also served in the Persian Gulf. For our previous published research, this group was reassigned to the Persian Gulf, because service in the Persian Gulf was the main exposure

of interest. In the present study, we assign this group "Gulf-Bosnia" and those who only went to Bosnia as "Bosnia-only."

Questionnaire

The questionnaire contained several measures of current health status, including a checklist of 50 symptoms, 39 medical disorders, the General Health Questionnaire-12 (a measure of psychiatric morbidity⁹), a fatigue questionnaire,¹⁰ and two subscales of the Short Form-36 (a health status questionnaire¹¹) for health perception and physical functioning. Four outcomes (fatigue, psychiatric morbidity, physical functioning, and health perception) were therefore available. We created an approximation of post-traumatic stress disorder, which we refer to as post-traumatic stress reaction. We also asked about their current alcohol consumption in units of alcohol (one unit being equivalent to a glass of wine, measure of spirits, or one-half pint of beer). We also asked about a number of demographic and occupational variables including age, ethnicity, education, previous deployments, and rank. We also asked about a range of exposures. The associations between exposures and outcomes have been reported in our previous article,⁸ and further analyses on the relationship between exposures and service in Bosnia will be the subject of a future study.

Analysis

We first compared the demographic and occupational variables according to theater (Era, Bosnia-only, or Gulf-Bosnia). We then performed univariate analyses to determine whether there were differences among the three groups in terms of medical outcome variables. Odds ratios and 95% confidence intervals were calculated for binary outcomes. Logistic regression analysis was used to control for potential confounders. Mean differences in total scores were calculated for the outcomes that were continuous variables (Short Form-36 health perception and physical function); these outcomes were modeled using multiple regression to control for potential confounders.

TABLE I
DEMOGRAPHIC CHARACTERISTICS OF THREE GROUPS

Variable	Era (n = 1,785)	Bosnia Alone (n = 2,049)	Gulf-Bosnia (n = 570)	Statistic
Gender				
Female (%)	7.4	10.6	1.8	$\chi^2 = 49.5; 2 \text{ df}; p < 0.001$
Age				
Mean age (SD)	34.2 (6.5)	29.3 (6.7)	31.8 (5.3)	$F = 267.2; 2 \text{ df}; p < 0.0001$
Rank				
Commissioned officers (%)	11.6	13.7	9.5	$\chi^2 = 8.7; 2 \text{ df}; p = 0.013$
Education				
Below O levels (%)	22.0	15.7	18.3	
O levels or General Certificate of Secondary Education (%)	55.5	61.9	68.6	$\chi^2 = 53.5; 4 \text{ df}; p < 0.001$
A levels or degree (%)	22.5	22.4	13.1	
Currently serving (%)	54.2	89.3	13.1	$\chi^2 = 661; 2 \text{ df}; p < 0.001$
Tours of Northern Ireland				
None	31.2	47.6	42.5	$\chi^2 = 139; 6 \text{ df}; p < 0.001$
1	30.7	27.9	30.9	
2	18.0	12.8	16.5	
3 or more	20.1	11.7	10.1	

TABLE II
ASSOCIATION BETWEEN DEPLOYMENT AND HEALTH OUTCOMES (BINARY AND ORDERED CATEGORICAL VARIABLES)

Outcome	Era	Bosnia-Only	Crude OR ^a (95% CI)	OR (95% CI) Adjusted for Age, Sex, Rank, and Education	Gulf-Bosnia	Crude OR (95% CI)	OR (95% CI) Adjusted for Age, Sex, Rank, and Education
General Health Questionnaire case	26.5%	26.6%	1.0 (0.9-1.2)	1.0 (0.9-1.2)	37.3%	1.6 (1.3-2.0)	1.6 (1.3-2.0)
Fatigue case	22.3%	26.0%	1.2 (1.0-1.4)	1.3 (1.1-1.5)	44.9%	2.8 (2.3-3.5)	2.8 (2.3-3.5)
Post-traumatic stress reaction case	4.5%	4.4%	1.0 (0.7-1.3)	0.9 (0.7-1.3)	13.2%	3.2 (2.3-4.5)	2.9 (2.1-4.2)
Over 21 units of alcohol per week	11.6%	21.1%	2.0 (1.7-2.4)	1.6 (1.3-2.0)	16.1%	1.4 (1.1-1.9)	1.3 (1.0-1.7)
Median symptoms (interquartile range)	3 (0-8)	3 (0-8)	NA	NA	8 (3-15)	NA	NA

^a OR, Odds ratio; CI, confidence interval; NA, not applicable.

Results

Using three mailings, we obtained a response rate of 61.9% in the Bosnia group and 62.9% in the Era group. We found that nonresponders tended to be younger and still in service.⁵ Table I gives the characteristics of the three groups. Individuals in the Era group were older than the Bosnia-only cohort, reflecting the fact that they were recruited to match the somewhat older Persian Gulf cohort in the original study. The Gulf-Bosnia group had the lowest numbers of women. The Gulf-Bosnia group also had fewer qualifications and fewer commissioned officers. The Era group had the most tours of Northern Ireland.

Tables II and III compare health outcomes between the three groups. The Bosnia-only group had slightly higher levels of fatigue and consumed significantly more alcohol than the Era group. The association with alcohol decreased after controlling for demographic variables but was still present. The Bosnia-only group had slightly better physical functioning than the Era group, and this difference was not explained by differences in key demographic variables. There were major differences between the Gulf-Bosnia group and Era. Indeed, all but one of the health outcomes were statistically significantly more common in the Gulf-Bosnia group—the exception being physical functioning. This is consistent with the results of our previously reported study.⁶

We assessed the relationship between deployment and symptoms (Table IV). There were few differences between the Bosnia-only and Era groups and the odds ratios were all between 0.8 and 1.5. Of 50 symptoms, there were 4 that were significantly more common in the Bosnia-only group (irritability and outbursts of anger, avoiding doing things, night sweats, and unintended weight gain). Two symptoms were more common in the

Era group than in the Bosnia-only group (dizziness and numbness or tingling in toes or fingers). By contrast, only 1 (vomiting) of the 50 symptoms was not associated with being deployed to both the Persian Gulf and Bosnia. For most symptoms, the odds ratios (comparing rates in the Persian Gulf and Bosnia groups with those in the Era group) were 1.5 to 3.0, indicating moderate to large differences in prevalence.

Table V shows the associations between ailments and deployment. Rates of cancer registration are reported in a separate article and are not shown here. Comparing the Bosnia-only with Era group, one ailment (hay fever) was statistically significantly associated with deployment. Stomach and duodenal ulcers were less common in the Bosnia-only group than in the Era group. Comparing the Gulf-Bosnia group with the Era group, nine ailments were statistically significantly more common (migraines, ear infections, back problems, chronic fatigue syndrome, hay fever, dermatitis, hair or scalp disease, diseases of genital organs, and sexual problems.) A number of other ailments showed high odds ratios, but the statistical power was too low to detect differences in rare outcomes between the groups.

Discussion

Given that we assessed 93 different outcomes, one would have expected approximately 5 to have statistically significant differences ($p = 0.05$) by chance. We found 11 statistically significant differences between the Bosnia-only and Era groups. Although fatigue and some other symptoms were more common, the effect sizes were all small (odds ratios of 1.5 or less), and these differences are balanced by the finding of slightly better physical functioning in the Bosnia-only group than in the Era

TABLE III
ASSOCIATION BETWEEN DEPLOYMENT AND HEALTH OUTCOMES (CONTINUOUS VARIABLES)

Outcome	Era (SD)	Bosnia-Only (SD)	Mean Difference (95% CI) ^a	Mean Difference (95% CI) Adjusted for Age, Sex, Rank, and Education	Gulf-Bosnia	Mean Difference (95% CI)	Mean Difference (95% CI) Adjusted for Age, Sex, Rank, and Education
Short form-36 physical functioning	91.4 (17.8)	95.6 (12.5)	3.6 (2.6, 4.6)	2.3 (1.3, 3.4)	93.2 (13.2)	1.8 (0.2, 3.4)	1.2 (-0.4, 2.8)
Short form-36 health perception	75.1 (22.6)	76.7 (20.5)	1.6 (0.3, 3.0)	0.1 (-1.4, 1.5)	68.5 (23.8)	-6.6 (-8.8, -4.4)	-7.1 (-9.3, -4.9)

^a CI, Confidence interval.

TABLE IV
RELATIONSHIP BETWEEN SYMPTOMS AND DEPLOYMENT

Symptom	Frequency (%)			Era vs. Bosnia-Only		Era vs. Gulf-Bosnia	
	Era	Bosnia-Only	Bosnia and Gulf	Univariate	Model 1	Univariate	Model 1
Chest pain	13.2	12.4	25.2	0.9 (0.8-1.1)	1.0 (0.8-1.2)	2.2 (1.8-2.8)	2.2 (1.7-2.8)
Headaches	36.7	36.7	50.4	1.0 (0.9-1.1)	0.9 (0.8-1.1)	1.8 (1.4-2.1)	1.7 (1.4-2.1)
Rapid heartbeat	8.0	7.5	15.1	0.9 (0.7-1.2)	1.0 (0.8-1.3)	2.0 (1.5-2.7)	2.2 (1.6-2.9)
Irritability/bursts of anger	27.3	32.3	57.5	1.3 (1.1-1.5)	1.2 (1.1-1.5) ^a	3.6 (3.0-4.4)	3.5 (2.8-4.2)
Unable to breathe deeply enough	8.5	9.8	19.2	1.2 (0.9-1.5)	1.1 (0.9-1.5)	2.6 (2.0-3.4)	2.6 (2.0-3.4)
Faster breathing than normal	3.8	4.4	9.8	1.2 (0.9-1.6)	1.3 (0.9-1.8)	2.8 (1.9-4.0)	2.8 (1.9-4.1)
Feeling short of breath at rest	5.9	6.4	12.3	1.1 (0.8-1.4)	1.1 (0.8-1.5)	2.2 (1.6-3.1)	2.3 (1.6-3.2)
Wheezing	11.0	10.0	17.4	0.9 (0.7-1.1)	0.9 (0.7-1.2)	1.7 (1.3-2.2)	1.7 (1.3-2.3)
Sleeping difficulties	29.2	30.3	48.3	1.1 (0.9-1.2)	1.1 (1.0-1.3) ^b	2.3 (1.9-2.8)	2.3 (1.9-2.8)
Feeling jumpy/easily startled	11.1	12.9	22.4	1.2 (1.0-1.4)	1.2 (0.9-1.5)	2.3 (1.8-3.0)	2.2 (1.7-2.8)
Feeling unrefreshed after sleep	32.1	32.5	56.7	1.0 (0.9-1.2)	1.1 (0.9-1.2)	2.8 (2.3-3.4)	2.8 (2.3-3.4)
Fatigue	28.3	28.8	50.8	0.9 (0.8-1.1)	1.0 (0.8-1.1)	2.6 (2.1-3.2)	2.7 (2.2-3.3)
Double vision	2.3	2.5	5.0	1.1 (0.7-1.6)	1.1 (0.7-1.8)	2.2 (1.3-3.6)	2.1 (1.3-2.6)
Intolerance to alcohol	4.5	5.0	8.2	1.1 (0.8-1.5)	1.1 (0.8-1.6)	1.9 (1.3-2.8)	1.9 (1.3-2.8)
Itchy or painful eyes	12.1	10.5	21.9	0.9 (0.7-1.0)	0.8 (0.8-1.2)	2.0 (1.6-2.6)	2.1 (1.6-2.7)
Shaking	4.9	5.2	13.3	1.2 (0.9-1.7)	1.1 (0.8-1.6)	3.4 (2.4-4.8)	3.2 (2.3-4.6)
Tingling in fingers and arms	11.7	8.5	21.5	0.7 (0.6-0.9)	0.9 (0.7-1.1)	2.1 (1.6-2.6)	2.3 (1.8-3.0)
Tingling in legs and toes	7.8	5.5	13.9	0.7 (0.5-0.9)	0.9 (0.6-1.1)	1.9 (1.4-2.6)	2.1 (1.5-2.8)
Numbness or tingling in fingers or toes	12.0	8.1	18.5	0.6 (0.5-0.8)	0.8 (0.6-1.0) ^c	1.7 (1.3-2.1)	1.8 (1.4-2.4)
Feeling distant and cut off from others	11.6	14.4	26.5	1.3 (1.1-1.6)	1.2 (1.0-1.4) ^b	2.7 (2.2-3.5)	2.5 (2.0-3.2)
Constipation	5.4	5.8	8.7	1.1 (0.8-1.4)	1.1 (0.8-1.4)	1.7 (1.2-2.4)	1.8 (1.2-2.6)
Flatulence or burping	19.3	15.5	31.9	0.8 (0.6-0.9)	0.9 (0.7-1.1)	2.0 (1.6-2.4)	2.0 (1.6-2.5)
Stomach cramp	7.4	7.7	12.8	1.0 (0.8-1.3)	0.9 (0.7-1.2)	1.8 (1.3-2.5)	1.9 (1.4-2.5)
Diarrhea	11.9	11.1	19.4	0.9 (0.8-1.1)	0.8 (0.7-1.0) ^b	1.9 (1.4-2.3)	1.7 (1.3-2.2)
Dry mouth	6.9	9.1	16.3	1.3 (1.1-1.7)	1.3 (1.0-1.7) ^b	2.6 (2.0-3.5)	2.5 (1.9-3.4)
Persistent cough	5.9	7.8	14.4	1.4 (1.1-1.8)	1.2 (0.9-1.6)	2.7 (2.0-3.7)	2.4 (1.8-3.4)
Lump in throat	3.1	3.8	6.4	1.2 (0.9-1.7)	1.2 (0.8-1.8)	2.1 (1.4-3.3)	1.9 (1.2-3.0)
Sore throat	14.3	15.0	21.0	1.1 (0.9-1.3)	1.0 (0.8-1.2)	1.6 (1.2-2.0)	1.5 (1.2-1.9)
Forgetfulness	18.0	19.4	44.4	1.1 (0.9-1.3)	1.2 (1.0-1.4) ^b	3.6 (3.0-4.5)	3.6 (2.9-4.5)
Dizziness	8.9	7.1	14.4	0.8 (0.6-1.0)	0.8 (0.6-1.0) ^c	1.7 (1.3-2.3)	1.7 (1.3-2.3)
Feeling disorientated	3.6	3.2	9.8	0.9 (0.6-1.3)	0.9 (0.6-1.3)	2.9 (2.0-4.2)	2.8 (1.9-4.2)
Loss of concentration	15.9	16.5	37.8	1.0 (0.9-1.2)	1.1 (0.9-1.4)	3.2 (2.6-4.0)	3.3 (2.6-4.1)
Pain on passing urine	1.9	2.3	5.5	1.2 (0.7-1.8)	1.1 (0.7-1.9)	3.0 (1.8-4.9)	2.6 (1.5-4.4)
Passing urine more often	6.3	4.9	12.8	0.7 (0.6-1.0)	0.8 (0.6-1.1)	2.2 (1.6-3.0)	2.3 (1.7-3.2)
Burning sensation in sex organs	1.8	1.3	4.1	0.7 (0.4-1.2)	0.8 (0.4-1.3)	2.3 (1.3-4.0)	2.0 (1.1-3.6)
Loss of interest in sex	7.0	7.1	14.7	1.0 (0.8-1.3)	1.2 (0.9-1.5)	2.3 (1.7-3.1)	2.4 (1.8-3.3)
Increased sensitivity to noise	5.9	6.3	13.0	1.1 (0.8-1.4)	1.2 (0.9-1.6)	2.4 (1.7-3.3)	2.4 (1.7-3.3)
Increased sensitivity to light	6.4	6.0	14.6	0.9 (0.7-1.2)	1.0 (0.8-1.4)	2.5 (1.9-3.4)	2.5 (1.8-3.5)
Ringing in ears	14.0	10.7	19.9	0.7 (0.6-0.9)	0.9 (0.7-1.1)	1.5 (1.2-2.0)	1.5 (1.2-2.0)
Avoiding doing things/situations	10.6	12.4	23.6	1.2 (1.0-1.5)	1.3 (1.0-1.6) ^b	2.6 (2.0-3.4)	2.7 (2.1-3.5)
Pain, without swelling or redness in several joints	15.4	13.6	30.7	0.9 (0.7-1.0)	0.9 (0.7-1.1)	2.4 (2.0-3.0)	2.4 (1.9-3.0)
Joint stiffness	24.4	21.0	36.9	0.8 (0.7-1.0)	1.0 (0.8-1.1)	1.8 (1.5-2.2)	1.8 (1.5-2.3)
Night sweats which soak the bedsheets	10.7	11.9	23.1	1.1 (0.9-1.4)	1.3 (1.0-1.6) ^b	2.5 (2.0-3.2)	2.5 (1.9-3.2)
Feeling feverish	3.1	3.5	10.1	1.1 (0.8-1.6)	1.1 (0.8-1.7)	3.6 (2.4-5.2)	3.4 (2.3-5.1)
Loss or decrease in appetite	6.3	8.4	14.9	1.4 (1.1-1.8)	1.2 (0.9-1.6)	2.6 (1.9-3.5)	2.4 (1.7-3.2)
Nausea	3.8	3.7	6.2	1.0 (0.7-1.4)	0.8 (0.6-1.2)	1.7 (1.1-2.6)	1.7 (1.1-2.6)
Vomiting	2.9	3.3	3.2	1.1 (0.8-1.6)	0.8 (0.5-1.2)	1.1 (0.6-1.9)	0.9 (0.5-1.6)
Distressing dreams	10.3	13.2	21.7	1.3 (1.1-1.6)	1.2 (1.0-1.6) ^b	2.4 (1.9-3.1)	2.3 (1.8-3.0)
Unintended weight gain greater than 10 lbs	9.3	10.7	20.3	1.2 (1.0-1.5)	1.5 (1.2-1.9) ^a	2.5 (1.9-3.2)	2.8 (2.1-3.6)
Unintended weight loss greater than 10 lbs	2.7	4.0	5.0	1.5 (1.0-2.2)	1.2 (0.8-1.7)	1.9 (1.2-3.0)	1.6 (1.0-2.6)

^a p < 0.01.

^b p > 0.05 (due to rounding, some confidence intervals may include one but be nonsignificant at p = 0.05).

^c 0.05 > p > 0.01.

TABLE V
RELATIONSHIP BETWEEN AILMENTS AND DEPLOYMENT

Condition	Frequency (%)			Era vs. Bosnia-Only		Era vs. Gulf-Bosnia	
	Era	Bosnia-Only	Bosnia and Gulf	Univariate	Model 1	Univariate	Model 1
Hypertension	6.1	4.2	6.1	0.7 (0.5-0.9)	0.9 (0.6-1.2)	1.0 (0.7-1.5)	1.0 (0.7-1.6)
Heart disease	0.6	0.3	0.2	0.4 (0.1-1.3)	0.8 (0.2-2.5)	0.3 (0.03-2.4)	0.4 (0.04-3.4)
Stroke	0.2	0	0	NA	NA	NA	NA
Epilepsy	0.5	0.4	0.4	0.9 (0.3-2.3)	0.7 (0.2-2.0)	0.8 (0.2-3.7)	0.8 (0.2-3.7)
Migraines	10.7	10.2	17.2	0.9 (0.8-1.2)	0.9 (0.7-1.1)	1.7 (1.3-2.3)	1.7 (1.3-2.3) ^a
Asthma	4.1	4.9	4.8	1.2 (0.9-1.7)	1.4 (1.0-2.0) ^b	1.2 (0.8-1.9)	1.3 (0.8-2.2)
Loss of hearing	8.8	5.4	9.6	0.6 (0.5-0.8)	0.8 (0.6-1.1)	1.1 (0.8-1.5)	1.3 (0.9-1.9)
Bronchitis	2.7	2.4	3.7	0.9 (0.6-1.3)	0.9 (0.6-1.4)	1.4 (0.8-2.4)	1.4 (0.8-2.5)
Pneumonia	0.4	0.4	1.1	1.0 (0.4-2.8)	0.7 (0.2-2.2)	2.7 (0.9-8.0)	2.6 (0.9-8.2)
Tuberculosis	0.1	0.1	0.4	0.9 (0.1-6.2)	1.4 (0.2-11.0)	3.1 (0.4-22.2)	5.3 (0.7-40.0)
Malaria	0.5	0.3		0.5 (0.2-1.7)	0.7 (0.2-2.6)		
Sinus problems	11.9	11.4	18.1	0.9 (0.6-1.2)	1.1 (0.9-1.8)	1.6 (1.3-2.1)	1.7 (1.3-2.2) ^a
Ear infection	9.3	7.2	12.3	0.7 (0.6-0.9)	0.9 (0.7-1.1)	1.4 (1.0-1.8)	1.4 (1.1-2.0)
Stomach or duodenal ulcers	3.2	1.3	3.0	0.4 (0.3-0.6)	0.5 (0.3-0.9) ^c	1.4 (0.5-1.6)	1.1 (0.6-1.9)
Colitis/Crohn's disease	0.3	0.2	0.4	0.7 (0.2-2.6)	0.7 (0.2-2.9)	1.3 (0.2-6.5)	1.1 (0.2-5.7)
Jaundice or hepatitis	0.7	0.3	0.4	0.4 (0.2-1.1)	0.5 (0.2-1.4)	0.5 (0.1-2.1)	0.5 (0.1-2.3)
Cirrhosis of the liver	0.1	0.1	0.2	0.9 (0.1-14.1)	0.9 (0.04-17.2)	3.1 (0.2-50.1)	2.6 (0.2-44.5)
Thyroid disease	0.4	0.5	1.1	1.1 (0.4-3.0)	1.3 (0.5-3.7)	2.7 (0.9-8.0)	2.3 (0.7-7.5)
Diabetes	0.3	0.2	0	0.7 (0.2-2.6)	0.9 (0.2-3.6)	NA	NA
Renal disease	1.1	0.7	0.9	0.6 (0.3-1.3)	0.7 (0.3-1.6)	0.9 (0.3-2.3)	0.7 (0.2-2.2)
Bladder infections	1.2	1.4	1.4	1.2 (0.7-2.1)	1.2 (0.7-2.3)	1.2 (0.5-2.7)	1.4 (0.6-3.1)
Arthritis or rheumatism	3.0	3.8	7.1	0.5 (0.3-0.6)	0.7 (0.5-1.0) ^b	0.9 (0.6-1.3)	1.1 (0.7-1.6)
Fibrositis or fibromyalgia	0.7	0.3	0.2	0.4 (0.1-1.0)	0.4 (0.1-1.2)	0.3 (0.03-2.0)	0.3 (0.04-2.3)
Back problems	28.6	23.7	36.4	0.8 (0.7-0.9)	0.9 (0.8-1.1)	1.4 (1.2-1.7)	1.5 (1.3-1.9) ^a
Chronic fatigue syndrome/ myalgic encephalomyelitis	0.8	0.8	2.3	0.9 (0.4-2.0)	1.2 (0.5-2.5)	2.9 (1.4-6.3)	3.5 (1.6-7.8) ^a
Multiple chemical sensitivity	0.5	0.4	0.4	0.9 (0.3-2.3)	1.3 (0.4-3.7)	0.8 (0.2-3.7)	1.0 (0.2-5.0)
Yeast disease or candidiasis	1.7	1.2	1.8	0.7 (0.4-1.2)	0.7 (0.4-1.3)	1.0 (0.5-2.1)	1.6 (0.7-3.7)
Hay fever	15.3	18.8	21.7	1.3 (1.1-1.5)	1.2 (1.0-1.5) ^a	1.5 (1.2-1.9)	1.5 (1.2-2.0) ^a
Eczema or psoriasis	6.9	6.1	7.5	0.9 (0.7-1.1)	0.9 (0.6-1.1)	1.1 (0.8-1.5)	1.1 (0.8-1.6)
Dermatitis or any other skin problem	11.9	13.5	22.0	1.2 (1.0-1.4)	1.1 (0.9-1.4)	2.1 (1.6-2.7)	2.1 (1.6-2.7) ^a
Any disease of the hair or scalp, including hair loss	8.7	7.1	16.7	0.8 (0.6-1.0)	1.0 (0.7-1.2)	2.1 (1.6-2.8)	2.2 (1.6-2.9) ^a
Any disease of genital organs	2.4	3.1	4.8	1.3 (0.9-1.9)	1.0 (0.6-1.5)	2.1 (1.3-3.4)	1.9 (1.1-3.1) ^c
Subfertility	1.1	0.6	1.4	0.6 (0.3-1.1)	0.8 (0.3-1.4)	1.3 (0.6-3.0)	1.6 (0.7-3.7)
Sexual problems	3.3	3.0	8.4	0.9 (0.6-1.3)	1.1 (0.8-1.7)	2.7 (1.8-4.0)	2.7 (1.8-4.2) ^a
Premenstrual tension	39.2	29.2	30.0	0.6 (0.4-1.0)	0.8 (0.4-1.30)	0.7 (0.2-2.7)	0.8 (0.2-3.5)
Period problems	24.8	18.5	40.0	0.7 (0.4-1.2)	0.6 (0.3-1.1)	2.0 (0.5-7.6)	2.5 (0.6-10.0)
Miscarriages	1.6	4.6	10.0	3.0 (0.6-13.7)	1.5 (0.3-8.2)	6.8 (0.6-82.8)	6.1 (0.5-81.4)

NA. Not applicable.

^a $p < 0.01$.

^b $p > 0.05$ (due to rounding, some confidence intervals may include one but be nonsignificant at $p = 0.05$).

^c $0.05 > p > 0.01$.

group and two symptoms and one ailment that were less common in the Bosnia-only group. The main finding of this article is, therefore, that military personnel who went to Bosnia but not the Persian Gulf have a very similar health status to the control group of nondeployed military personnel.

The group who went to both Bosnia and the Persian Gulf reported considerably worse health outcomes on most measures. This finding is similar to those we have reported elsewhere,⁸ which indicates that there is a major health effect of deployment to the Persian Gulf. The effect size for the Gulf-Bosnia group is similar to that of the original Gulf cohort in

our earlier article, and there are no grounds to suppose that the combination of serving in the Persian Gulf and Bosnia leads to worse outcomes than service in the Persian Gulf alone.

Caution is required in interpreting what we view as an overall lack of association between service in Bosnia-only and subsequent illness. "Negative" findings could be attributable to confounding. There were some differences between the Bosnia-only and Era groups, the most obvious of which was that the Bosnia-only group was younger. However, we were able to control for age and other key demographic variables in

Peacekeeping in Bosnia

413

the analysis. Lack of association could also be attributable to the "healthy warrior effect." In other words, personnel who were deployed to Bosnia might have had higher levels of fitness than those who were not deployed there, disguising a decrement in their health due to deployment. We do not think this is a likely explanation because the Era group was originally matched with the Persian Gulf group according to records of fitness and therefore should have been of equivalent fitness to deployed personnel. Furthermore, the scores on Short Form-36 subscales for the Era group are higher than those that would have been expected for even a young population, indicating that they are on average a fit group. The lack of association could also be due to type II error. However, the statistical power of this study would have been sufficient to detect even subtle differences in all but some of the rarer outcomes shown in Table V. Finally, it may be that the survey took place too soon after deployment to detect illnesses, which have subsequently emerged. We are currently conducting a follow-up of our original study to determine whether there has been any change in the health of these personnel.

Although we urge a degree of caution in interpreting these findings, they are the best available evidence so far on the health of peacekeepers in Bosnia. They indicate that although sporadic cases of ill health have been reported following deployment to Bosnia, there are, as yet, no grounds to fear a repeat of the illnesses seen following deployment to the Persian Gulf.

Acknowledgments

This study was funded by the U.S. Department of Defense. We thank the Gulf War Illness Unit at the United Kingdom Ministry of Defense for their assistance in identifying the cohorts and tracing them.

References

1. Mitrovika A: Fears about toxic dirt ignored; soldier. *Globe and Mail*, September 25, 1999.
2. Kondro W: Soldiers claim ill health after contact with contaminated soil in Croatia. *Lancet* 1999; 354: 494.
3. Rumblelow H: British troops in fears of Balkans cancers. *The Times*, London, January 6, 2001.
4. Litz BT: The psychological demands of peacekeeping for military personnel. *Natl Center PTSD Clin Q* 1996; 6: 1-8.
5. Johansson E, Larsson G: A model for understanding stress and daily experiences among soldiers in peacekeeping operations. *Int Peacekeeping* 1993; 3: 124-41.
6. Johansson E: The role of peacekeepers in the 1990s: Swedish experience in UNPROFOR. *Armed Forces Soc* 1997; 23: 451-66.
7. Cannon S: The uranium minefield. *The Independent*, London, January 26, 2001.
8. Unwin C, Blatchley N, Coker W, et al: Health of U.K. servicemen who served in the Persian Gulf War. *Lancet* 1999; 353: 169-78.
9. Goldberg D: *The Detection of Psychiatric Illness by Questionnaire*. London, Oxford University Press, 1972.
10. Chaider T, Berelowitz C, Pawlikowska T: Development of a fatigue scale. *J Psychosomatic Res* 1993; 37: 147-54.
11. Stewart AD, Hays RD, Warr JE: The MOS short-form General Health Survey. *Med Care* 1988; 26: 724-32.

**AVERAGE LENGTH OF UTERINE FIBROID
EMBOLIZATION INCISION. (ALSO APPLIES TO HOSPITAL
STAY, DISCOMFORT, AND RECOVERY TIME.)**

Uterine Fibroid Embolization (UFE) is giving women with fibroids an important, minimally invasive treatment option for hysterectomy and other surgeries. With less risk and less pain, by blocking the flow of blood to the fibroids and causing them to shrink, the procedure is about 90% successful at alleviating the heavy bleeding and painful periods often associated with them.

Society of Cardiovascular
& Interventional Radiology
ENHANCED CARE THROUGH
ADVANCED TECHNOLOGY
www.uterinefibroids.org
1-877-357-2847

