Q J Med 2002; **95**:671–676

Skin disease in Gulf war veterans

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Received 27 February 2002 and in revised form 13 June 2002

Summary

Background: Gulf war veterans report more symptomatic ill-health than other military controls, and skin disease is one of the most frequent reasons for military personnel to seek medical care.
Aim: To compare the nature and prevalence of skin disease in UK Gulf veterans with non-Gulf veterans, and to assess whether skin disease is associated with disability.
Design: Prospective case comparison study.
Methods: Disabled ($n = 111$) and non-disabled ($n = 98$) Gulf veterans and disabled non-Gulf veterans ($n = 133$) were randomly selected from representative cohorts of those who served in the Gulf conflict 1990–1991, UN Bosnia Peacekeeping Force 1992–1997, or veterans in active service between 1990–91, but not deployed to the Gulf. Disability was defined as reduced physical functioning as measured by the Short Form 36 [score < 72.2]. All subjects recruited were examined by a dermatologist, blind to the military and health status of the veteran.
Results: The prevalences of skin disease in disabled Gulf, non-disabled Gulf and disabled non-Gulf veterans were 47.7, 36.7, and 42.8% respectively. Seborrhoeic dermatitis was twice as common as expected in the Gulf veterans (both disabled and non-disabled).
Discussion: Skin disease does not appear to be contributing to ill health in Gulf war veterans, with the exception of an unexplained two-fold increase in seborrhoeic dermatitis.

Introduction

Gulf war veterans report more symptomatic ill health than other military controls.[1–3] Symptoms reported are multi-system and non-specific, and as yet no medical explanation or cause(s) has been identified. Previous studies have also shown that skin disease is one of the most frequent reasons for military personnel to seek medical care.[4,5] Rash was one of the most common symptoms reported by United States (US) registries of Gulf veterans[6,7] and in studies comparing Gulf veterans with non-Gulf veterans.[8] Dermatitis was the third most common health condition (21%) reported by Gulf veterans and reported twice as often than in Bosnia (13.7%) and Era veterans (12%).[1] The limitation of these studies was that they used self-reported measures. To date, there has not been a study that has used clinician diagnosis of dermatological conditions. In this study, we investigated first, whether ill health in Gulf veterans was associated with skin disease and second, whether there was a difference in skin disease between Gulf veterans and non-Gulf veterans who reported ill health.

Methods

Design

The study population was a sample from Stage 2 of a two-stage cohort study of three UK military

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populations,[9] the study design being shown schematically in Appendix 1. Stage 1 was a random sample of veterans of the Gulf conflict (1990–1991) ($n = 5046$), veterans of the Bosnia Peace-Keeping mission (1992–1997) ($n = 3450$) and veterans in active service 1990–1991 who were not deployed to the Gulf ('Era' veterans) ($n = 4248$). These veterans were sent postal questionnaires, and the details of recruitment, tracing, response rates and baseline levels of ill-health in Stage 1 have been reported elsewhere.[1] In stage 2, four samples were randomly selected based on health status measured at Stage 1. Ill-health was defined as impaired physical functioning using the Short Form 36 Physical functioning measure (SF-36PF)[10] at a cut-off of <72.2, the score representing the 10% most physically impaired group in the era sample. The rationale for using a generic measure of ill health is that there is no specific case definition for 'Gulf war syndrome'.[9] The numbers of disabled Gulf, non-disabled Gulf, disabled Bosnia and Era veterans were 406, 3 047, 138 and 278, respectively, from which random samples were invited to attend the Gulf War Illnesses research unit at King's College London for a standardized clinical evaluation, between January 1999–September 2000. The study had ethical committee approval and informed consent was obtained from each subject.

Measures

Using a standardized format, participants were asked for socio-demographic details, military rank, current service history, current smoking status and alcohol use. All subjects underwent detailed medical assessment. All subjects had a complete skin examination by a dermatologist, who was blind to the veteran's service history and health status. Any current cutaneous abnormalities were recorded. Where histology was required to confirm diagnosis, this was done at the veteran's local hospital.

Statistical analysis

Statistical analysis used STATA7 (Stata Corporation) The prevalence of all skin diseases was reported as percentage proportions. Disabled Bosnia and disabled Era veterans were grouped together for analysis as disabled non-Gulf veterans, to provide a group that was more representative of the non-Gulf (non-exposed) veterans. Univariate analysis of a current dermatological condition was performed, first comparing disabled Gulf veterans with non-disabled Gulf veterans, and then disabled Gulf with disabled non-Gulf veterans, using the χ^2 test for heterogeneity. Skin disease was then categorized into broader categories based on aetiology (infective, inflammatory, pilo-sebaceous, solar damage or miscellaneous). Multivariate analysis was performed using logistic regression to adjust for the association between the major categories of skin disease and military group status, adjusting for age, sex, rank, smoking and alcohol, which are recognized risk factors for skin disease.[11] Where the proportion of any category appeared to be increased in either of the Gulf groups, an adjusted prevalence of that category was generated using p weights, which are weights that take account of sampling bias in two-stage cohort studies[12] and which will be reported elsewhere.[9] Results are presented as percentage proportions and associations as either χ^2 (degrees of freedom) or odds ratio with 95%CIs.

Results

In total, 342 individuals were screened. The numbers of disabled and non-disabled Gulf veterans were 111 and 98, respectively, and the numbers of disabled Bosnia and disabled Era veterans were 54 and 79, respectively, which combined gave a total of 133 non-Gulf veterans. Fifty percent of subjects were still in active service. The demographic profiles of the sample are outlined in Table 1.

The prevalence of skin disorders in the entire sample was 42.7%. When stratified by group status, there was little difference in the proportion of skin disorders between disabled and non-disabled Gulf and disabled non-Gulf veterans (Table 2). However, miscellaneous benign conditions (grouped together as benign other) were more frequent in the disabled Gulf compared to non-disabled Gulf veterans ($p = 0.03$). However, the proportion of 'benign other' skin conditions was very similar in both the disabled Gulf and disabled non-Gulf veterans.

The skin disorders were then grouped together into broader categories based on common aetiology (infective, inflammatory, solar, pilo-sebaceous and miscellaneous benign) and these results are presented in Table 3. Although for the most part there was no significant difference in prevalence of each broader skin category between the cohorts, there was a trend for disabled Gulf to have more skin problems than non-disabled Gulf (47.7 vs. 36.7%), but not more than disabled non-Gulf veterans (42.8%). The exception was seborrhoeic

Table 1 Distribution and univariate analysis of sociodemographic and military characteristics of disabled Gulf (DG, $n = 111$), non-disabled Gulf (NDG, $n = 98$) and disabled Bosnia and Era (i.e. non-Gulf) (DNG, combined $n = 133$) veterans

	DG (%)	NDG (%)	DNG (%)	DG vs. NDG χ^2 (df), p	DG vs. DNG χ^2 (df), p
Sex					
Males	105 (94.6%)	93 (94.9%)	121 (90.9%)	0.01 (1), 0.922	1.16 (1), 0.282
Female	6 (5.4%)	6 (5.1%)	12 (9.1%)		
Age (years)					
21–30	25 (22.5%)	33 (33.7%)	41 (30.8%)	11.35 (2), 0.003	2.25 (2), 0.325
31–40	53 (47.4%)	54 (55.1%)	55 (41.4%)		
>40	33 (29.7%)	11 (11.2%)	37 (27.8%)		
Current service					
Still in service	33 (29.7%)	52 (53.1%)	56 (42.1%)	11.74 (1), 0.001	3.99 (1), 0.046
Not in service	78 (70.3%)	46 (46.9%)	44 (57.9%)		
Rank					
Private	28 (25.5%)	16 (16.3%)	24 (18%)	7.92 (2), 0.019	6.04 (2), 0.049
NCO	78 (70.9%)	69 (70.4%)	93 (69.9%)		
Commissioned officer	4 (3.6%)	13 (13.3%)	15 (11.3%)		
Alcohol					
Problem drinking*	39 (35.8%)	35 (36%)	33 (25.6%)	0.002 (1), 0.95	2.91 (1), 0.08
No problem drinking	72 (64.2%)	63 (64%)	100 (74.4%)		
Smoking					
Current smoker	54 (48.7%)	29 (29.6%)	55 (41.4%)	11.35 (2),0.003	3.12 (2), 0.12
Ex-smoker	20 (18%)	14 (14.3%)	19 (14.3%)		
Never smoked	37 (33.3%)	55 (56.1%)	59 (44.4%)		

*As defined by AUDIT value >8.

dermatitis, which occurred in 8 (7.2%) disabled Gulf veterans and 9 (9.2%) non-disabled Gulf veterans compared to only 3/133 (2.3%) disabled non-Gulf controls, suggesting that this condition was more common in the Gulf groups, regardless of disability status. We used the proportions of seborrhoeric dermatitis in the disabled and non disabled Gulf groups to give an estimated adjusted prevalence (taking account of the p weight) of 8.1% for the entire Gulf cohort. However, we were unable to calculate an adjusted prevalence for the non-Gulf cohort, as they did not have a comparable non-disabled sample.

Discussion

This study examines the prevalence and spectrum of skin disease in Gulf war veterans and other military controls 8–10 years after the conflict. Skin disease has been an important health concern in military personnel throughout history,[13] particularly during active combat. Skin complaints accounted for up to 75% of all dispensary visits during World War II. Dermatological disease is often thought of as relatively minor, but is associated with significant morbidity and can have a major impact on active military operations, accounting for up to 30% of hospitalizations and 70% of all man-days lost in the Vietnam[14] and Bosnia[15] campaigns. Contributory factors are climatic (heat and UV exposure), the occlusive effect of protective clothing, cramped living conditions and the stress of deployment.[16] However, even in peacetime, skin disease accounts for 25% of all man-days lost.[13]

As a result, the Armed Forces pay rigorous attention to pre-existing skin disease when recruiting, and skin disease may necessitate medical discharge from the military services. Skin disease produced significant morbidity during active service in the Gulf, even though those deployed had been selected as fully fit before departure.[16] Eczema and infections accounted for the majority of referrals.[16] These findings were mirrored during active deployment in Bosnia, where 12% of all medical consultations were dermatological, most frequently infective (bacterial, viral or fungal), but the commonest single complaint was that of eczema (19%).[17] As skin disease is often chronic, it would not be

Table 2 Frequency of skin disease in disabled Gulf (DG), non-disabled Gulf (NDG) and disabled non-Gulf (DNG) war veterans

	All ($n = 342$)	DG ($n = 111$)	NDG ($n = 98$)	DNG ($n = 133$)	DG vs.NDG χ^2 (df), p	DG vs. DNG χ^2 (df), p
Any skin condition*	146 (42.7%)	53 (47.7%)	36 (36.7%)	57 (42.8%)	2.58 (1), 0.11	0.59 (1), 0.45
Tinea pedis/ onychomycosis	30 (8.8%)	12 (10.8%)	7 (7.1%)	11 (8.3%)	0.85 (1), 0.36	0.46 (1), 0.45
Tinea corporis	4 (1.2%)	2 (1.8%)	1 (1.02%)	1 (0.75%)	0.22 (1), 0.64	0.55 (1), 0.46
P. versicolor	3 (0.9%)	1 (0.9%)	0	2 (1.5%)	0.89 (1), 0.35	0.18 (1), 0.67
Folliculitis/boils	7 (2.05%)	4 (3.6%)	1 (1.02%)	2 (1.5%)	1.49 (1), 0.22	1.11 (1), 0.29
Viral wart	1 (0.3%)	0	1 (1.02%)	0	1.32 (1), 0.29	–
Other infections**	4 (1.2%)	1 (0.9%)	2 (2.0%)	1 (0.75%)	0.48 (1), 0.49	0.02 (1),0.89
Acne/hidradenitis	12 (3.5%)	3 (2.7%)	4 (4.1%)	5 (3.8%)	0.31 (1), 0.58	0.21 (1) 0.64
Rosacea	5 (1.5%)	1 (0.9%)	2 (2.0%)	2 (1.5%)	0.49 (1), 0.49	0.18 (1),0.67
Keratosis pilaris	6 (1.8%)	3.2 (2.7%)	1 (1.02%)	2 (1.5%)	0.78 (1), 0.38	0.43 (1), 0.51
Psoriasis	12 (3.5%)	4 (3.6%)	2 (2.0%)	6 (4.5%)	0.46 (1), 0.50	0.13 (1), 0.72
Atopic eczema	21 (14.4%)	8 (7.2%)	4 (4.1%)	9 (6.8%)	0.94 (1), 0.33	0.02 (1), 0.89
Hand eczema	9 (2.6%)	3 (3.0%)	3 (2.7%)	3 (2.7%)	0.02 (1), 0.88	0.05 (1), 0.82
Discoid eczema	4 (1.2%)	1 (0.9%)	2 (2%)	1 (0.75%)	0.48 (1), 0.49	0.02 (1), 0.89
Seborrhoeic dermatitis	20 (5.8%)	8 (7.2%)	9 (9.2%)	3 (2.3%)	0.27 (1), 0.60	3.45 (1), 0.06
Basal cell carcinoma	2 (0.6%)	1 (0.9%)	1 (1.0%)	0	0.008 (1), 0.93	1.2 (1), 0.27
Actinic keratosis/ solar damage	9 (2.6%)	2 (1.8%)	1 (1.0%)	6 (4.5%)	0.23 (1), 0.64	1.4 (1), 0.24
Malignant melanoma	0	0	0	0	–	–
Trauma	1 (0.2%)	1 (0.9%)	0	0	0.89 (1), 0.35	1.2 (1), 0.27
Benign other***	32 (9.3%)	14 (12.6%)	4 (4.1%)	14 (10.5%)	4.81 (1), 0.03	0.26 (1), 0.61
Normal skin	196 (57.3%)	58 (52.3%)	62 (63.3%)	76 (57.1%)		

*This is the number of subjects with at least one skin condition; some subjects had more than one, therefore the individual numbers in the columns do not add up to total. **Other infections, e.g. Candida, impetigo. ***Benign other: congenital naevi, seborrhoeic warts, urticaria, lipoma, dermatofibroma and vitiligo.

surprising if skin complaints were found to contribute to morbidity long after active service is over.

One US study did find an unexplained increase in post-war hospitalization among Gulf-war veterans, but skin disease did not appear to account for part of this.[18] Nonetheless, Gulf war veterans report a high frequency of skin symptoms,[5] and these appear to increase over time.[5] Estimates of dermatological symptoms amongst Gulf-war veterans range from 19%[2] to >30%.[6]

While skin disease is common in the general population,[19] our study has confirmed that cutaneous disease is rather more prevalent in military veterans, but for the most part there appears to be no marked difference between the different cohorts studied. However, it is interesting that there was a trend for more skin problems to be seen in disabled Gulf than in the non-disabled Gulf, but not more than the disabled non-Gulf veterans. When all the miscellaneous benign conditions are grouped together, they are significantly more frequent in the disabled Gulf cohort. This cohort tended to be older and less likely still to be serving in the Armed Forces, and this may in part explain the increased skin disease in this group.

The most striking finding was the increase in seborrhoeic dermatitis in Gulf veterans. Seborrhoeic dermatitis was more common amongst veterans who served in the Gulf (17/209 (8.1%) vs. 3/133 (2.3%) in the non-Gulf cohort), irrespective of disability status. The prevalence of seborrhoeic dermatitis in the general population is estimated to be around 3%,[20] so the prevalence of this condition in the Gulf sample is twice as high as expected. Although we do not have adjusted prevalences for a non-Gulf military group, this suggests that there may have been an effect of serving in the Gulf itself, rather than an effect associated with disability within the Gulf cohort. This 'Gulf effect' has not been reported previously. The explanation for the apparent increase in seborrhoeic dermatitis is not clear, and could be due to chance. However, it is noteworthy that seborrhoeic dermatitis is more common in patients with immune dysfunction[20] and there is some evidence that patients who served in the Gulf have identifiable immunological

Table 3 Frequency of skin disease (grouped by aetiology) in disabled Gulf (DG), non-disabled Gulf (NDG) and disabled non-Gulf (DNG) war veterans

	All ($n = 340$)	DG ($n = 111$)	NDG ($n = 98$)	DNG ($n = 133$)	DG vs. NDG OR (95%CI)		DG vs. DNG OR (95%CI)	
					Unadjusted	Adjusted^{++}	Unadjusted	Adjusted^{++}
All fungal	38* (11.2%)	16* (14.4%)	8 (8.2%)	14 (10.5%)	1.9 (0.8–4.8)	1.3 (0.5–3.7)	1.45 (0.7–3.1)	0.9 (0.4–2.2)
All non-fungal infections	11 (3.2%)	5 (4.5%)	3 (3.06%)	3 (2.25%)	1.5 (0.4–6.5)	1.2 (0.2–6.0)	2.1 (0.5–9.1)	2.2 (0.5–10)
Pilo-sebaceous	17 9 (5.3%)	4 (3.6%)	6 (6.3%)	7 (5.3%)	0.8 (0.2–2.1)	0.4 (0.1–1.9)	0.7 (0.2–2.5)	0.5 (0.1–2.2)
All eczemas**	54 (15.8%)	20 (18%)	18 (18.3%)	16 (12%)	1.1 (0.5–2.2)	1.0 (0.4–2.2)	1.6 (0.8–3.4)	1.5 (0.7–3.2)
Solar damage	11 (3.2%)	3 (2.7%)	2 (2.0%)	6 (4.5%)	1.3 (0.2–8.2)	0.6 (0.1–5.0)	0.6 (0.1–2.4)	0.6 (0.1–2.4)
All inflammatory dermatoses^{+}	66 (19.4%)	24 (21.6%)	20 (20.4%)	22 (16.5%)	1.1 (0.6–2.3)	1.0 (0.5–2.4)	1.4 (0.7–2.8)	1.5 (0.7–3.1)
Misc. benign	39 (11.5%)	18 (16.2%)	5 (5.1%)	16 (12%)	3.6 (1.3–10.1)	4.0 (1.3–12.5)	1.4 (0.7–2.9)	1.9 (0.8–3.7)

*Includes 1 case Candida; **includes seborrhoeic dermatitis; $^{+}$includes all eczemas, seborrhoeic dermatitis and psoriasis; $^{++}$adjusted for age, rank, smoking and alcohol consumption.

abnormalities.[21] Further studies to measure immune dysfunction in Gulf veterans, with and without seborrhoeic dermatitis, will be needed to investigate the plausibility of this hypothesis more fully.

In conclusion, although a significant number of Gulf war veterans report on-going ill-health, including skin symptoms,[2,5] there is little evidence from this study that dermatological disease is contributory to their perception of ill-health.

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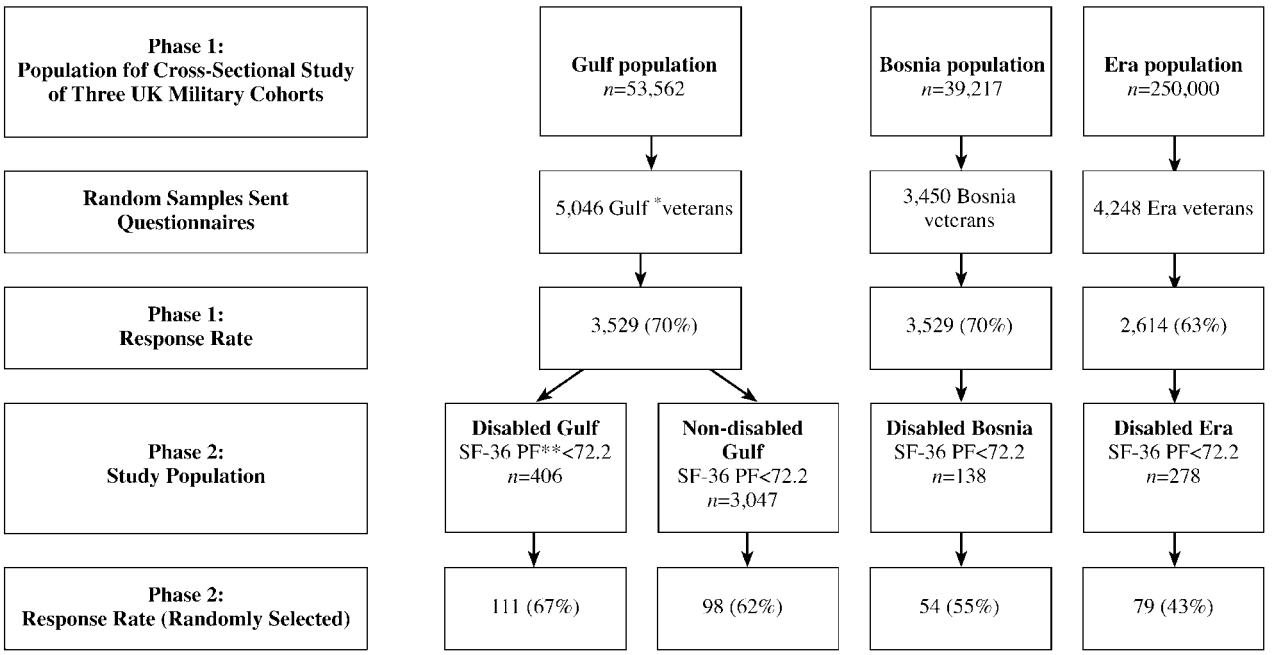
Appendix 1

Study design[9]



*Includes 800 Bosnia veterans from Bosnia sample who had also been deployed to the Gulf and for all subsequent analyses were taken as part of the Gulf cohort. **Short Form-36 Physical Functioning scale (SF-36 PF) score <72.2 = ill health, score >72.2 = healthy. Adapted from Ismail *et al*.[9]