



# Is there an Iraq war syndrome? Comparison of the health of UK service personnel after the Gulf and Iraq wars

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## Summary

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**Background** UK armed forces personnel who took part in the 1991 Gulf war experienced an increase in symptomatic ill health, colloquially known as Gulf war syndrome. Speculation about an Iraq war syndrome has already started.

**Methods** We compared the health of male regular UK armed forces personnel deployed to Iraq during the 2003 war (n=3642) with that of their colleagues who were not deployed (n=4295), and compared these findings with those from our previous survey after the 1991 war. Data were obtained by questionnaire.

**Findings** Graphs comparing frequencies of 50 non-specific symptoms in the past month in deployed and non-deployed groups did not show an increase in prevalence of symptoms equivalent to that observed after the Gulf war. For the Iraq war survey, odds ratios (ORs) for self-reported symptoms ranged from 0·8 to 1·3. Five symptoms were significantly increased, and two decreased, in deployed individuals, whereas prevalence greatly increased for all symptoms in the Gulf war study (ORs 1·9–3·9). Fatigue was not increased after the 2003 Iraq war (OR 1·08; 95% CI 0·98–1·19) but was greatly increased after the 1991 Gulf war (3·39; 3·00–3·83). Personnel deployed to the Gulf war were more likely (2·00, 1·70–2·35) than those not deployed to report their health as fair or poor; no such effect was found for the Iraq war (0·94, 0·82–1·09).

**Interpretation** Increases in common symptoms in the 2003 Iraq war group were slight, and no pattern suggestive of a new syndrome was present. We consider several explanations for these differences.

## Introduction

Not long after the end of the 1991 Gulf war, reports started appearing in the USA and subsequently in the UK of non-specific ill health in members of the armed forces who had served in the conflict. Large-scale epidemiological studies confirmed an increase in general symptomatic ill-health in service personnel from the USA,<sup>1</sup> UK,<sup>2,3</sup> Canada,<sup>4</sup> Denmark,<sup>5</sup> and Australia.<sup>6</sup> However, no increase was noted in mortality,<sup>7,8</sup> cancer registrations,<sup>9</sup> or well defined physical outcomes,<sup>10</sup> with the possible exception of an increase in the incidence of motor neuron disease.<sup>11,12</sup> This phenomenon became widely known as Gulf war syndrome, although no compelling evidence existed of a range of symptoms or signs uniquely associated with Gulf service. Irrespective of the label applied, the increase in ill health was substantial, was associated with disability, caused great concern, resulted in political controversy, cost substantial resources in terms of war pensions and disability payments, and has not yet been resolved.<sup>13</sup> Among the more plausible suggested explanations were psychological stress, side-effects of medical counter-measures such as vaccinations or pyridostigmine bromide, unobserved exposure to nerve agents, and cultural and media pressures.<sup>14</sup> Despite an intense research effort, no explanation has proved compelling.

Many of the concerns that had surfaced in the context of the controversy over Gulf war syndrome were not resolved by the start of the 2003 invasion of Iraq. However, the need was recognised for an improved system of health surveillance and research in the aftermath of the 2003 war.

We report the results of a large-scale epidemiological study of the physical and psychological health of a random sample of UK Armed Forces personnel, of which half took part in the 2003 invasion of Iraq. In this paper we address specifically the question of whether or not there has been an increase in symptomatic ill health similar to that observed after the 1991 Gulf War.

## Methods

### Study design and population

We defined two populations of UK armed forces personnel: those that were deployed on the first phase of the Iraq war, where major combat duties took place (Operation TELIC 1; group designated TELIC 1), and those that were serving at the time but did not deploy on this operation (designated Era). Random samples of a comparable size were provided from each of these populations by the Ministry of Defence. A separate report<sup>15</sup> provides a detailed description of the sampling, methods used to contact respondents, and measures. We report here on the sections of the survey related to symptomatic ill health: the occurrence of any of 50 non-specific symptoms in the past month (using the same checklist used in our previous cohort study of Gulf war veterans),<sup>2</sup> fatigue (assessed with a validated 13-item fatigue scale),<sup>16</sup> and a single item indicating general health taken from the SF-36 questionnaire ("In general, how would you rate your health?", options: Poor/Fair/Good/Very Good/Excellent);<sup>17</sup> We only compared respondents from the TELIC 1 and Era cohorts that were regular armed forces personnel at the time of the Iraq

war (Jan 18, 2003, to June 28, 2003); an effect of deployment had been noted in the reserve armed forces, as reported in the companion paper.<sup>15</sup> The present analysis was exploratory, in so far that we could not predict the shape and form that a new syndrome might take. We also restricted this analysis to men, to make results comparable to those from our previous Gulf war survey.<sup>2</sup> The demographic characteristics of this subsample were similar to those of the entire sample described in our companion paper.<sup>15</sup>

Our Gulf war survey<sup>2</sup> comprised three randomly sampled groups: personnel who served in the Gulf region between Sept 1, 1990, and June 30, 1991 (Gulf war group); personnel who served in Bosnia between April 1, 1992, and Feb 6, 1997 (Bosnia group); and a comparison group who were serving on Jan 1, 1991, but had not been deployed to the Gulf war or Bosnia (Era group). Special forces were not included for security reasons, and only men were included in the analyses

### Analysis

The proportions of respondents who had each of the 50 symptoms in two groups were presented in a graph to show differences and similarities in the pattern and frequencies of symptoms. This graph was then assessed alongside its equivalent from our previous Gulf war cohort study<sup>2</sup> to show any differences in the deployment effects on symptomatic ill health between the two studies. The rank ordinal positions of all symptoms were tabulated and compared between the studies. The frequencies of the 15 most common symptoms from each survey were tabulated and odds ratios (ORs) with 95% CI were computed by logistic regression to express differences between the groups within each survey. ORs were also calculated for the proportion of cases of fatigue (scores >3)<sup>16</sup> and for the proportion of respondents reporting their health to be fair or poor on the general health perception item, in each survey. The ORs in the analyses relating to the Iraq war survey were calculated adjusting for medical downgrading status only (medical downgrading refers to the system of assessment of fitness and employability, including deployability, of UK Armed Forces personnel, on the basis of a medical examination). However, there was a slight difference in the sample selection for the 1991 Gulf study, in that the individuals in the deployed and non-deployed samples were all graded as fit to fight—ie, downgraded personnel who could not deploy were excluded. For this reason, adjustment was not necessary for the Gulf war survey sample. All statistical analyses were done with SPSS for Windows (version 13).

### Role of the funding source

The UK Ministry of Defence funded this project. They had no role in the design, analysis, interpretation, or decision to submit this paper. The Ministry of Defence provided us with the names and contact details of potential participants in the study. We disclosed the paper to

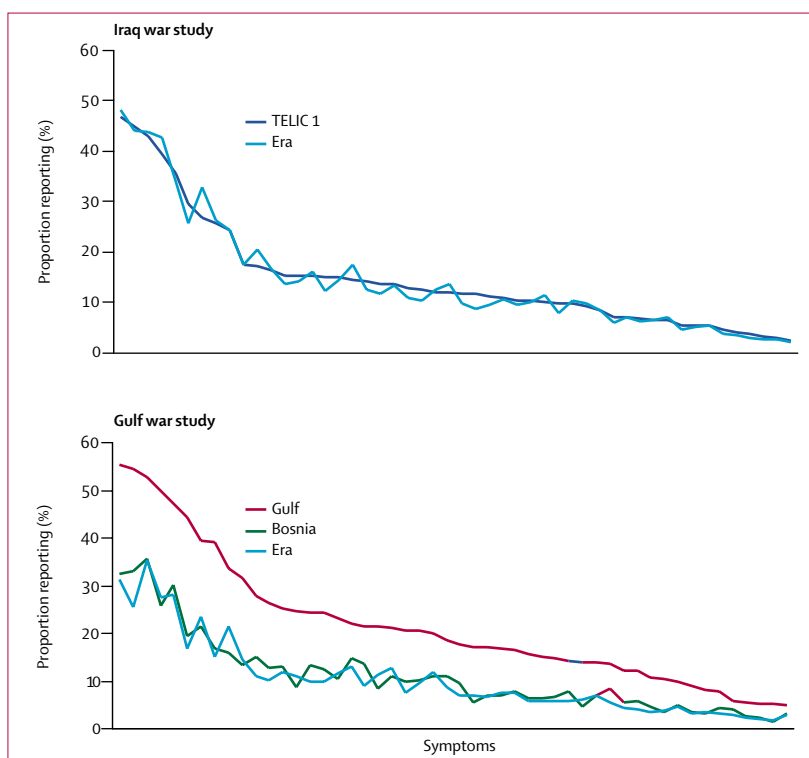


Figure: Frequencies of symptoms

Ministry of Defence at the point when we submitted it for publication, and any errors of fact identified by the Ministry were corrected at the same time as addressing the comments of reviewers. The corresponding author had full access to all the data in the study and had final responsibility for the decision to submit for publication.

### Results

Details of follow-up rates are described in the companion paper.<sup>15</sup> 10 272 (61%) of our contacted sample responded to the questionnaire, of which 7937 regular servicemen were included in these analyses (all regulars who were not included were women). The figure shows the proportion of TELIC 1 (n=3642) and Era (n=4295) respondents who experienced each of the 50 symptoms, along with these proportions for each of the three groups in our previous Gulf war study: Gulf war (n=3293), Bosnia (n=1835), and Era (n=2422). The symptoms were ordered by descending frequency according to the deployed sample in each graph (so that the patterns of symptoms were not directly comparable between the two studies). The raised frequencies of symptoms in the deployed group observed in the Gulf war study were not evident in the Iraq war survey. We also did the same analyses for servicewomen, and compared those who deployed after TELIC 1 (when the nature of the operation changed to counter-insurgency) with those not deployed. No effect of deployment was shown for either analysis (data available from authors).

	Gulf study ordinal position	Iraq study ordinal position	Change in rank order
Feeling unrefreshed after sleep	1	1	0
Irritability/outbursts of anger	2	5	3
Headaches	3	2	-1
Fatigue	4	4	0
Sleeping difficulties	5	3	-2
Forgetfulness	6	6	0
Joint stiffness	7	7	0
Loss of concentration	8	9	1
Flatulence or burping	9	8	-1
Joint pain, without swelling or redness	10	11	1
Feeling distant or cut off from others	11	14	3
Avoiding doing things/situations	12	15	3
Chest pain	13	13	0
Tingling fingers and arms	14	17	3
Feeling jumpy/easily startled	15	20	5
Nightsweats that soak bedsheets	16	16	0
Itchy or painful eyes	17	18	1
Sore throat	18	10	-8
Distressing dreams	19	19	0
Numbness in fingers/toes	20	32	12
Ringin in the ears	21	25	4
Inability to breathe deeply enough	22	26	4
Wheezing	23	22	-1
Diarrhoea	24	12	-12
Unintended weight gain >10 lb	25	27	2
Dry mouth	26	21	-5
Tingling legs and toes	27	34	7
Loss of interest in sex	28	24	-4
Dizziness	29	31	2
Rapid heartbeat	30	23	-7
Feeling short of breath at rest	31	36	5
Increased sensitivity to light	32	41	9
Increased sensitivity to noise	33	38	5
Persistent cough	34	29	-5
Passing urine more often	35	35	0
Stomach cramp	36	28	-8
Loss or decrease in appetite	37	30	-7
Intolerance to alcohol	38	33	-5
Shaking	39	37	-2
Faster breathing than normal	40	39	-1
Feeling disoriented	41	43	2
Constipation	42	40	-2
Feeling feverish	43	42	-1
Nausea	44	44	0
Lump in throat	45	45	0
Unintended weight loss >10 lb	46	49	3
Double vision	47	47	0
Pain on passing urine	48	48	0
Burning sensation in the sex organs	49	50	1
Vomiting	50	46	-4

Symptoms ranked by frequency in the deployed sample in each study.

**Table 1: Ranked order of self-reported symptoms**

Most symptoms showed little or no change in rank order of frequency between the Gulf war and Iraq war studies (0–2 ordinal positions; table 1). Table 2 shows ORs for the 15 most frequent self-reported symptoms by deployment status in the studies. Personnel deployed to the Gulf war were significantly more likely to experience all the 15 most common symptoms than their non-deployed counterparts (table 2). By contrast, in the Iraq war survey, two symptoms were significantly less common in those deployed on TELIC 1 (joint pain and joint stiffness) than in the non-deployed group, and five symptoms (irritability, forgetfulness, feeling distant or cut off, chest pain, and night sweats) were significantly more common. The rank order of all 50 symptoms between the deployed groups both the studies was very similar ( $r=0.96$ ,  $p<0.0001$ , data available from authors). Personnel deployed to the Gulf war had significantly higher ORs for being a fatigue case than their non-deployed colleagues; this was not the case in the Iraq study (table 3). Whereas personnel deployed to the Gulf war were more likely to report their health as fair or poor compared with the non-deployed group, no significant difference was noted between the deployed and non-deployed groups in the Iraq war sample (table 3).

## Discussion

Our results show that no substantial increase in symptomatic ill health has occurred in members of the regular UK armed forces who took part in the 2003 invasion of Iraq, compared with those who did not take part. This finding is in marked contrast to the situation after the 1991 Gulf war, when a substantial increase in symptomatic ill health was noted. Comparison of the two control groups showed that overall, symptoms have increased in frequency between the two wars. This increase is clearly not an effect of deployment, and is more probably a further manifestation of a general increase in reporting of symptoms.<sup>18</sup>

Our study has several strengths. It is representative of all three branches of the services, and includes serving and ex-serving personnel. The test sample was compared with an appropriate military control group, identical except that they did not deploy during the invasion of Iraq. Numbers are large. The questions we asked were the same as those we asked after the 1991 Gulf war, making direct comparisons possible.

In a separate analysis using the same data<sup>15</sup> we showed a small increase in total physical symptoms in people deployed to Iraq, and we report that five of the most common 15 symptoms were reported more frequently in deployed than in non-deployed personnel. However, these symptoms are, by definition, common; the sample size is large; and multiple outcomes have been tested; so there is a risk of type 1 error. The effect size for each symptom is small, and no symptom was very much more frequent than others.

	1991 Gulf war			2003 Iraq war		
	Number (%)		OR (95% CI)	Number (%)		OR (95% CI)
	Gulf (n=3284)	Era (n=2408)		TELIC 1 (n=3642)	Era (n=4295)	
Feeling unrefreshed after sleep	1842 (56%)	761 (32%)	2.8 (2.5–3.1)	1712 (47%)	2066 (48%)	1.00 (0.91–1.09)
Irritability or outbursts of anger	1813 (55%)	621 (26%)	3.5 (3.2–4.0)	1296 (36%)	1458 (34%)	1.12 (1.02–1.23)
Headaches	1757 (54%)	857 (36%)	2.1 (1.9–2.3)	1646 (45%)	1891 (44%)	1.08 (0.99–1.18)
Fatigue	1665 (51%)	667 (28%)	2.7 (2.4–3.0)	1444 (40%)	1825 (43%)	0.93 (0.85–1.01)
Sleeping difficulties	1576 (48%)	684 (28%)	2.3 (2.1–2.6)	1562 (43%)	1879 (44%)	1.01 (0.93–1.11)
Forgetfulness	1475 (45%)	412 (17%)	3.9 (3.5–4.5)	1078 (30%)	1102 (26%)	1.27 (1.15–1.40)
Joint stiffness	1314 (40%)	566 (24%)	2.2 (1.9–2.4)	974 (27%)	1405 (33%)	0.80 (0.72–0.88)
Loss of concentration	1304 (40%)	364 (15%)	3.7 (3.2–4.2)	894 (25%)	1043 (24%)	1.07 (0.96–1.18)
Flatulence or burping	1120 (34%)	518 (22%)	1.9 (1.7–2.1)	940 (26%)	1118 (26%)	1.02 (0.92–1.13)
Pain without swelling or redness in several joints	1057 (32%)	347 (14%)	2.8 (2.5–3.2)	628 (17%)	874 (20%)	0.87 (0.78–0.98)
Feeling distant or cut off from others	923 (28%)	265 (11%)	3.2 (2.7–3.7)	561 (15%)	602 (14%)	1.19 (1.04–1.35)
Avoiding doing things or situations	880 (27%)	248 (10%)	3.2 (2.7–3.7)	558 (15%)	685 (16%)	1.01 (0.89–1.14)
Chest pain	831 (25%)	284 (12%)	2.5 (2.2–2.9)	565 (16%)	574 (13%)	1.23 (1.08–1.40)
Tingling in fingers and arms	811 (25%)	267 (11%)	2.6 (2.3–3.1)	545 (15%)	619 (14%)	1.10 (0.97–1.25)
Night sweats	808 (25%)	238 (10%)	3.0 (2.5–3.5)	552 (15%)	525 (12%)	1.32 (1.16–1.50)
Sore throat	n/a	n/a	n/a	632 (17%)	748 (17%)	1.01 (0.90–1.13)
Diarrhoea	n/a	n/a	n/a	596 (16%)	719 (17%)	0.99 (0.88–1.12)

ORs for Iraq war survey adjusted for medical downgrading status only. Sore throat and diarrhoea were not of the 15 most frequent symptoms in the Gulf war survey; they were of the 15 most frequent symptoms in the Iraq war survey (reported for the latter only).

**Table 2: 15 most frequent self-reported symptoms by deployment status**

We do not know exactly when the increase in ill health after the 1991 Gulf war developed. Although anecdotal reports emerged quite swiftly, systematic surveys did not commence until at least 2–3 years after the conflict. Thus, although we can confidently say that 2 years after the invasion of Iraq there is little, if any, evidence for an increase in physical ill health, it will be prudent to continue health surveillance for a further period. We report our results in regular forces men only, which made up 93% of the deployment. Because of a differential response rate and interaction by deployment,<sup>15</sup> we have elected to analyse reservists separately. In our Gulf war studies<sup>4</sup> we noted no difference between the health of reservists and that of regulars, with both being equally affected by the rise in frequency of symptoms. This is no longer the case.

Our results will serve to allay concerns raised by sporadic media reports of a new Iraq war syndrome, or Gulf war syndrome II. But do they shed any light on what happened after the 1991 Gulf war? All wars are different, and the 1991 war differed from the 2003 invasion in many respects. Nevertheless, both the similarities and differences allow us to draw some tentative conclusions. First, no one can disagree that war is stressful to many combatants. The fact that before 1991, similar syndromes to Gulf war syndrome had been observed after many of the major conflicts of the 20th century involving the British military<sup>19</sup> had seemed to many commentators, ourselves included, as arguing that at least part of the Gulf war syndrome story was the non-

specific stress of war. Yet in military terms the 1991 and 2003 conflicts were similar—fought over similar terrain, involving similar forces, being relatively brief in historical terms, and the initial fighting period being free from mass casualties amongst the coalition forces. Yet one led to prolonged ill health in a substantial minority, and the other has not yet done so.

	Number (%)	OR (95% CI)
<b>Fatigue</b>		
Gulf war survey		
Era (n=2361)	485 (21%)	Reference
Bosnia (n=1761)	450 (26%)	1.33 (1.15–1.54)
Gulf (n=3174)	1483 (47%)	3.39 (3.00–3.83)
Iraq war survey		
Era (n=4232)	1296 (31%)	Reference
TELIC 1 (n=3554)	1119 (32%)	1.08 (0.98–1.19)
<b>Fair or poor general health</b>		
Gulf war survey		
Era (n=1564)	239 (15%)	Reference
Bosnia (n=960)	125 (13%)	0.83 (0.66–1.05)
Gulf (n=2735)	724 (27%)	2.00 (1.70–2.35)
Iraq war survey		
Era (n=4268)	533 (13%)	Reference
TELIC 1 (n=3590)	381 (11%)	0.94 (0.82–1.09)

ORs for Iraq war survey adjusted for medical downgrading status only.

**Table 3: Relation between deployment and fatigue and between deployment and perceived fair or poor general health**

Second, before both conflicts, the UK armed forces used medical countermeasures to counteract the threat from biological and chemical weapons. However, there were differences in the measures used. Although pyridostigmine bromide was issued in both conflicts, the pattern of vaccination changed. In 1991, personnel were offered the combination of vaccinations against anthrax (linked with pertussis as an adjuvant) and plague. In 2003, anthrax and plague vaccines were given without pertussis. Efforts were also made to space out the time scale in which vaccinations were given, and the nature of the consent and information procedures changed. Observational data such as ours do not permit any definitive conclusions about whether or not these changes made any difference, although we will be looking in more detail at the associations and persistence of side-effects in further follow-up of the cohort. If we had found an increase in morbidity after the Iraq war equivalent to that after the Gulf war we could say that these changes were not related to the occurrence of symptoms; all we can now say at this stage is that our new data add to the evidence that there was some relation between the specific pattern of medical countermeasures used in 1991 and ill health.<sup>20</sup> Additionally, the true threat from chemical and biological weapons was different between the 1991 and 2003 conflicts. Finally, it is possible that one factor that amplified, even if it did not create, the Gulf war syndrome crisis, was the perceived neglect of health surveillance and research on both sides of the Atlantic, allowing rumour and conjecture to flourish. The implementation of improved health surveillance, including but not restricted to the present study, might also have reduced some health concerns.

#### Contributors

O Horn managed electronic aspects of data collection for the study, did the analysis, and was involved in the writing of the paper. I Hull co-ordinated the study. M Jones, D Murphy, and T Browne were involved in data collection and tracing. N Fear and M Hotopf gave epidemiological advice, and commented on previous drafts. M Hotopf was also principal investigator, alongside R Rona and S Wessely, who all planned, designed, and supervised the study. S Wessely is the grant holder, and also contributed to the writing of the paper and its supervision.

#### Conflict of interest statement

S Wessely is honorary civilian adviser in psychiatry to the British army. All other authors declare that they have no conflict of interest.

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