



Original Contribution

The Long-Term Consequences of Military Deployment: A 5-Year Cohort Study of United Kingdom Reservists Deployed to Iraq in 2003

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Reserve and National Guard forces have been mobilized to an unprecedented degree in recent overseas conflicts. There is concern that rates of psychological problems may continue to rise for many years after deployment. The authors conducted a cohort study of 552 United Kingdom Reservists who deployed to Iraq in 2003 and 391 nondeployed Reservists. Measures of mental health and social functioning were collected a mean of 16 months and 4.8 years after return from possible deployment. At the first follow-up, deployment was associated with increased common mental disorder, post-traumatic stress disorder (PTSD), and poor general health. By the second follow-up, those who had deployed were no longer at increased risk for common mental disorder or poor general health and had good levels of social functioning. However, those who deployed continued to have over twice the odds of PTSD (odds ratio = 2.42, 95% confidence interval: 1.04, 5.62) and were more likely to report actual or serious consideration of separation from their partner. In conclusion, the authors found that the majority of mental health and social problems following deployment are transient. However, Reservists who deployed in the Iraq War remain at increased risk of PTSD and relationship problems 5 years after their tour of duty.

anxiety; combat disorders; depression; Iraq; marriage; mental disorders; military personnel; post-traumatic stress disorder

Abbreviations: CI, confidence interval; PTSD, post-traumatic stress disorder; UK, United Kingdom.

Close to 2 million US and coalition military personnel have deployed to Afghanistan and Iraq since 2001 (1). Reserve or National Guard forces, which have traditionally been used for home defense roles, have been mobilized to an unprecedented degree in these conflicts (2–4). In the United States, over 760,000 National Guard and Reservist mobilizations have occurred since 2001 (5). At the height of the military operations in Afghanistan and Iraq, close to 40% of deployed US and 12% of United Kingdom (UK) forces have been Reservists (2, 3).

In recent years, there has been increasing concern regarding the psychological consequences of combat exposure, particularly among Reservists (6). Studies of both US and UK military personnel following deployment to Iraq demonstrated that, compared with regular military personnel,

Reservists had significantly elevated rates of common mental disorders and post-traumatic stress disorder (PTSD) (7–10). A variety of possible hypotheses for this apparent vulnerability have been proposed, including different operational experiences, altered perception of risk, lack of cohesion with regular forces, lack of peer support, and difficulties adjusting to civilian life postdeployment (4, 7, 11). A recent study of UK military personnel who had deployed to either Iraq or Afghanistan demonstrated that, compared with regular forces, Reservists had considerably more difficulties with postdeployment social functioning and that these postdeployment difficulties appeared to be important predictors of mental health problems (12). Such observations have led to concern that rates of mental illness may continue to rise in the months and years after Reservists have returned home

from deployment (13). This has been reinforced by a number of US-based studies that have found evidence for a steady increase in the rates of psychiatric disorder over the first 12 months after deployment (14–16), particularly among Reservists or National Guard personnel (9, 10). The results of these studies have led to concern regarding the level and chronicity of postdeployment mental health problems and the notion of a “ticking time bomb” of mental disorders, with fears that rates of conflict-related psychological problems will continue to rise substantially in the years following deployment. Given the large numbers of US and allied troops who have deployed to Iraq or Afghanistan, the costs and policy implications of such an effect would be substantial (17). However, to date, prospective or sequential cross-sectional studies of Reservists returning from deployment have been limited to 12-month follow-up (9, 10, 13), with the longer term consequences of deployment remaining unclear.

The nature of UK Reservist deployment to the conflict in Iraq, with the majority of Reservist deployments occurring as a single tour of duty in 2003, provides a unique opportunity to examine the longer term effects of a single deployment. This study aims to use data from an ongoing cohort study of UK military personnel to examine the consequences of deployment to the Iraq War, in terms of both mental health and social functioning, over a 5-year follow-up period.

MATERIALS AND METHODS

Study participants

This study represents the follow-up of UK Reservists originally recruited to the King's Centre for Military Health Research study during the 2003 phase of the Iraq War (8). The focus of this cohort study is the buildup and completion of major combat operations in Iraq between January 18 and June 28, 2003, which was given the British military code name, Operation TELIC 1. Previous analysis has shown that significant combat operations occurred during this period, with the majority of Reservists who deployed as part of TELIC 1 (61%) reporting coming under mortar or artillery fire and nearly half (49%) seeing other personnel wounded or killed (7).

In 2003, with the aid of the UK Ministry of Defence, a list of all personnel (excluding Special Forces and high-security personnel) who had deployed on operation TELIC 1 was generated. In March 2003, a similar list of all UK military personnel who were serving on March 31, 2003, but who had not deployed on TELIC 1 was constructed to allow a comparison group, termed Era. As described previously, random stratified samples of both TELIC and Era populations were selected (8). Reservists were oversampled in both groups, with 1,400 selected from the TELIC population and 1,811 from the Era group. More individuals were sampled from the Era population to allow for the exclusion of those who were not eligible to deploy for practical reasons, such as still being university cadets ($n = 135$), and the possibility that some of those who had not deployed at the time of sampling would be deployed as part of TELIC operations in the period between sampling and the original data collection.

Study design

The overall study design is summarized in Figure 1. The initial phase of data collection, a postal questionnaire, began in June 2004 and ended in March 2006, meaning that initial postdeployment information was collected on average 16 months after the exit date from any deployment (8). Between November 2007 and September 2009 (an average of 4.8 years from the completion of any TELIC deployment), an attempt was made to follow up all participants with a phase 2 questionnaire (18). In order to allow an accurate assessment of the long-term impact of a single deployment, individuals from either group who reported subsequent deployments (after baseline assessment) to either Iraq or Afghanistan were excluded ($n = 151$).

Health measures

All participants were asked to complete a series of identical measures of health during both the phase 1 and phase 2 assessments. Symptoms of common mental disorders were measured by using the 12-item General Health Questionnaire (GHQ-12) (19), with a cutoff for caseness of 4 or more (20, 21). Symptoms suggestive of PTSD were identified by using the 17-item National Centre for PTSD Checklist (PCL-C), with probable PTSD defined by a score of 50 or more (22). Alcohol use was assessed by using the 10-item World Health Organization Alcohol Use Disorders Identification Test (AUDIT) (23). This is a validated and widely used measure of alcohol misuse, with scores of 16 or more usually indicating a high level of alcohol consumption which is likely to be harmful to health (23). Finally, each participant was asked to rate his/her general health as excellent, very good, good, fair, or poor.

Measures of social functioning

Current models of social functioning have proposed that social networks influence health via a number of different pathways, such as social support, social participation, and access to material goods (24). Each individual's level of social participation was assessed by asking how many of 10 possible social activities they regularly chose to participate in outside of work. Those who participated in less than 2 of these activities (representing the bottom quartile of the entire sample) were classified as having low levels of social participation. The extent of each participant's social network was assessed via asking how many close friends or relatives they meet and/or talked with on a regular basis. Once again, those in the bottom quartile (with less than 3 close friends or relatives) were classed as having a limited social network. Participants' relationship status was ascertained at both assessments, with each participant additionally being asked if he/she or his/her partner had seriously suggested the idea of divorce or permanent separation within the last year. By combination of these questions, a variable was created that recorded any actual or serious consideration of permanent separation from his/her partner between phase 1 and phase 2 follow-up. Finally, by asking about serving status at follow-up, it was possible to

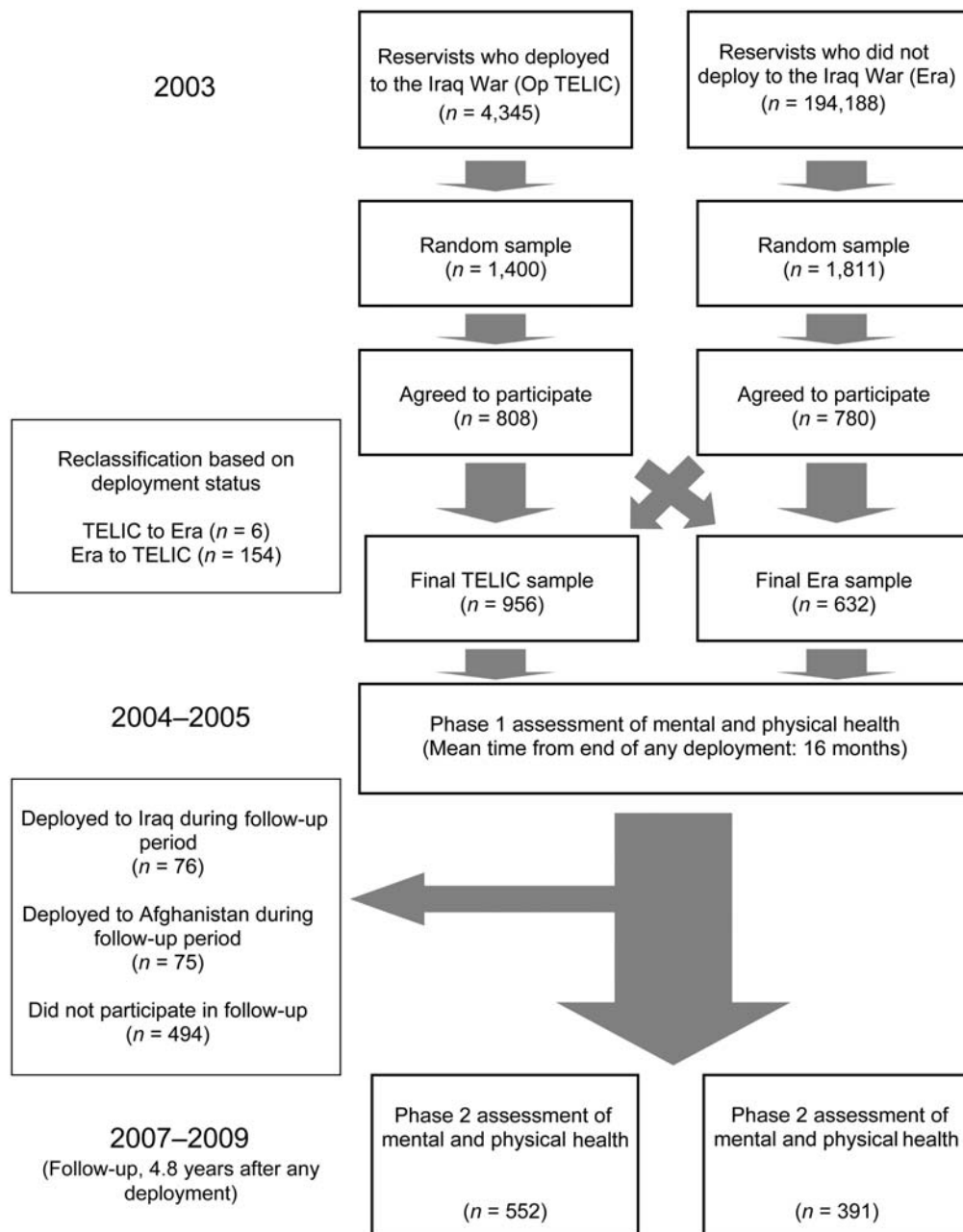


Figure 1. Summary of study design and number of Reservists followed in the King's Centre for Military Health Research Cohort Study, 2003–2009. Op, Operation.

determine which participants had left the military over the follow-up period.

Other measures

Information on potential confounding factors including sex, age, rank, and service branch was also collected.

Statistical analyses

All analyses were conducted by using Stata, version 11, software for Windows (25). In order to allow direct comparisons between results at phase 1 and phase 2, only those participants who responded to both surveys were included in this study. Response weights were constructed to take account of nonresponse according to sex, rank, and age

Table 1. Description of the Reservists Who Responded to Both Phase 1 and Phase 2 Surveys in the King's Centre for Military Health Research Cohort Study, 2003–2009^a

Variable	TELIC ^b (n = 552)			Era ^b (n = 391)			P Value ^c
	No.	% ^d	Mean (SD)	No.	% ^d	Mean (SD)	
Gender							
Male	447	82.8		311	80.8		0.42
Female	105	17.2		80	19.2		
Age, years ^e			39.4 (7.95)			42.0 (8.89)	<0.001
<30	68	13.8		32	9.6		
30–39	219	40.4		130	33.9		<0.001
40–49	215	37.9		147	36.9		
≥50	50	8.0		82	19.5		
Relationship status ^e							
In relationship	416	75.4		306	77.9		
Single	86	15.9		54	14.3		0.67
Separated or widowed	48	8.7		31	7.8		
Rank							
Officer	126	19.5		118	27.0		
NCO	337	63.4		208	54.6		0.01
Other rank	89	17.1		65	18.3		
Service branch							
Naval services	48	8.8		45	11.4		
Army	429	78.0		304	78.2		0.22
Royal Air Force	75	13.2		42	10.4		

Abbreviations: NCO, noncommissioned officers; SD, standard deviation.

^a Phase 1, average of 16 months after return from deployment; phase 2, average of 4.8 years after return from deployment.

^b "TELIC" and "Era" are designations for United Kingdom military personnel who did and did not deploy during the 2003 phase of the Iraq War, respectively.

^c Pearson χ^2 corrected for response weights. The Student *t* test was used when testing for difference in mean age.

^d Percentages are adjusted to take account of response weights.

^e At phase 1.

(factors empirically shown to predict response). Response weights were defined as the inverse probability of responding at phase 2 once sampled. The resulting weights were used for all analyses using the survey (svy) commands in Stata. The sociodemographic details of the TELIC and Era samples used in these analyses were initially described, with differences in terms of potential confounding variables (sex, age, rank, and service branch) examined with Pearson chi-squared statistics. The associations between deployment status and each health and social functioning outcome were explored by multivariable logistic regression. Multivariable models considered sex, age (as a continuous variable), rank, and service branch as covariates. All the presented tables include weighted percentages and odds ratios (including 95% confidence intervals) together with unweighted cell counts.

Ethics and role of the funding source

The cohort study of UK military personnel was approved by the Ministry of Defence Research Ethics Committee and King's College Hospital's local research ethics committee.

RESULTS

Of the 3,076 Reservists invited to participate in this study, 1,588 (51.6%) returned completed initial questionnaires. As found in every study of military populations of which we are aware, lower response rates were associated with male gender, younger age, and not being a commissioned officer (8). As expected, a number of Reservists (*n* = 154) who were initially sampled as part of the Era group deployed on a TELIC operation in the period between sampling and completing the baseline questionnaire. In addition, 6 individuals sampled as part of the TELIC group claimed not to have served on this deployment. In line with previous studies using this cohort, these individuals were reassigned accordingly, resulting in a final cohort of 956 Reservists in the TELIC group and 632 in the Era group.

As outlined in Figure 1, between completing the initial questionnaire in 2004/2006 and undertaking the follow-up in 2007/2009, 151 (9.5%) Reservists (from both the TELIC and the Era group) had deployed on further operations to Iraq or Afghanistan. In order to allow a clear focus on the longer

Table 2. Association Between Deployment Status and Various Health Outcomes Among Reservists at Phase 1 and Phase 2 Follow-up in the King's Centre for Military Health Research Cohort Study, 2003–2009^a

Health Outcome at Follow-up	Era ^b Sample (n = 391)				TELIC ^b Sample (n = 552)					
	No.	% ^c	OR	95% CI	No.	% ^c	Unadjusted OR	95% CI	Adjusted OR ^d	95% CI
Common mental disorder ^e										
Phase 1	56	14.6	1	Referent	143	26.1	2.06***	1.46, 2.91	2.08***	1.47, 2.93
Phase 2	72	19.0	1	Referent	117	21.7	1.18	0.85, 1.64	1.15	0.82, 1.61
Probable PTSD ^e										
Phase 1	8	2.2	1	Referent	33	6.3	3.01**	1.36, 6.64	2.91**	1.34, 6.31
Phase 2	7	2.0	1	Referent	26	5.1	2.62*	1.12, 6.16	2.42*	1.04, 5.62
Alcohol misuse ^e										
Phase 1	29	7.6	1	Referent	57	10.8	1.48	0.92, 2.37	1.39	0.87, 2.22
Phase 2	23	5.9	1	Referent	50	9.5	1.67	1.00, 2.79	1.54	0.92, 2.58
Fair or poor general health										
Phase 1	38	9.9	1	Referent	73	13.3	1.39	0.92, 2.12	1.54*	1.01, 2.36
Phase 2	52	13.5	1	Referent	77	13.9	1.04	0.71, 1.52	1.14	0.77, 1.69

Abbreviations: CI, confidence interval; OR, odds ratio; PTSD, probable post-traumatic stress disorder.

* $P < 0.05$; ** $P < 0.01$; *** $P < 0.001$ using logistic regression.

^a Phase 1, average of 16 months after return from deployment; phase 2, average of 4.8 years after return from deployment.

^b "Era" and "TELIC" are designations for United Kingdom military personnel who did not and did deploy during the 2003 phase of the Iraq War, respectively.

^c Percentages are adjusted to take account of response weights.

^d Adjusted for gender, age (as continuous variable), rank, and service. All odds ratios also take account of response weights.

^e Common mental disorder defined by a total 12-item General Health Questionnaire score of 4 or more, PTSD as a 17-item National Centre for PTSD Checklist of 50 or more, and alcohol misuse as a score of 16 or more on the World Health Organization Alcohol Use Disorders Identification Test (AUDIT) questionnaire.

term consequences of a single deployment in 2003, these individuals were excluded. Of the 1,437 Reservists remaining, 943 (65.6%) participated in the phase 2 follow-up assessment. Loss of follow-up between phase 1 and phase 2 was not associated with gender, rank, service, or deployment status. However, younger Reservists were less likely to be followed up at phase 2 ($P < 0.001$). Importantly, mental health status at phase 1 was not associated with loss to follow-up by phase 2. A description of this final sample and a comparison of the demographics of the 2 groups are provided in Table 1.

Table 2 demonstrates the association between deployment in 2003 and a variety of health outcomes. At the time of the phase 1 questionnaire (an average of 16 months after possible deployment), deployment to Iraq was associated with over twice the odds of case-level common mental disorder (adjusted odds ratio = 2.08, 95% confidence interval (CI): 1.47, 2.93), nearly 3 times the odds of probable PTSD (adjusted odds ratio = 2.91, 95% CI: 1.34, 6.31), and being more likely to rate their general health as fair or poor (adjusted odds ratio = 1.54, 95% CI: 1.01, 2.36). By the time of phase 2 follow-up (an average of 4.8 years after possible deployment), those who had deployed were no longer at increased risk for either case-level symptoms of common mental disorder or poor self-rated general health. However, at phase 2, those who deployed continued to have

over twice the odds of reporting symptoms suggestive of PTSD (adjusted odds ratio = 2.42, 95% CI: 1.04, 5.62).

The associations between deployment and social functioning at follow-up are outlined in Table 3. At phase 2 follow-up, there were no differences in the levels of social participation and the extent of social networks between Reservists who deployed and those who didn't. Deployment was also not associated with any increase in leaving the military over the follow-up period. However, Reservists who deployed were more likely to report actual or serious consideration of permanent separation from their partner (adjusted odds ratio = 1.58, 95% CI: 1.06, 2.35). More than 1 in 5 of the deployed Reservists who were in a relationship at phase 1 ($n = 93$, 22.8%) reported actual or serious consideration of permanent separation by phase 2. Post-hoc analysis suggested that the persistently elevated rates of probable PTSD among the deployed group of Reservists may be important in explaining some of the increased risk of separation. The inclusion of PTSD symptoms (PCL score) into the model reduced the effect of deployment on partner separation to nonsignificant levels (results not shown).

DISCUSSION

This is the longest prospective study of UK, US, or any other coalition Reservist force deployed to Iraq in 2003.

Table 3. Association Between Deployment Status and Social Functioning in Reservists at Phase 2 Follow-up in the King's Centre for Military Health Research Cohort Study, 2003–2009^a

Health Outcome at Follow-up	Era ^b Sample (n = 391)				TELIC ^b Sample (n = 552)					
	No.	% ^c	OR	95% CI	No.	% ^c	Unadjusted OR	95% CI	Adjusted OR ^d	95% CI
Actual or serious consideration of permanent separation from partner ^e	46	15.5	1	Referent	93	22.5	1.62*	1.09, 2.39	1.58*	1.06, 2.35
Low level of social participation ^f	84	21.9	1	Referent	123	22.5	1.03	0.75, 1.42	1.03	0.75, 1.43
Limited social network ^f	95	24.4	1	Referent	132	24.2	0.99	0.73, 1.34	0.99	0.73, 1.35
Left the military	184	47.6	1	Referent	235	43.0	0.83	0.64, 1.08	0.84	0.64, 1.11

Abbreviation: OR, odds ratio.

* $P < 0.05$ using logistic regression.

^a Phase 2, average of 4.8 years after return from deployment.

^b "Era" and "TELIC" are designations for United Kingdom military personnel who did not and did deploy during the 2003 phase of the Iraq War, respectively.

^c Percentages are adjusted to take account of response weights.

^d Adjusted for gender, age (as continuous variable), rank, and service. All odds ratios also take account of response weights.

^e Analysis limited to those in a relationship at phase 1 ($n = 722$).

^f Low level of social participation defined by membership or participation in less than 2 of 10 possible groups or organizations. Limited social network defined by less than 3 close friends or relatives with whom they meet and/or talk to regularly (bottom quartile for both).

The results from phase 1 of this study confirm that, among Reservists, deployment is associated with higher levels of common mental disorder and PTSD and poorer levels of general health in the period immediately after deployment. However, some of the psychological and social consequences of deployment appear to be transient, and there was no evidence of a "ticking time bomb" of postdeployment mental health problems in this sample, with no signs of increasing psychiatric problems in the years following deployment. By 5 years postdeployment, Reservists who had deployed to Iraq were no more likely to suffer from case-level symptoms of common mental disorder or to report poor levels of general health. The increased risk of PTSD, however, was more chronic, with deployed Reservists continuing to have over twice the level of probable PTSD as Reservists who had not deployed. Although longer term levels of social participation and social networks did not appear to be adversely affected by deployment, Reservists who had deployed remained at increased risk of marital problems 5 years after returning from Iraq.

As noted above, the longitudinal nature of this study and the relatively long follow-up time represent a significant advance on previously published studies. However, this study has some important limitations. Military personnel, and in particular Reservists, represent a difficult mobile group to engage in long-term studies, primarily because of difficulties in maintaining contact (26). Although the response rate was maximized by using extensive tracing methods and all analyses were weighted for response weights (27), we acknowledge some sampling bias with young men being underrepresented in our sample. While acknowledging the limitations associated with a reduced response rate, we note that prospective studies of military

populations have always proved to be very difficult and that our response rate was higher than that obtained in other longitudinal studies of military personnel (28). We have also previously shown that nonresponse in our sample is mainly related to practical issues, such as difficulty tracing individuals or apathy of participants (26, 27). Another possible source of bias is the "healthy warrior effect," where any impact of deployment may be disguised because of healthier individuals being more likely to deploy (29). However, the observation of particularly low levels of mental health problems, especially PTSD, among the Era group of Reservists suggests that this is unlikely to have been a major problem. Reclassification of those selected as part of the Era group but who deployed prior to entering this study was necessary to ensure accurate description of each individual's exposure to deployment. This reclassification has been used in previous publications using these data and does not appear to have any impact on important associations (8). However, the deployment status of these participants relies on self-report. Although the consideration of social functioning, in addition to standard health assessments, is a strength of this study, the measures used to assess levels of social participation and the size of social networks have not been validated. While similar measures have been used in previously published studies and appear to capture important aspects of social functioning (30), there were no previously validated cutoff scores to use in this analysis. In contrast, the mental health measures used in this study were validated and are widely used (19, 22, 23), although we acknowledge that they are reliant on self-report and cannot be considered the equivalent of a clinical diagnosis. Finally, there are 3 further potential limitations of the sampling and analysis strategies used in this study.

The limited sample size available for this study may have resulted in type 2 errors because of a lack of power to detect the small or subtle effects of deployment. Additionally, the exclusion of personnel who deployed to Iraq or Afghanistan after phase 1 may have biased the sample and prevents the examination of the effects of multiple deployment. However, this sampling allowed detailed, long-term examination of a single deployment, and post-hoc sensitivity analyses including individuals who had redeployed did not demonstrate any significant alternations from the results presented. Finally, it should be noted that no information was available regarding the detection and possible treatment of disorders between the 2 assessments, meaning that we are unable to comment on the impact of treatment on the long-term outcomes reported in this study.

Our finding that deployment to Iraq was associated with higher rates of mental and general health problems is in keeping with findings from previous studies examining both UK and US Reservists (8–10, 18), although as with previous studies, overall rates of PTSD were lower than in US studies (13). The transient nature of some of these difficulties and the lack of any expansion in postdeployment mental health problems between the first and fifth year after returning from Iraq are important new findings. Some previous studies had found that rates of mental health problems rise during the first year after Reservists returned from deployment (9, 10), although not all studies found this effect, and the trajectory of symptoms after this time was previously unknown (13, 27). The results presented in this paper suggest that, among UK Reservists, rates of mental health problems do not continue to rise after the initial postdeployment year and that, over a 5-year period, levels of common mental disorder return to similar levels found in those who did not deploy. As noted above, rates of postdeployment PTSD in studies of UK military personnel have tended to be lower than those reported among US soldiers (13). There are a variety of deployment, cultural, and health-care related factors that may be important in explaining these differences and, as such, the generalizability of these findings to US and other coalition Reservists remains unclear.

Although the apparent transient nature of the increased risk of common mental disorders and some aspects of social functioning is reassuring, the prolonged increased levels of PTSD are more worrying. Although the numbers of individuals reporting symptoms suggestive of PTSD were relatively low and did not appear to be increasing, the level of distress and functional impairment associated with such symptoms is considerable (31). The observation of high levels of PTSD symptoms many years after combat exposure is not without precedent. A recent review of veterans from the Vietnam War demonstrated that 19% had developed combat-related PTSD during their lifetimes and that 9% were still suffering from PTSD 11–12 years after their deployment (32). Post-hoc analysis of the data used in our study showed that the persistent elevation in levels of PTSD symptoms may not be due solely to chronic symptoms among early sufferers. Of those with symptoms suggestive of PTSD at the initial postdeployment assessment, only 41% still had case-level symptoms at 4.8 years of follow-up, with almost half of the cases of probable PTSD

at the later follow-up appearing to be due to new or late-onset symptoms. This apparent shift may be an artifact, with some test-retest unreliability around the cutoff score for caseness. However, the notion of some late PTSD cases and the persistence of the risk for PTSD among those that deployed add to speculation that delayed-onset PTSD may be a problem among a minority of military personnel (33, 34). The persistently elevated risk of PTSD also adds weights to recent, less trauma-focused models of PTSD, which highlights the role of posttrauma “daily stressors” in partially mediating the relation between war exposure and later psychological distress (35).

In conclusion, we have demonstrated that, 5 years after returning from deployment to the Iraq War, the majority of UK Reservists do not have evidence of mental illness and are functioning well. Reservists who deployed were at increased risk of common mental disorders and perceived poor general health, but this effect was transient. Those who deployed remained at increased risk of PTSD and relationship problems 5 years after returning from Iraq. Although broadly reassuring, our results demonstrate that some of the psychological effects of combat deployments are enduring and highlight the necessity for Reservists who have deployed to have structures in place that facilitate appropriate monitoring and support targeted to those most in need.

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