

What are the consequences of deployment to Iraq and Afghanistan on the mental health of the UK armed forces? A cohort study



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Summary

Background Concerns have been raised about the psychological effect of continued combat exposure and of repeated deployments. We examined the consequences of deployment to Iraq and Afghanistan on the mental health of UK armed forces from 2003 to 2009, the effect of multiple deployments, and time since return from deployment.

Methods We reassessed the prevalence of probable mental disorders in participants of our previous study (2003–05). We also studied two new randomly chosen samples: those with recent deployment to Afghanistan, and those who had joined the UK armed forces since April, 2003, to ensure that the final sample continued to be representative of the UK armed forces. Between November, 2007, and September, 2009, participants completed a questionnaire about their deployment experiences and health outcomes.

Findings 9990 (56%) participants completed the study questionnaire (8278 regulars, 1712 reservists). The prevalence of probable post-traumatic stress disorder was 4.0% (95% CI 3.5–4.5; n=376), 19.7% (18.7–20.6; n=1908) for symptoms of common mental disorders, and 13.0% (12.2–13.8; n=1323) for alcohol misuse. Deployment to Iraq or Afghanistan was significantly associated with alcohol misuse for regulars (odds ratio 1.22, 95% CI 1.02–1.46) and with probable post-traumatic stress disorder for reservists (2.83, 1.23–6.51). Regular personnel in combat roles were more likely than were those in support roles to report probable post-traumatic stress disorder (1.87, 1.26–2.78). There was no association with number of deployments for any outcome. There was some evidence for a small increase in the reporting of probable post-traumatic stress disorder with time since return from deployment in regulars (1.13, 1.03–1.24).

Interpretation Symptoms of common mental disorders and alcohol misuse remain the most frequently reported mental disorders in UK armed forces personnel, whereas the prevalence of probable post-traumatic stress disorder was low. These findings show the importance of continued health surveillance of UK military personnel.

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Introduction

We have previously shown that deployment to Iraq has not adversely affected the mental health of regular UK military personnel; however, deployment did affect the mental health of reservists (individuals paid by the military only when they are undertaking military duties; reservists typically have civilian jobs when not working for the military).¹ Our results contrasted with data from the USA that show increased prevalences of probable mental disorders, particularly post-traumatic stress disorder, in military personnel returning from deployment.^{2–11}

Much has changed since the publication of our initial report in 2006.¹ The war in Iraq continued and UK armed forces experienced an increase in hostilities in the south of Iraq. At the same time, the campaign in Afghanistan intensified, with UK armed forces deployed in large numbers to Helmand Province in southern Afghanistan, close to the Pakistan border (at present there are 9500 UK armed forces personnel in Afghanistan).¹² Fighting continues to be intense, and casualties, often resulting from improvised explosive devices, have been frequent.

Further, as the military operations in Iraq and Afghanistan continued, rates of post-traumatic stress disorder in the USA have increased with time since return from deployment.⁵ If replicated in the UK, this increase in prevalence over time would have implications for the long-term effect of deployment, with some predicting a so-called tidal wave of mental disorders in years to come.¹³ Additionally, some speculate that experiencing multiple deployments will lead to an increase in the frequency of mental disorders.^{14,15}

To address these issues we assessed the effect of deployment to Iraq and Afghanistan from 2003 to the end of data collection (September, 2009). We have re-assessed the mental health of those who participated in phase 1 of our cohort study¹ and included two additional groups of UK armed forces personnel to represent the present military structure (those who have joined the military since 2003) and present operational deployments (those deployed to Afghanistan, between April, 2006, and April, 2007).

We examined: (1) the effect of deployment to Iraq and Afghanistan from 2003 to the end of data collection

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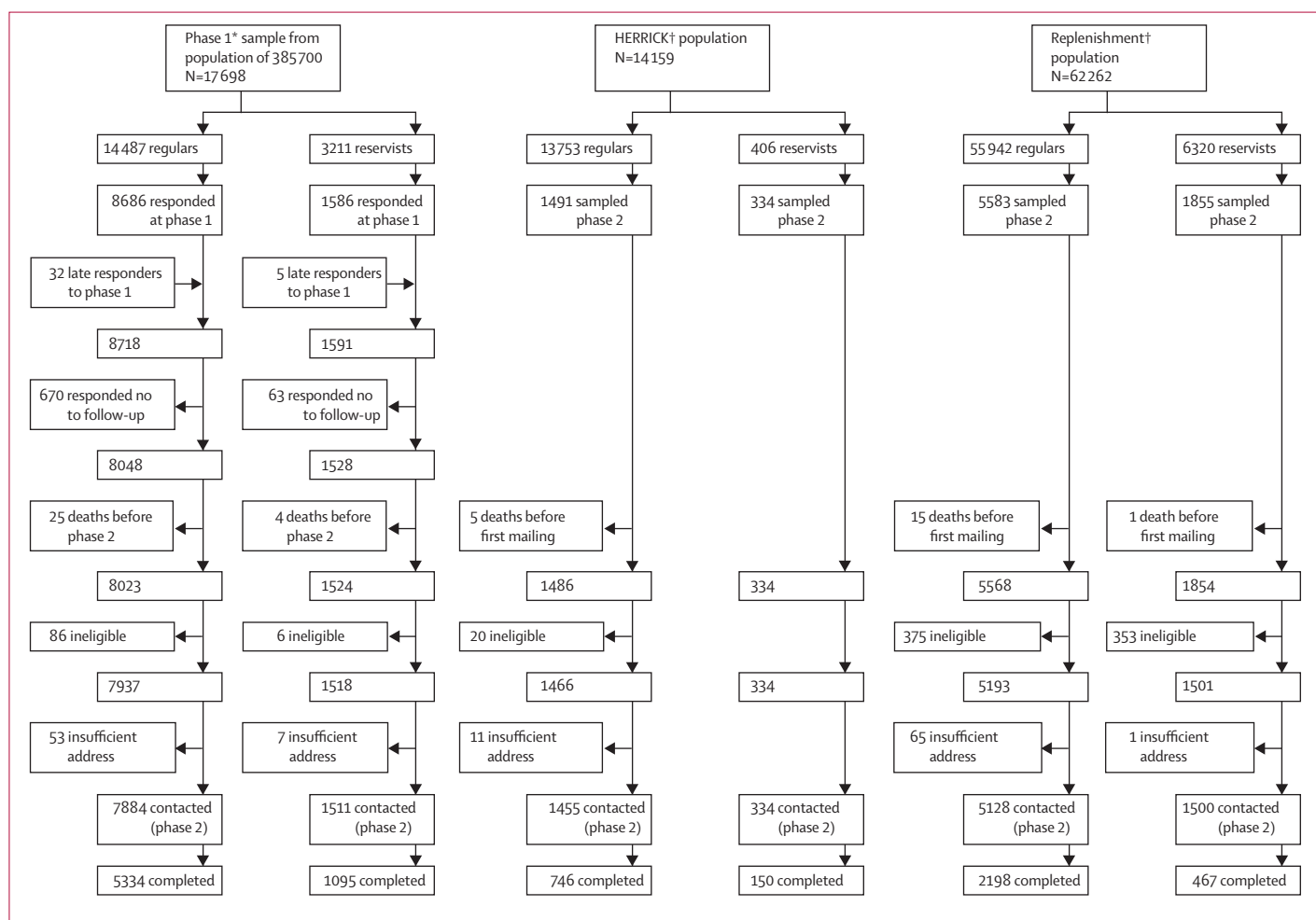


Figure 1: Summary of sampling and response

*TELIC/ERA cohort sampled at phase 1 in 2003. †Additional sample at phase 2 in 2007.

(September, 2009); (2) the effect of multiple deployments of UK personnel to both Iraq and Afghanistan; and (3) whether any effects of deployment on mental disorders increase or decrease with time since return from deployment.

Methods

Study design and participants

The first phase of our cohort study compared a range of health outcomes between two randomly selected groups.¹ The first group consisted of roughly 10% of the fighting force that was deployed during the 2003 Iraq war (codename Operation TELIC 1). Our TELIC sample comprised individuals deployed between Jan 18, 2003, and April 28, 2003. The second group comprised individuals who were in the military at the same time but were not deployed on Operation TELIC 1 (termed ERA). The sample included those who had left the military, those employed under a regular engagement (in full-time military employment), and those employed under a reservist engagement. Reservists were oversampled at a ratio of 2:1

and the non-deployed group (ERA) was increased by 10% because we anticipated that many individuals within this group would deploy on later military operations to Iraq and to take account of the fact that several non-deployed personnel would have had medical limitations placed on their ability to deploy. Overall, we obtained a response from 10272 (59%) participants. We have termed this group our follow-up sample. Full details of sampling and response rates for phase 1 have been described previously.^{1,16}

Of the 10272 participants, 914 could not be followed up because they had not given consent to be contacted again, had died, or could not be contacted because we were supplied with insufficient information for their address. 37 participants who had returned completed questionnaires after phase 1 data collection had ended were included in the follow-up sample at phase 2. 9395 participants were entered into the data collection for phase 2; 7884 were regular personnel and 1511 were reservists (figure 1).

Two new samples were included in the second phase of the study. The first additional sample, termed the

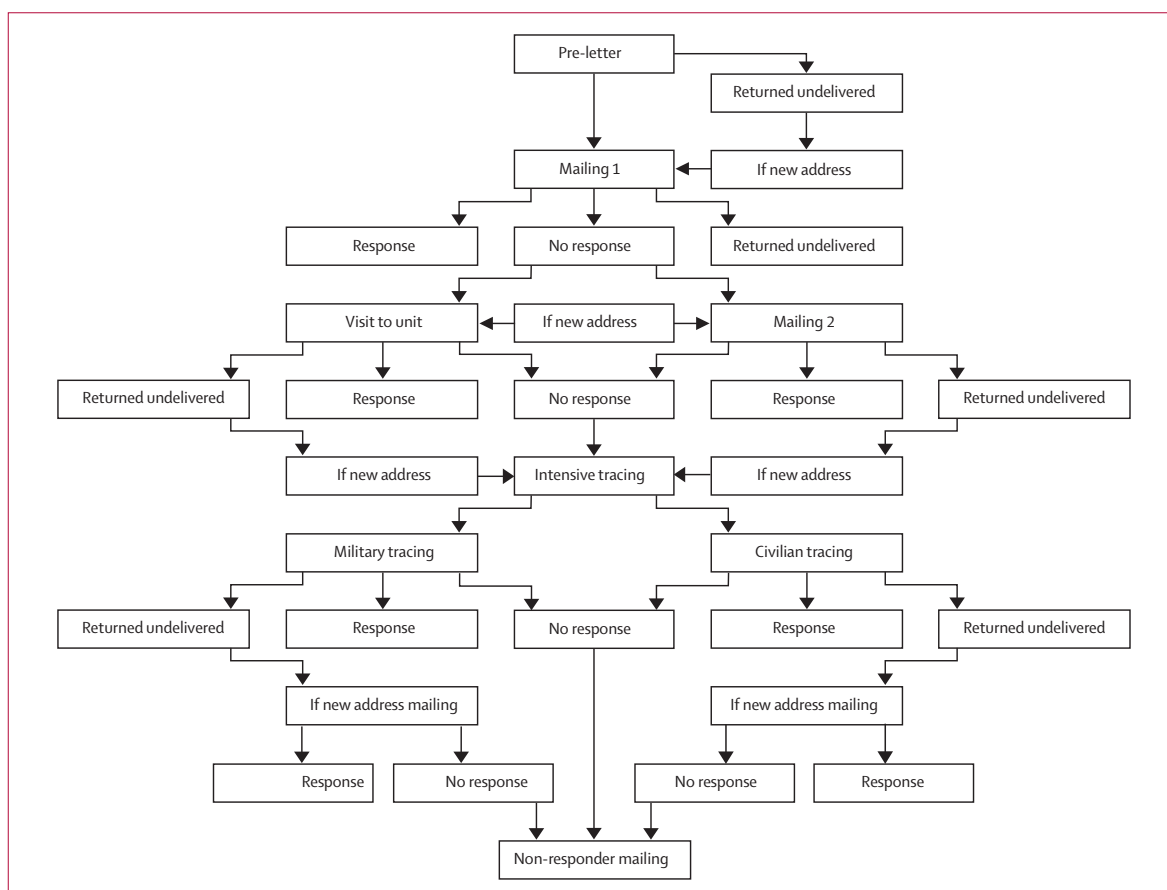


Figure 2: Data collection strategy

HERRICK sample, was included in response to the expansion of the military operation in Afghanistan. This was a random sample of military personnel who had deployed to Afghanistan between April, 2006, and April, 2007 (the period spanning Operations HERRICK 4 and 5: Operation HERRICK is the UK military codename for the current military operations in Afghanistan). About 10% of regular personnel and 90% of reservists who had served on Operations HERRICK 4 and 5 were sampled (1491 and 334, respectively). 36 individuals originally sampled were not eligible, and the final HERRICK sample contained 1789 individuals (1455 regulars and 334 reservists; figure 1).

The second additional sample, termed the replenishment sample, was added to include those who had joined the military since the cohort was first recruited in 2003, and thus would have had the opportunity to deploy to either military operation during the study period. The replenishment sample was randomly drawn from personnel who joined the military and were trained between the end of April, 2003, and April, 2007. For regulars, a sample proportion of approximately 10% was used. For reservists to be eligible they had to have received a bounty payment in 2007 and 2008 (bounty payments are made for attending a minimum number

of training sessions during the previous year). For reservists, a sample proportion of approximately 30% was used. Overall, 7438 individuals were selected. Of these, 810 were ineligible because they had been incorrectly sampled, had died before we were able to contact them, or insufficient address information was supplied making contact impossible. The final size of the replenishment sample was 6628, of which 5128 were regular personnel and 1500 reservists (figure 1).

All potential study participants were identified by Defence Analytical Services and Advice (DASA), UK Ministry of Defence (MoD). 17812 potential study participants were included in our overall sample (figure 1). We compared the characteristics of our overall sample with the composition of the UK military at April, 2007,^{17,18} to ensure that the demographic characteristics of our cohort were representative. We included the replenishment sample to ensure that the age and rank distribution of the sample continued to represent that of the UK armed forces. The distribution of age, sex, rank, and engagement type was similar, the only exception being service (data not shown). Our sample had proportionally more army personnel (67%) than did the UK military in 2007 (56%); however, our sample included those likely to be deployed on operations.

The study received ethics approval from the MoD's research ethics committee (MODREC) and King's College Hospital local research ethics committee.

Procedures

Data collection used an extensive questionnaire that was piloted across the three services: the naval services (which includes the Royal Marines), the British Army, and the Royal Air Force (RAF). The instructions in the questionnaire stated that participation was voluntary, that participants were free to withdraw, and that the researchers were independent of the UK MoD. Additionally, an information leaflet was included giving further details of the study. The questionnaire had five sections covering sociodemographics, service history, life since leaving the services (if relevant), most recent deployment experiences in Iraq and Afghanistan, and mental and physical health. Participants in the replenishment and HERRICK samples, who were being surveyed for the first time, were also asked questions about adversity in early life and baseline measures of physical activity, which had been captured in phase 1 for the follow-up sample. Throughout the questionnaire booklet, there were several questions specifically for reservists (eg, regarding their civilian employment).

The deployment sections of the questionnaire included questions about participants' roles while on deployment, measures of unit cohesion, welfare support, difficulties that they (or their families) might have had at home during their absence, and questions about their return from deployment and adjustment to being back at home. Also included was a measure of military operational experiences—eg, encountering sniper fire or seeing personnel wounded or killed. This measure was adapted from the combat experience scale.² Participants who had deployed to both Iraq and Afghanistan were asked to complete both sections for their most recent deployment to each operational location, the exception being for follow-up participants whose last deployment was TELIC 1 (up to end April, 2003) or TELIC 2 (May–October, 2003) for which data were collected at phase 1.

The questions about health consisted of a checklist of previous or current health problems, and self-rated health from the 36-item Short Form Health Survey.^{19,20} Symptoms of common mental disorder were measured with the 12-item General Health Questionnaire (GHQ-12),²¹ probable post-traumatic stress disorder with the 17-item National Centre for PTSD Checklist (PCL-C),²² and alcohol use with the 10-item WHO Alcohol Use Disorders Identification Test (AUDIT).²³ Binary outcomes of interest for these analyses were defined with the following cutoffs: 50 or more for the PCL²² (which we have termed probable post-traumatic stress disorder), four or more for the GHQ-12²¹ (which we have termed symptoms of common mental disorder), and 16 or more for the AUDIT^{23,24} (usually defined as hazardous use that is also harmful to health, which we have termed alcohol misuse).

Data collection

Data collection began on Nov 21, 2007, and ended on Sept 30, 2009, with 7695 responders (77%) returning their

	Number (%) responded	Adjusted OR of responding (95%CI)	p value
Overall study sample (N=17 812)			
Age at Jan 12, 2008* (years)			<0.0001
<25	1901 (38.4%)	1.0	
25–29	1948 (50.0%)	1.17 (1.07–1.29)	
30–34	1930 (62.2%)	1.73 (1.55–1.93)	
35–39	1400 (69.6%)	2.24 (1.97–2.56)	
40–49	2291 (72.0%)	2.39 (2.11–2.71)	
>50	520 (81.0%)	3.57 (2.83–4.50)	
Sex*			<0.0001
Female	1187 (63.0%)	1.0	
Male	8803 (55.3%)	0.65 (0.58–0.72)	
Service*			0.87
Naval services	1541 (57.4%)	0.98 (0.89–1.07)	
Army	6493 (54.7%)	1.0	
RAF	1956 (60.0%)	0.99 (0.91–1.08)	
Rank (taken from MoD administrative databases)*			<0.0001
Officer	2244 (74.7%)	1.0	
Other rank	7746 (52.3%)	0.53 (0.49–0.59)	
Engagement type*			<0.0001
Regular	8278 (57.2%)	1.0	
Reservist	1712 (51.2%)	0.65 (0.60–0.71)	
Sample*			<0.0001
Follow-up	6429 (68.4%)	1.0	
HERRICK	896 (50.1%)	0.58 (0.52–0.65)	
Replenishment	2665 (40.2%)	0.54 (0.49–0.59)	
Phase 1 health for follow-up sample only† (N=9395)			
Symptoms of common mental disorders			0.88
Non-case	5068 (69.0%)	1.0	
Case	1279 (67.7%)	1.01 (0.90–1.13)	
Probable PTSD			0.54
Non-case	6093 (69.0%)	1.0	
Case	231 (62.6%)	0.93 (0.75–1.16)	
Fatigue‡			0.40
Non-case	4255 (68.9%)	1.0	
Case	2075 (68.4%)	1.04 (0.95–1.15)	
Multiple symptoms‡			0.76
Non-case	5711 (68.7%)	1.0	
Case	703 (67.1%)	0.98 (0.85–1.13)	
Alcohol misuse			0.51
Non-case	4993 (70.3%)	1.0	
Case	1354 (63.1%)	0.96 (0.87–1.07)	
General health perception			0.052
Excellent/good	5630 (69.0%)	1.0	
Fair/poor	734 (65.5%)	0.87 (0.76–1.00)	

RAF=Royal Air Force. MoD=Ministry of Defence. PTSD=post-traumatic stress disorder. *Odds ratios adjusted for all other variables in the table but not for phase 1 health. †Odds ratios adjusted for all demographic variables but not for the other phase 1 health variables. ‡Fatigue case defined as scoring 4+ on the Chalder Fatigue Scale;²⁵ multiple symptom case defined as reporting 18 or more symptoms (of a total of 53).² Cutoffs used for the remaining measures are described in the Methods section.

Table 1: Characteristics of responders and non-responders

	Not deployed to Iraq or Afghanistan (N=3255)	Deployed to Iraq only (N=4203)	Deployed to Afghanistan only (N=1123)	Deployed to Iraq and Afghanistan (N=1389)
Sociodemographic factors				
Age group (years)				
<25	677 (12.4%)	640 (15.0%)	392 (30.2%)	192 (14.9%)
25–29	513 (14.9%)	855 (23.4%)	259 (21.8%)	321 (24.3%)
30–34	462 (15.3%)	925 (23.3%)	193 (19.4%)	342 (26.0%)
35–39	368 (13.3%)	661 (16.6%)	118 (13.4%)	252 (18.4%)
>40	1235 (44.1%)	1122 (21.8%)	161 (15.1%)	282 (16.4%)
Sex				
Female	536 (13.2%)	471 (9.4%)	88 (5.5%)	92 (5.7%)
Male	2719 (86.8%)	3732 (90.6%)	1035 (94.5%)	1297 (94.3%)
Marital status				
In a relationship	2455 (79.8%)	3297 (79.6%)	758 (70.6%)	1059 (76.6%)
Single, divorced, separated, widowed	782 (20.2%)	894 (20.4%)	351 (29.4%)	324 (23.5%)
Educational attainment				
Low (O-levels or none)	1194 (40.0%)	1864 (50.5%)	478 (46.6%)	558 (45.1%)
High (A-levels, degree and above)	1914 (60.0%)	2130 (49.5%)	617 (53.5%)	799 (54.9%)
Military factors				
Service branch				
Naval services	722 (23.6%)	541 (11.7%)	148 (12.8%)	124 (7.5%)
Army	1819 (54.3%)	2979 (72.4%)	799 (71.3%)	891 (67.1%)
RAF	714 (22.1%)	683 (15.9%)	176 (15.9%)	374 (25.4%)
Rank*				
Officer	771 (22.5%)	868 (16.8%)	216 (17.4%)	354 (20.4%)
Non-commissioned officer	1522 (56.6%)	2580 (65.9%)	496 (52.0%)	868 (67.7%)
Other rank	962 (20.9%)	755 (17.3%)	411 (30.6%)	167 (11.9%)
Engagement type				
Regular	2518 (85.0%)	3515 (91.0%)	972 (93.5%)	1256 (96.1%)
Reservist	737 (15.1%)	688 (9.0%)	151 (6.5%)	133 (3.9%)
Serving status				
Serving	2184 (60.4%)	3175 (77.9%)	1050 (94.5%)	1291 (93.1%)
Left	1062 (39.6%)	1020 (22.1%)	68 (5.5%)	96 (6.9%)
Data are number (%). Numbers might not add up to totals because of missing data. Percentages are adjusted to take account of sample and response weights. RAF=Royal Air Force. *Officer=someone who is recruited directly into a management/leadership position; non-commissioned officer=someone who has moved from the other ranks to holding a junior management/leadership position; other rank=those individuals undertaking routine military duties.				
Table 2: Description of study participants (sociodemographic factors, military factors, deployment experience, and mental health measures) by deployment location				

questionnaires by the end of 2008. Participants were recruited through several strategies. Address information for individuals in the sample was supplied monthly by DASA. Figure 2 shows the data collection strategy. First, all participants were posted a letter informing them about the study and that they would shortly be receiving a questionnaire. Questionnaires were then sent out to the entire sample. Non-responders were then assigned either to a visit by researchers from the King's Centre for Military Health Research (KCMHR; London, UK) or to a second mailing. Individuals were assigned to a visit if they were serving and located at a military base with at least 30 other sampled personnel. During data collection, KCMHR researchers visited more than 100 military units located at military bases across the UK, Germany, and Cyprus. The questionnaires of individuals who were not

able to attend the sessions were left behind for forwarding or completion at a later date. Non-attendance was usually because individuals had been transferred to a different unit or had work commitments.

Participants who did not respond to a visit or second mailing were entered into either military tracing (if they were still serving as a regular or reservist) or civilian tracing (if they had left the UK armed forces). Military tracing for regular personnel included asking senior military personnel to distribute questionnaires to eligible participants located within their military base. They were asked to remind participants that taking part in the study was voluntary. A similar strategy was used for reservists using Training Majors as the point of contact within each reserve centre. Civilian tracing included checking addresses against the electoral

	Deployed to Iraq or Afghanistan* (N=6715)	Deployed to Iraq only (N=4203)	Deployed to Afghanistan only (N=1123)	Deployed to Iraq and Afghanistan (N=1389)
Operational role				
Combat	1482 (24.6%)	904 (24.3%)	285 (26.6%)	293 (24.0%)
Combat support	746 (11.4%)	410 (9.7%)	128 (12.5%)	208 (16.1%)
Combat service support	4234 (64.1%)	2786 (66.0%)	658 (60.9%)	790 (59.8%)
How often did you†:				
See personnel wounded and killed				
Never	2524 (53.4%)	1378 (57.0%)	504 (48.3%)	642 (48.7%)
Once	730 (15.0%)	387 (15.7%)	182 (15.6%)	161 (12.6%)
2–4 times	921 (19.8%)	426 (18.9%)	225 (21.4%)	270 (20.8%)
≥5 times	647 (11.9%)	220 (8.5%)	169 (14.6%)	258 (18.0%)
Come under small arms/RPG fire				
Never	2455 (49.8%)	1230 (48.2%)	521 (50.0%)	704 (53.7%)
Once	527 (10.9%)	325 (13.1%)	99 (9.1%)	103 (6.9%)
2–4 times	817 (17.4%)	465 (20.2%)	155 (13.4%)	197 (14.0%)
≥5 times	1033 (21.9%)	404 (18.6%)	305 (27.4%)	324 (25.4%)
Come under mortar/artillery fire/rocket attack				
Never	1108 (22.4%)	513 (20.4%)	259 (25.8%)	336 (24.5%)
Once	329 (6.8%)	114 (5.0%)	98 (9.2%)	117 (9.1%)
2–4 times	777 (15.9%)	302 (13.2%)	224 (21.0%)	251 (18.4%)
≥5 times	2656 (54.9%)	1510 (61.4%)	506 (44.0%)	640 (48.1%)
Experience hostility from civilians				
Never	2635 (53.3%)	1177 (47.2%)	616 (59.4%)	842 (63.3%)
Once	478 (9.7%)	241 (9.8%)	116 (9.5%)	121 (9.6%)
2–4 times	917 (18.8%)	506 (20.2%)	204 (18.8%)	207 (15.5%)
≥5 times	793 (18.2%)	491 (22.9%)	124 (12.2%)	160 (11.7%)
Discharge your weapon in direct combat				
Never	3880 (81.0%)	2098 (86.1%)	773 (73.2%)	1009 (75.0%)
Once	213 (4.1%)	113 (4.5%)	52 (4.0%)	48 (3.3%)
2–4 times	253 (5.5%)	100 (4.6%)	66 (6.2%)	87 (7.2%)
≥5 times	468 (9.4%)	101 (4.9%)	184 (16.7%)	183 (14.5%)
Experience a landmine strike				
Never	4259 (88.7%)	2272 (93.7%)	871 (81.0%)	1116 (82.8%)
Once	261 (5.9%)	81 (4.4%)	91 (8.8%)	89 (6.9%)
≥2 times	282 (5.5%)	45 (1.8%)	113 (10.2%)	124 (10.4%)

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register and seeking telephone numbers via directory enquires. The research team endeavoured to make telephone contact with these individuals to answer any queries about the study and to encourage them to complete and return a questionnaire. Participants who were difficult to contact were traced, when possible, by the National Health Service Strategic Tracing Service. Throughout data collection some questionnaires were returned undelivered because of incorrect addresses. If a new address became available from tracing strategies or the monthly update of data from DASA, a questionnaire was mailed to this new address.

Statistical analyses

For the purposes of these analyses, all samples have been combined. However, sample weights have been generated to take into account the sampling strategies used. Sample

weights reflected the inverse probability of a subject from a specific subpopulation and specific engagement type (regular reservist status) being sampled; this probability varies by subpopulation and engagement type. Response weights were also generated to account for non-response. Response weights were defined as the inverse probability of responding once sampled and driven by factors shown empirically to predict response (sex, rank, engagement type, age, sample, and the interaction between sample and engagement type). The sample and response weights were multiplied together to generate one combined weight. The weighted analyses provide valid results under the assumption that the data are missing at random and that the observed variables modelled to drive non-response were correctly identified.

The main analyses presented compare mental health status according to deployment experiences. Our primary

	Deployed to Iraq or Afghanistan* (N=6715)	Deployed to Iraq only (N=4203)	Deployed to Afghanistan only (N=1123)	Deployed to Iraq and Afghanistan (N=1389)
(Continued from previous page)				
Experience an IED				
Never	3636 (73.9%)	1764 (71.4%)	809 (75.4%)	1063 (78.6%)
Once	599 (12.9%)	322 (13.9%)	130 (11.5%)	147 (11.9%)
≥2 times	597 (13.2%)	334 (14.7%)	141 (13.1%)	122 (9.5%)
Encounter sniper fire				
Never	3965 (81.5%)	2040 (82.5%)	848 (79.5%)	1077 (80.8%)
Once	288 (6.4%)	157 (7.1%)	75 (7.0%)	56 (4.0%)
≥2 times	569 (12.1%)	225 (10.4%)	152 (13.4%)	192 (15.2%)
Experience a threatening situation and were unable to respond due to rules of engagement				
Never	3881 (79.5%)	1897 (76.8%)	843 (79.7%)	1141 (86.0%)
Once	395 (8.5%)	230 (9.9%)	92 (7.8%)	73 (5.7%)
≥2 times	566 (12.0%)	302 (13.3%)	147 (12.5%)	117 (8.3%)
Had a comrade shot/hit who was near you				
No	4131 (85.4%)	2113 (86.6%)	901 (83.4%)	1117 (83.9%)
Yes	691 (14.6%)	304 (13.4%)	177 (16.6%)	210 (16.1%)

Data are number (%). Numbers might not add up to totals because of missing data. Percentages adjusted to take account of sample and response weights. RPG=rocket propelled grenade. IED=improvised explosive device. *For those with previous deployment experience to both Iraq and Afghanistan, deployment on their last deployment has been included here. †Only available for those who completed phase 2 questionnaire for their most recent deployment experience (excludes follow-up personnel whose last deployment was to Iraq in 2003; details of that deployment were collected at phase 1 and were not collected with a comparable questionnaire).

Table 3: Deployment experiences of study participants, by deployment location

exposures of interest were deployment status (whether or not deployed to Iraq or Afghanistan); location of deployment (Iraq only, Afghanistan only, or both); number of deployments to Iraq and Afghanistan; and time since return from deployment. Self-reported deployment data were used to classify participants. 19 individuals who were sampled as part of the HERRICK sample were not deployed to Afghanistan; these individuals were classified as deploying to Iraq only (n=10) or were not deployed (n=9). As well as these nine HERRICK participants, the group not deployed to Iraq or Afghanistan (n=3255) comprised individuals from the follow-up (n=2133) and replenishment (n=1113) samples. We also examined role on deployment—combat (eg, infantry), combat support (eg, explosive ordnance disposal, aircrew, signals), combat service support (eg, medical, logistics)—and stage of deployment (eg, TELIC 1, 2 onwards, and HERRICK 1, 2 onwards; generally each stage of deployment is 6 months in length). For follow-up participants, we used data from phase 1 to ensure deployment information was as complete as possible.

Analyses were undertaken with the statistical software package STATA (version 10.0), and statistical significance was defined as a p value less than 0.05. All analyses take account of the weighting by using the survey commands in STATA. Weighted percentages and odds ratios are presented in the tables, together with unweighted cell counts. We describe the sociodemographic, military, and deployment experiences of our sample in detail, before presenting odds ratios, 95% CI, and p values, which were

calculated to estimate associations between deployment experiences and the outcomes of interest. Univariable and multivariable logistic regression analyses were done, and standard sociodemographic (age, sex, marital status, educational status) and military (rank, service, engagement type [regular or reservist status]) factors were included in the models. All study participants were analysed together, irrespective of which sample they were from, and we analysed the follow-up sample separately to allow for previous mental health status (being defined as a common mental disorder case, based on the GHQ-12, and probable post-traumatic stress disorder, based on the PCL) to be taken into account in the analysis.

Our sample size was devised to allow us at least 80% power to detect a difference in the prevalence of probable post-traumatic stress disorder from 3% to 6% within the follow-up sample and a difference in prevalence of probable post-traumatic stress disorder between the HERRICK and non-deployed follow-up (ERA) sample of 8% and 4%, respectively. The sample sizes used probable post-traumatic stress disorder, since this outcome had the lowest prevalence of the outcomes examined at phase 1 (data not shown).¹

Role of the funding source

The sponsor of the study had no role in study design, data analysis, or data interpretation. The MoD provided us with the names and contact details of the study participants who were newly selected into phase 2, and updated contact details for those enrolled at phase 1. We disclosed the paper to the MoD when it was submitted

	Regulars				Reservists			
	Not deployed to Iraq/Afghanistan (N=2518, 41%)	Deployed (N=5743, 59%)	OR* (95% CI); p value	Adjusted† OR* (95% CI); p value	Not deployed to Iraq/Afghanistan (N=737, 60%)	Deployed (N=972, 40%)	OR* (95% CI); p value	Adjusted† OR* (95% CI); p value
Common mental disorders	494 (19.9%)	1074 (19.6%)	0.98 (0.86-1.12); p=0.81	0.98 (0.84-1.14); p=0.77	132 (18.1%)	203 (19.9%)	1.12 (0.85-1.49); p=0.42	1.16 (0.85-1.59); p=0.34
Probable PTSD	98 (4.0%)	222 (4.2%)	1.03 (0.79-1.36); p=0.81	1.13 (0.82-1.54); p=0.46	11 (1.8%)	44 (5.0%)	2.90 (1.37-6.12); p=0.005	2.83 (1.23-6.51); p=0.014
Alcohol misuse	299 (10.9%)	881 (15.7%)	1.52 (1.30-1.79); p<0.0001	1.22 (1.02-1.46); p=0.030	53 (6.8%)	89 (9.5%)	1.43 (0.95-2.16); p=0.088	1.38 (0.89-2.13); p=0.15

Data are number (%), unless otherwise specified. Percentages and odds ratios (ORs) adjusted to take account of sample and response weights. PTSD=post-traumatic stress disorder. *Baseline group=not deployed to Iraq or Afghanistan. †Odds ratios adjusted for age (as a continuous variable), sex, marital status, educational status, rank, serving status (still serving or left), and service.

Table 4: Association between probable mental disorders and deployment status, stratified by engagement type (regular or reservist status)

for publication, and any errors of fact identified by the MoD were corrected at the same time as addressing the comments of the 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

9990 participants completed our study questionnaire (response rate 56%). The response rate was higher for the follow-up sample (6429 [68%]) than for the replenishment (896 [40%]) and HERRICK samples (2665 [50%]). Table 1 shows the characteristics of responders compared with non-responders. Response was associated with older age, being female, being an officer, and being of regular engagement type (table 1). For the follow-up sample, we examined whether response was associated with phase 1 mental health status (probable post-traumatic stress disorder, symptoms of common mental disorders, alcohol misuse, fatigue, multiple symptoms, and general health perception). We noted no significant associations between mental health status at phase 1 and responding at phase 2 (table 1). From the model presented, response weights were generated with factors shown to predict response: sex, rank, engagement type, age, sample, and the interaction between sample and engagement type. All subsequent analyses took these response weights into account.

Table 2 summarises the sociodemographic and military characteristics of the sample by deployment status. Of the total sample, 4203 (37%) had deployed to Iraq only, 1123 (9%) to Afghanistan only, and 1389 (11%) to both locations. Generally, the non-deployed group were older and more likely to be female, to be in the naval services, to be a reservist, and to have left the military than were those who had deployed to either Iraq or Afghanistan. Those who had deployed to Iraq only were, generally, older and more likely to be female, to be a reservist, and to have left the military than were those who had deployed to Afghanistan only or to both Afghanistan and Iraq. Those who had deployed to Afghanistan only were, generally, younger, and more likely to be single and to hold a lower rank than were those who had deployed to Iraq only or to both Afghanistan and Iraq. Those who

had deployed to both locations were, generally, more likely to be in the RAF, to be an officer or non-commissioned officer, and to be a regular than were those who had deployed to only Iraq or Afghanistan.

Table 3 shows the deployment characteristics for participants with deployment to Iraq or Afghanistan. The most frequently cited deployment experience was coming under mortar attack, whereas few participants experienced a landmine strike or had witnessed a comrade shot. The distribution of deployment experiences varied substantially by deployment location. Generally, those deployed to Iraq only were more likely to have been in combat service support roles; to experience hostility from civilians and mortar, artillery fire, or rocket attacks; and were less likely to see personnel wounded and killed, to experience a landmine strike, or to discharge their weapon in direct combat than were those deployed to Afghanistan only and those deployed to both Iraq and Afghanistan.

Overall, 4.0% (95% CI 3.5-4.5; n=376) of participants reported probable post-traumatic stress disorder, 19.7% (18.7-20.6; n=1908) reported common mental disorder, and 13.0% (12.2-13.8; n=1323) reported alcohol misuse. The webappendix presents the prevalence of these outcomes by sociodemographic and military factors, plus the prevalence estimates by sample.

We recorded a significant interaction between deployment status and engagement type for probable post-traumatic stress disorder (p=0.011), which was anticipated from phase 1,¹ thus implying that the effect of deployment on the reporting of probable post-traumatic stress disorder differs between regulars and reservists. We noted no presence of an interaction for alcohol misuse (p=0.78) nor symptoms of common mental disorders (p=0.40). However, for consistency we assessed all associations separately for regulars and reservists (table 4). Reporting symptoms of common mental disorder was not associated with deployment status for either regulars or reservists (table 4). Probable post-traumatic stress disorder was significantly associated with being a deployed reservist, and alcohol misuse was significantly associated with being a deployed regular (table 4). These associations persisted after adjustment

See Online for webappendix

for confounding by sociodemographic and military factors (table 4). Despite the association between deployment status and probable post-traumatic stress disorder being significant for reservists, the prevalence of symptoms in deployed reservists and in non-deployed reservists was low (table 4). Further, although the odds ratio for alcohol misuse in reservists was not significant, the adjusted odds ratio was slightly larger in reservists than was that seen for regulars (table 4).

We then examined whether there was an effect of deployment location (table 5). In regulars, after adjustment, the association between deployment and alcohol misuse remained for those deployed to both Iraq and Afghanistan. Comparison of the unadjusted and adjusted odds ratios showed that age had the largest effect on the odds ratios (data not shown). Because of the small number of reservists, these analyses have been restricted to regulars only. Of the 44 deployed reservists reporting probable post-traumatic stress disorder, 33 were deployed to Iraq only, five to Afghanistan only, and six to both Iraq and Afghanistan.

To assess whether there was an association between experience of combat duties and the outcomes under study, we did a further analysis of only those who had deployment experience to Iraq or Afghanistan, or both, comparing those in a combat role and those with combat support roles (eg, explosive ordnance disposal, aircrew, signals) with those in combat service support (eg, medical, logistics; table 6). These analyses were restricted to regular personnel because few reservists were deployed in combat roles. Having a combat role was associated with increased reporting of probable post-traumatic stress disorder. The unadjusted analysis showed that there was an association between holding a combat role

and alcohol misuse, but this association was no longer present after adjustment (this association was mainly accounted for by age). Additionally, those in combat support roles were less likely than were those in combat service support roles to report alcohol misuse, and this effect remained significant after adjustment (table 6).

We also examined whether stage of deployment to Iraq or Afghanistan had an effect on probable mental disorders (figure 3 and figure 4). For each figure, the death rate (per 1000) in UK military personnel is also shown as a proxy for the combat intensity of each deployment. We noted no apparent association between the death rate and the reporting of probable mental disorders.

For those with deployment experience to Iraq and Afghanistan, the number of times they had been deployed to Iraq and Afghanistan was explored in relation to mental disorders. These analyses were restricted to regular army personnel who were still in service at the time of questionnaire completion because this group generally deploy for periods of 6 months, whereas the pattern of deployments differs for the other services and for reservists.²⁸ For example, RAF personnel (eg, aircrew) deploy more often but for shorter periods of time than do other military personnel. Further, these analyses were restricted to still serving personnel, because there was a significant interaction between number of deployments and current serving status for probable post-traumatic stress disorder ($p=0.023$). Table 7 presents the association with number of deployments and mental disorders. We noted no evidence that number of deployments was associated with an increase in the reporting of probable mental disorders. Additional adjustment for operational role had a small effect on the odds ratios presented (data available from the authors).

	Not deployed to Iraq/Afghanistan (N=2518, 41%)	Deployed to Iraq only (N=3515, 38%)	Adjusted OR* (95% CI); p value	Deployed to Afghanistan only (N=972, 10%)	Adjusted OR* (95% CI); p value	Deployed to Iraq and Afghanistan (N=1256, 11%)	Adjusted OR* (95% CI); p value
Common mental disorders	494 (19.9%)	682 (20.8%)	1.03 (0.88–1.21); p=0.69	167 (17.3%)	0.79 (0.62–1.01); p=0.059	225 (17.9%)	0.93 (0.75–1.17); p=0.55
Probable PTSD	98 (4.0%)	153 (4.8%)	1.20 (0.87–1.67); p=0.27	29 (3.4%)	0.93 (0.54–1.59); p=0.78	40 (2.7%)	0.92 (0.58–1.46); p=0.71
Alcohol misuse	299 (10.9%)	510 (15.3%)	1.21 (0.99–1.46); p=0.057	176 (17.8%)	1.20 (0.92–1.57); p=0.17	195 (15.1%)	1.30 (1.01–1.67); p=0.039

Data are number (%), unless otherwise specified. Percentages and odds ratios (ORs) adjusted to take account of sample and response weights. PTSD=post-traumatic stress disorder. *Baseline group=not deployed to Iraq or Afghanistan. Odds ratios adjusted for age (as a continuous variable), sex, marital status, educational status, rank, serving status (still serving or left), and service.

Table 5: Association between probable mental disorders and location of deployment for regular personnel

	Combat service support (N=3500, 63%)	Combat (N=1334, 25%)	OR* (95% CI); p value	Adjusted† OR* (95% CI); p value	Combat support (N=709, 12%)	OR* (95% CI); p value	Adjusted† OR* (95% CI); p value
Common mental disorders	650 (19.7%)	270 (20.6%)	1.06 (0.88–1.28); p=0.54	1.06 (0.86–1.30); p=0.57	124 (18.3%)	0.91 (0.71–1.18); p=0.49	0.98 (0.76–1.28); p=0.90
Probable PTSD	116 (3.6%)	90 (6.9%)	1.99 (1.42–2.78); p<0.0001	1.87 (1.26–2.78); p=0.002	11 (2.1%)	0.58 (0.28–1.19); p=0.14	0.67 (0.32–1.41); p=0.29
Alcohol misuse	485 (14.2%)	296 (22.5%)	1.75 (1.45–2.12); p<0.0001	1.15 (0.93–1.42); p=0.20	82 (10.8%)	0.73 (0.54–0.98); p=0.039	0.68 (0.50–0.93); p=0.015

Data are number (%), unless otherwise specified. Percentages and odds ratios adjusted to take account of sample and response weights. PTSD=post-traumatic stress disorder. *Baseline group=combat service support. †Odds ratios adjusted for age (as a continuous variable), sex, marital status, educational status, rank, serving status (still serving or left), and service.

Table 6: Association between probable mental disorders and role on deployment for regular personnel

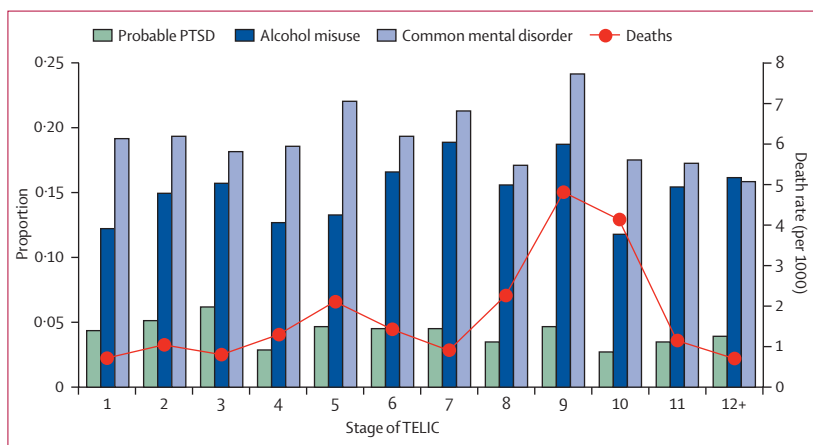


Figure 3: Probable mental disorders (proportion) and death rate per 1000 UK military personnel by stage of deployment to Iraq (Operation TELIC)^{26,27}
PTSD=post-traumatic stress disorder.

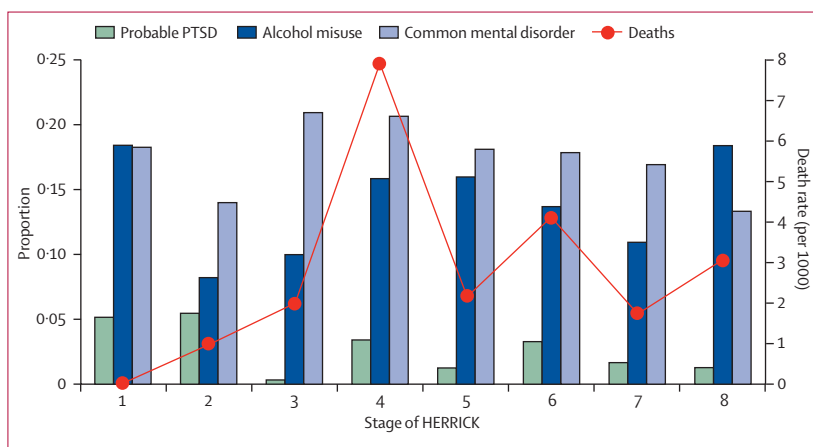


Figure 4: Probable mental disorders (proportion) and death rate per 1000 UK military personnel by stage of deployment to Afghanistan (Operation HERRICK)^{22,27}
PTSD=post-traumatic stress disorder.

For regulars, unadjusted analyses showed evidence of a positive effect of time since return from deployment on reporting both symptoms of common mental disorder and probable post-traumatic stress disorder (table 8). The odds ratio peaked at up to 3 years since return from deployment for symptoms of common mental disorder and at up to 4 years since return from deployment for the reporting of probable post-traumatic stress disorder. We recorded the opposite for alcohol misuse—time since return had a negative effect on the reporting of alcohol misuse, with the lowest odds ratio reported at up to 5 years since return from deployment (table 8). After adjustment, we recorded no association with symptoms of common mental disorders and alcohol misuse (table 8). These associations were mainly accounted for by educational status (symptoms of common mental disorder) and age (alcohol misuse; data not shown). After adjustment, there remained a small but significant trend for the reporting of probable

post-traumatic stress disorder (table 8). This analysis was restricted to regulars because of the small number of reservists.

The association between reporting probable post-traumatic stress disorder and time since deployment might be due to the so-called healthy warrior effect (in which those who have difficulties are not deployed)²⁹ and, therefore, we established whether probable mental disorders at phase 1 affected the odds of being deployed by phase 2. For the follow-up sample, previous mental health status was not associated with subsequent deployment status for either regulars (odds ratio 0.97, 95% CI 0.91–1.03, $p=0.30$ for common mental disorders; 0.96, 0.90–1.02, $p=0.17$ for probable post-traumatic stress disorder) or reservists (1.00, 0.82–1.22, $p=0.97$ for common mental disorders; 0.98, 0.87–1.11, $p=0.77$ for probable post-traumatic stress disorder). Adjustment for sociodemographic characteristics, military factors, and deployment status at phase 1 had a small effect on the odds ratios (data available from the authors). In regulars, examination of the characteristics of those deployed between phase 1 and phase 2 of the study again showed that they were more likely than were those not deployed to be younger, male, be a non-commissioned officer, remain in service, and have been deployed at phase 1 and be in the army (data not shown). In reservists, being younger, remaining in service, and having been deployed at phase 1 were predictive of being deployed between phase 1 and phase 2 of the study (data not shown).

Discussion

Our main finding is that, overall, the prevalence of mental disorders in the UK armed forces remained stable between 2003 and 2009. For regular personnel, we did not detect an effect of deployment to Iraq or Afghanistan on two of the three outcomes (probable post-traumatic stress disorder and common mental disorders) but we did record a modest effect of deployment on alcohol consumption. As we first noted in our 2006 report,¹ covering the period of the UK military operation in Iraq from 2003 to 2005, the most frequent mental health problems encountered by returning UK armed forces personnel continue to be alcohol misuse and common mental disorders, rather than probable post-traumatic stress disorder. We previously reported¹ that, unlike regulars, deployed reservists were more likely to report probable post-traumatic stress disorder than were non-deployed reservists. Despite several policy initiatives, this effect has persisted. We also noted a significant association between deployment and probable post-traumatic stress disorder in regular personnel who had a combat role during deployment.

Findings from this study suggest that the mental health of the UK armed forces has not changed since our initial study.¹ This finding, although reassuring, is also surprising because the war in Iraq turned out to be a prolonged deployment, and UK military personnel in southern Iraq began to be exposed to increased levels of

	1 deployment (N=1767)	2 deployments (N=1109)	OR* (95% CI); p value	Adjusted† OR* (95% CI); p value	≥3 deployments (N=411)	OR* (95% CI); p value	Adjusted† OR* (95% CI); p value
Common mental disorders	355 (21.2%)	199 (18.3%)	0.83 (0.66–1.05); p=0.12	0.90 (0.71–1.14); p=0.39	67 (16.8%)	0.75 (0.54–1.05); p=0.091	0.80 (0.57–1.13); p=0.20
Probable PTSD	66 (4.1%)	37 (3.4%)	0.83 (0.51–1.36); p=0.47	0.96 (0.58–1.57); p=0.86	11 (2.5%)	0.61 (0.29–1.26); p=0.18	0.72 (0.34–1.50); p=0.38
Alcohol misuse	296 (16.3%)	186 (17.0%)	1.05 (0.83–1.33); p=0.71	1.05 (0.82–1.36); p=0.68	61 (14.5%)	0.87 (0.62–1.23); p=0.43	0.88 (0.61–1.26); p=0.47

Data are number (%), unless otherwise specified. Percentages and odds ratios (ORs) adjusted to take account of sample and response weights. PTSD=post-traumatic stress disorder.*Baseline group=one deployment. †Odds ratios adjusted for age (as a continuous variable), sex, marital status, educational status, and rank.

Table 7: Association between probable mental disorders and number of deployments to Iraq or Afghanistan, for currently serving regular Army personnel (N=4098)

combat. Further, there has been an escalation in the UK commitment to Afghanistan, with substantial numbers of UK military personnel being deployed to Helmand Province, where fighting has been intense. Many UK military personnel have now had multiple deployments to either or both operational locations, yet we noted that multiple deployments were not associated with mental health disorders.

Concerns have been raised about the long-term effect of deployment on the mental health of the UK armed forces, particularly the expected so-called tidal wave of mental health problems,^{13,30–32} similar to reports from the USA.^{2,3,6–11} However, we report only a small increase in the reporting of probable post-traumatic stress disorder with time since return from deployment.

Although our findings on the effect of deployment in regulars are, up to a point, reassuring, there are two areas of continued concern: alcohol misuse, in general, and probable post-traumatic stress disorder in those deployed in combat roles. Our present analysis showed an effect of deployment on the reporting of alcohol misuse, and alcohol misuse continues to be greatest in those holding combat roles.^{24,33,34} In view of the predominance of young men in the military, that members of the UK armed forces have high levels of alcohol misuse is perhaps unsurprising. Even when these differences were taken into account, the levels of misuse were substantially higher than in those reported within the general population.²⁴ The US military, despite having different attitudes towards alcohol use, report similar associations of alcohol misuse with deployment and deployment-related experiences.^{35,36} In the UK, the three services have each recently introduced new alcohol policies. Although the effect of these new policies cannot yet be assessed, we suggest that any substantial and sustained reduction will need attitudinal change, since alcohol use within British military culture is seen as aiding social interaction and unit cohesion, a view that has some empirical support.³³

Regular military personnel deployed in combat roles were more likely to report probable post-traumatic stress disorder than were others. But we did not record an association between combat intensity and the reporting of mental disorders. Combat intensity, and hence casualty figures, have varied between different periods of both the Iraq and Afghanistan deployments. We predicted that this variation would be reflected in similar fluctuations

in the reporting of probable mental disorders, as has been shown historically,³⁷ but we did not find this to be the case. This finding might be partly because such a link is more evident in some subgroups or in those who have directly taken part in combat,³⁸ but might also reflect that, taken in its historical context, rates of death, serious injury, and mental breakdown are all fairly low, at least compared with the two world wars from where most of the published work originates. The main data collection period of this study was earlier than the most recent and most injurious phases of the UK deployment to Afghanistan.^{12,27} We are unable to examine the effect of these more recent stages of deployment on the mental health of those deployed; thus continued surveillance of mental health outcomes remains crucial.

In deployed reservists, as shown previously, we report an increase in post-traumatic stress disorder,^{1,39} but this finding should be interpreted in the context of an unusually low rate of this disorder in the non-deployed reservists. This prevalence was lower than that reported in the general population.⁴⁰ The increased reporting of probable post-traumatic stress disorder in reservists is not simply a result of traumatic experiences during deployment but is affected by the context in which deployment takes place—in particular reservists' perception of support and risk while on deployment, and their domestic and employment circumstances when they return.³⁹ The relative infrequency of symptoms of post-traumatic stress disorder meant that we did not have statistical power to investigate the effect of deployment to each operational theatre.

After the publication of our previous report,¹ the UK MoD responded with a series of initiatives designed to improve the mental health of reservists both during and after deployment and to assist in the integration of reservists alongside their regular counterparts. However, reservists still seem to be at greatest risk of the effects of deployment.

With the continuing UK commitment to Afghanistan and, until 2009, the dual commitment to Iraq, the effect of multiple deployments has become pertinent. Multiple deployments could potentially increase military personnel's chances of being exposed to combat or combat-related trauma, which could in turn lead to an increase in reporting of mental disorders.^{14,15} Despite the fact that a number of our study participants have undertaken multiple deployments, we did not find an association between the number of deployments and

	Common mental disorder	OR (95% CI); p value	Adjusted* OR (95% CI); p value	Probable PTSD	OR (95% CI); p value	Adjusted*OR (95% CI); p value	Alcohol misuse	OR (95% CI); p value	Adjusted* OR (95% CI); p value
Up to 1 year	303 (17.5%)	1.0	1.0	58 (3.0%)	1.0	1.0	302 (16.7%)	1.0	1.0
Up to 2 years	264 (19.6%)	1.15 (0.92-1.43); p=0.21	1.17 (0.93-1.46); p=0.18	52 (3.6%)	1.19 (0.76-1.86); p=0.44	1.18 (0.75-1.86); p=0.47	228 (16.5%)	0.99 (0.79-1.24); p=0.94	1.02 (0.81-1.29); p=0.87
Up to 3 years	125 (22.4%)	1.36 (1.04-1.78); p=0.025	1.37 (1.04-1.81); p=0.026	28 (5.7%)	1.95 (1.16-3.27); p=0.012	1.80 (1.05-3.10); p=0.033	119 (17.9%)	1.09 (0.83-1.44); p=0.55	1.20 (0.89-1.62); p=0.24
Up to 4 years	75 (21.5%)	1.29 (0.93-1.78); p=0.13	1.15 (0.81-1.64); p=0.44	17 (5.8%)	1.98 (1.08-3.65); p=0.028	1.88 (0.98-3.62); p=0.058	61 (16.2%)	0.97 (0.68-1.37); p=0.85	1.25 (0.85-1.83); p=0.25
Up to 5 years	192 (21.0%)	1.25 (0.99-1.59); p=0.064	1.24 (0.96-1.61); p=0.098	42 (4.7%)	1.59 (0.99-2.57); p=0.055	1.53 (0.92-2.55); p=0.10	83 (10.5%)	0.59 (0.43-0.79); p=0.001	0.75 (0.54-1.04); p=0.088
Up to 6-5 years	82 (19.8%)	1.17 (0.86-1.58); p=0.32	1.20 (0.85-1.68); p=0.30	19 (5.2%)	1.79 (0.98-3.26); p=0.059	1.89 (0.99-3.60); p=0.054	56 (14.8%)	0.87 (0.61-1.23); p=0.43	1.12 (0.77-1.63); p=0.54
Odds ratio (95% CI; p _{trend})†	..	1.05 (1.00-1.09); p _{trend} =0.044	1.04 (0.99-1.10); p _{trend} =0.10	..	1.13 (1.04-1.23); p _{trend} =0.003	1.13 (1.03-1.24); p _{trend} =0.008	..	0.93 (0.88-0.98); p _{trend} =0.007	0.99 (0.94-1.05); p _{trend} =0.76

Data are number (%), unless otherwise specified. Percentages and odds ratios adjusted to take account of sample and response weights. PTSD=post-traumatic stress disorder. *Odds ratios adjusted for age (as a continuous variable), sex, marital status, educational status, rank, service, and role on last deployment. †Odds ratio associated with every additional year since return from deployment.

Table 8: Association between time since return from deployment and probable mental disorders for regulars

probable mental disorders.²⁸ This finding might be partly explained by selection or the so-called healthy warrior effect, in which those who were unwell as a result of previous deployment have less chance of subsequent deployment,²⁹ whereas those who are more psychologically robust have an increased chance of deployment.⁴¹ Thus, those with multiple deployments could represent a more resilient group of individuals. However, we did not find any evidence that previous mental disorder was associated with significant reduction in likelihood of deployment between phase 1 and phase 2 of this study (data not shown).

Our finding of no association between multiple deployments and mental ill health can be viewed as support for the appropriateness of the UK military's harmony guidelines,⁴² which outline the recommended number of deployments and length of time between deployments for the UK armed forces, and suggest that the actual length of time deployed over 3 years might be more important than the number of deployments. A more rigorous analysis will be needed to explore the association between number of deployments, cumulative length of time deployed, and mental disorders.

We did report a modest increase in the prevalence of reported probable post-traumatic stress disorder with time since return from deployment, but not to the extent expected.^{13,30-32} This finding is surprising in view of our understanding of the psychopathology of post-traumatic stress disorder that, generally, symptoms associated with trauma decrease with time.⁴³ Most of the data for recovery are based on patients exposed to one trauma, whereas our sample has multiple exposures over time. Our findings might represent a small group of personnel with delayed onset post-traumatic stress disorder, for whom the gradual accumulation of symptoms might be seen over a 2-3 year period after a traumatic event.^{44,45}

Our finding of a modest increase in prevalence of probable post-traumatic stress disorder with time since

return from deployment is less than that documented in US-based reports, in which studies have indicated that the prevalence of reporting of probable post-traumatic stress disorder has substantially increased (figure 5).^{2,3,6-11,46} Since the UK are fighting the same enemy, on the same terrain, facing similar risks, and using similar tactics, the reason for these differences is unlikely to be attributable to the operational location. Many other differences exist between the US and UK military that could account for some of the differences in prevalence, including the sociodemographic structure (US troops are younger), length of deployment (12-15 months in the USA vs 6 months in the UK), greater use of reservists within the US military, a higher ratio of troops to leader in the US military, and higher casualties and fatalities in the US military in Iraq, although not in Afghanistan. However, why there are different temporal trends in the UK and the USA is difficult to understand. Post-deployment health care is delivered differently in the UK and USA. In the USA, since January, 2008, military personnel, including US reservists, have access to 5 years of Veterans Affairs (VA) health care after leaving service, for disorders that are determined by their VA doctor to be related to service in a combat area of operations.⁴⁷ Before January, 2008, the entitlement was for 2 years rather than 5 years. By contrast, in the UK all ex-service personnel have access to the National Health Service in perpetuity.

This is the third large-scale epidemiological study that we have undertaken of UK armed forces personnel.^{1,48} Despite considerable efforts, we obtained a response rate of 56%. With our previous experience,^{1,48} we made extensive efforts to achieve a high response rate: personnel were sent questionnaires, military bases were visited, and we used all available methods for tracing. For example, non-responders were contacted by telephone and we used a variety of incentives, newsletters, and media articles to encourage participation. We do not think a higher participation rate could have been achieved

with survey methodology in the UK military. In survey research, there is debate about the benefits of further mailings to produce small increments in participation rates potentially being offset by increasing measurement error. We showed with data from phase 1 of our study that further efforts to increase response rates do not change the overall estimates being studied.¹⁶

We have already presented data suggesting that participation was limited because of our difficulty in finding people and participant inertia.⁴⁹ Furthermore, we know that our non-responders were more likely to be young males who hold lower ranks, and we accounted for non-response in all our analyses with standard statistical techniques. But most crucially, we were able to use the data that we had already collected for all those who took part in the first phase of our study¹ to investigate whether mental health at phase 1 affected non-response at phase 2. With use of that data, we recorded no evidence to suggest that response was associated with mental health status. Finally, non-response rate alone is a weak predictor of non-response bias, and changes in non-response rates do not necessarily alter survey estimates.⁵⁰

Our response rate is similar to that achieved in other large population-based studies, especially of mobile populations dominated by young men. Most large population-based studies report difficulties in obtaining participation from the same groups as we do, with the serving military being a population over-represented by mobile young men. We also note that the only other military study that obtains longitudinal data for identified individuals (the US-based Millennium cohort study) has a response rate of 36%;⁵¹ another US study that affects US policy is the RAND study with a response rate of about 5%.⁴

We acknowledge that there are other limitations to this study. Some of our analyses were restricted to regular personnel only because of the small number of reservists and low prevalence of reporting probable post-traumatic stress disorder. We have ensured that the analyses we have presented for reservists were based on adequate numbers to allow robust conclusions to be made. The prevalence of post-traumatic stress disorder is overestimated when based on self-reported questions compared with clinical interviews, and thus even the low prevalence of post-traumatic stress disorder reported here is likely to be overestimated. Further, we were unable to verify an individual's deployments against military records. However, all published studies relating to Iraq or Afghanistan have this challenge, with, as far as we are aware, only two exceptions for studies of Vietnam veterans.⁵²⁻⁵⁴

We have done several analyses, hence increasing the possibility of associations arising by chance. We have not made adjustments for multiple comparisons in line with the recommendations of Rothman.⁵⁵ The exposures and outcomes studied are highly correlated. Bonferroni (or

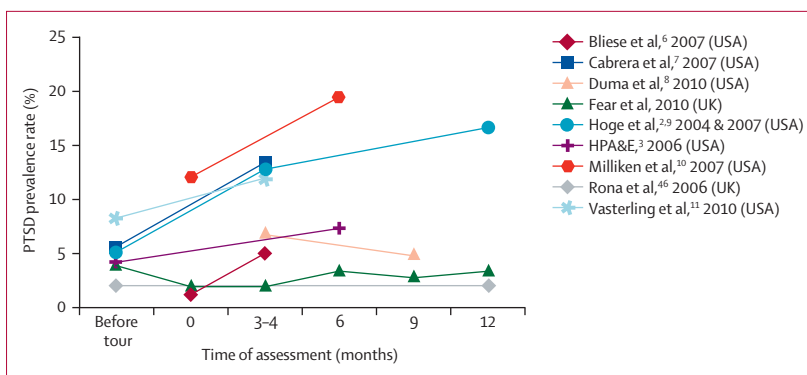


Figure 5: Prevalence of probable post-traumatic stress disorder (PTSD) within the first year of return since deployment

other corrections for multiple testing) assume independence of data that would not have been the case in this study.

Our results do have some implications for policy. First, most of the present initiatives to improve the mental health of the armed forces, in both the UK and USA, continue to be dominated by post-traumatic stress disorder. Yet in the UK, at least, alcohol use is more of a problem, both before and after deployment. Second, both reservists and combat personnel have more mental health problems after deployment. Many recent policy changes and initiatives have been implemented, such as new systems of peer support, new policies on third location decompression (a 1–2 day period spent in Cyprus to unwind before returning to their families), and improved access for reservists to mental health services, which will need time to have an effect. The case for surveillance of mental health outcomes to monitor both the effect of these initiatives and any future trends in prevalence remains strong. Finally, the absolute number of military personnel requiring support or treatment is increasing. This rise is not because of an increase in the rate of mental disorders, but as more of the UK armed forces are deployed, the number of people needing help will inevitably increase. This finding should not be taken as evidence that the situation is getting worse, but it does mean that military mental health services, service charities, and the UK national health system should anticipate a steady increase in the number of serving and ex-service personnel needing support.

Contributors

NTF is one of the principal investigators for this study, was involved in the design of the study, developed the analytical strategy for this paper, undertook the data analyses presented here, and wrote the paper. MJ was involved in the design of the study, participated in data collection, undertook the responder-non-responder data analyses presented here, was involved in developing the analytical strategy for this paper, and commented on the paper. DM participated in data collection, drafted the methods section of the paper, and commented on the paper. LH was involved in the design and planning of the study, coordinated the project, and commented on the paper. BC was the data manager for this project, and commented on the paper. ACI was involved in the design and planning of the study, and commented extensively on the paper.

LM participated in data collection, and commented on the paper. JS and CW were involved in the analytical strategy for this paper, and commented extensively on the paper. NJ and NG provided military assistance and advice in the design and undertaking of the study, and commented on the paper. SL was involved in developing the analytical strategy for this paper, and commented on the paper. CD is one of the principal investigators for this study, was involved in the design and planning of the study, and commented extensively on the paper. RJR is one of the principal investigators for this study, was involved in the design and planning of the study, was involved in developing the analytical strategy for this paper, and commented extensively on the paper. MH is one of the principal investigators for this study, was involved in the design of the study, was involved in developing the analytical strategy for this paper, and commented extensively on the paper. SW is the chief investigator for this study, was responsible for securing funding for this study, led the design and planning of the study, was involved in developing the analytical strategy for this paper, and commented extensively on the paper.

Conflicts of interest

All authors are based at King's College London which, for the purpose of this study and other military-related studies, receives funding from the UK MoD. NJ is a member of the British Army and NG is a member of the Royal Naval Services; both are currently seconded to King's College London. Although they are both paid directly by the UK MoD, they were not directed in anyway by the MoD in relation to this publication. NTF, ACI, and SW have grant support for a study of the children of military fathers from the US Department of Defense. NTF holds PhD studentship funding from the Medical Research Council and the Royal British Legion. ACI holds a grant from King's Learning Institute, King's College London. SW is Honorary Civilian Consultant Advisor in Psychiatry to the British Army and a Trustee of Combat Stress, a UK charity that provides services and support for veterans with mental health problems. MH and SW are part funded in relation to a National Institute for Health Research (NIHR) Applied Programme grant awarded to the South London and Maudsley NHS Foundation Trust, and in relation to the NIHR Specialist Mental Health Biomedical Research Centre at the Institute of Psychiatry, King's College London and the South London and Maudsley NHS Foundation Trust. SW has grant support from the European Union and the Medical Research Council. MH has grant support from the National Institute for Health Research, Medical Research Council, ESRC, US National Institutes of Health, Wellcome Trust, Royal Medical Benevolent Fund, Guy's and St Thomas' Charitable Foundation, and South London and Maudsley NHS Foundation Trust Trustees, and receives income support from St Christopher's Hospice. SL works on projects for which King's College London receives funding from PPP Foundation, ALS Association, Parkinson's Disease Society, and Johnson & Johnson. SL holds shares in GlaxoSmithKline for which dividends are received.

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