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The Contribution of Prior Psychological Symptoms and Combat Exposure to Post Iraq Deployment Mental Health in the UK Military

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This study assessed the contribution of baseline psychological symptoms, combat exposure, and unit support in the etiology of posttraumatic stress disorder (PTSD), and psychological distress. From 2004–2006, 67% of a random sample of 2,820 participants who had been assessed for psychological symptoms in 2002 were reassessed. Baseline psychological symptoms, combat exposure, and unit support factors were associated with the outcomes and the effect sizes for combat exposure were marked for PTSD symptoms. Adjustment for baseline psychological symptoms did not modify the pattern of association of group cohesion and combat exposures. The authors concluded that combat exposure and group cohesion have an effect on mental health outcomes independent of previous mental health status, which explains why screening prior to deployment is ineffective.

Vulnerability factors and combat exposures contribute to the etiology of posttraumatic stress disorder (PTSD; Brewin, Andrews, & Valentine, 2000; Ozer, Best, Lipsey, & Weiss, 2003), mood disorders, and multiple physical symptoms (Breslau, Davis, Peterson, & Schultz, 2000; Hodge et al., 2004; Hotopf et al., 2006; Norris, Maguen, Litz, Adler, & Britt, 2005). The relative importance of vulnerability and combat exposure factors in these disorders has been difficult to gauge because most studies have been based on cross-sectional design. Recall bias is an important limitation in the interpretation of the results of cross-sectional studies, as the mental state of participants can influence the reporting of vulnerability and exposure factors (Brewin, et al., 2000; Ozer et al., 2003; Wessely et al., 2003). Although useful for assessing the evolution of mental disorders over time, longitudinal studies that started at the time of a military deployment are not free of recall bias (Levav et al., 1979; Schnurr, Lunney, & Sengupta, 2004; Orcutt, Erickson, & Wolfe 2004; Toomey et al., 2007), as information on vulnerability factors was collected after combat exposure and its ensuing mental health repercussions, if any. Studies that collected information before deployment should be less problematic in relation to recall bias as information on vulnerability was collected before the alleged traumatic experience. This type of longitudinal study is rare, but those available, have shown that psychological problems before trauma are associated with combat-related psychiatric symptoms (Bramsen, Dirkzwager, & van der Ploeg, 2000; Kaplan et al., 2002; Schnurr, Friedman, & Rosenberg, 1993; Smith et al., 2008).

Only a minority of persons exposed to a traumatic experience develop psychological symptoms (Hoge et al., 2004; Wessely, 2005; Yehuda & McFarlane, 1995). Among those who develop

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PTSD, many also develop depressive symptoms (Blanchard, Buckley, Hickling, & Taylor, 1998; Breslau, Davis, Peterson, & Schultz, 2000; Erickson, Wolfe, King, King, & Sharkansky, 2001; Shalev et al., 1998). Breslau and colleagues (2000) have shown that preexisting depression increases the risk of PTSD following a traumatic experience in a civilian population. A similar overview has been supported, albeit using cross-sectional data, in a large U.S. military study (Toomey et al., 2007). The interrelation from one type of pathology to another is important because mood problems are common in military studies that have assessed the effect of deployment on mental health (Hoge et al., 2004; Hotopf et al., 2006; Ikin et al., 2005; Toomey et al., 2007).

Several studies have established that the intensity of combat is associated with PTSD and other psychological symptoms (Barrett, Gray, Doebbeling, Clauw, & Reeves, 2002; Hoge & Castro, 2006; Hoge et al., 2004; Hotopf et al., 2006; Iversen et al., 2008; Levav et al., 1979; Unwin et al., 1999; Wolf, Brown, & Kelly, 1993). However, the contribution of combat activity to psychological symptoms may have been exaggerated because information was not available on prior mental health (Norris et al., 2005).

During deployment, networks of social support fulfill a role. Resilience can increase because people can see a wider purpose to accepting risk, for example, as reported during the London Blitz in the World War II (Jones, Hyams, & Wessely, 2003; Wessely, 2005), or because resources within the military such as leadership and reliance on comrades could increase self-efficacy and mitigate the effects of potential stressors (Britt & Dickinson, 2006; Maguen & Litz, 2006). We have already shown in a large cross-sectional study that these factors lowered the risk of PTSD (Iversen et al., 2008).

In 2002, before the Iraq war started, we carried out a study to assess the suitability of screening for psychological symptoms in the British Armed Forces (Rona, Jones, French, Hooper, & Wessely, 2004; Rona, Hooper, Jones, French, & Wessely, 2004). A proportion of those in our study were subsequently deployed to Iraq. Between 2004 and 2006 we contacted those who participated in our initial study including those who had deployed to Iraq (Rona et al., 2006). This prospective design enabled us to assess the contribution of psychological symptoms before deployment, combat exposures and protective factors during deployment, and sociodemographic background, in the etiology of PTSD and psychological distress. Thus, we were able to assess (a) whether risk factors during deployment and mental health outcomes were, to some extent, accounted for by previous mental health, and (b) whether psychological distress, PTSD symptoms, physical symptoms, and the perception of health at baseline were associated with a specific mental health outcome later on. This study design would minimize recall bias in relation to vulnerability factors and allowed us to compare results with an U.S. study, which used a similar approach (Smith et al., 2008).

METHOD

Participants

In 2002, two groups were randomly selected to receive either a full screening questionnaire or an abridged questionnaire to assess psychological health (Rona et al., 2004). The selection of these groups was based on units of the Naval Services (Royal Navy and Royal Marines), Army, and Royal Air Force by their relative strengths. We used a multistage approach: first randomly selecting 100 units, then randomly selecting 45 individuals from each of these units. Altogether 4,500 men and women were selected for the study (Rona et al., 2004). In the follow-up stage we contacted the 2,820 of the 2,873 subjects who had completed the initial questionnaire, and for whom follow-up details were available, to complete a second questionnaire between June 2004 and March 2006. Of the 53 not contacted 9 had died and the rest exited the Armed Forces before the Iraq war. The participants had at least three opportunities to complete the questionnaire (Rona et al., 2006).

Operation TELIC is the code name used to describe the United Kingdom deployment to the Iraq war. Personnel deployed between January 18 and April 28, 2003 belonged to TELIC 1; if they were deployed after April 28, they belonged to TELIC 2 or later; if they were not deployed to the Iraq War but were in service at the time they were included in the Era sample and used as a reference group. We distinguish TELIC 1 and TELIC 2 or later in the analysis because the range of exposures would differ in the two groups. We distinguished between Era participants who had been on another major deployment (Era deployed), and Era participants who had not (Era not deployed). The cohort sample includes only regular personnel.

Measures and Procedures

Participants received one of two questionnaires in the 2002 survey (baseline). The full questionnaire (baseline) included the civilian version of the PTSD Checklist (PCL; Blanchard, Jones-Alexander, Buckley, & Forneris, 1996); the General Health Questionnaire 12 (GHQ-12) as a measure of psychological distress (Goldberg & Williams, 1988); 15 physical symptoms selected from a previously used questionnaire to represent symptoms of high, intermediate, and low prevalence in previous studies (Unwin et al., 1999); and a self-assessment of health status from the SF-36 (Ware, Snow, Kosinski, & Gandek, 1993). The abridged 2002 questionnaire included 14 out of 17 items of the PCL, a selection of 4 items from the GHQ-12 following published criteria (Jacobsen, Hasvold, Høyer, & Hansen, 1995), 5 of the 15 symptoms of the full questionnaire (chest pain; pain on passing urine; fatigue; joint stiffness; and pain, without swelling or redness, in several joints) and the question on self-perception of health from the SF-36. The PCL items omitted were "trouble remembering important parts of

a stressful experience," "feeling distant or cut-off from other people," and "having difficulty concentrating." The abridged questionnaire was designed to assess whether its use would improve response rate at baseline (Rona et al., 2004). In the case of the PCL, we omitted one item from each of the three domains and in the case of physical symptoms we preserved proportionality of high, intermediate and low prevalence of symptoms. Caseness in the full questionnaire was defined as a score of 50 or more for PCL, score of 4 or more for GHQ-12, five or more mild or a combination of mild or moderate physical symptoms, three or more moderate physical symptoms or at least one severe symptom, and those endorsing fair or poor health. The equivalent for the abridged questionnaire was 41 or more for PCL, two or more for GHQ-4 and at least three mild or moderate symptoms or at least one severe physical symptom for physical symptoms. Using data from those who completed the full questionnaire and using the responses to the full PCL, GHQ, and physical symptom versions as the gold standard the sensitivity for the embedded 14-item PCL was 94% (95% CI: 78–99%), for the GHQ-4 was 94% (95% CI: 89–96%), and the five physical symptoms was 45% (95% CI: 38–52%). The equivalent percentages for specificity were 99.5% (95% CI: 98.9–99.8%), 99.1% (95% CI: 98.3–99.5%), and 99.1 (95% CI: 98.3–99.5%). A comparison of those who completed the full with those who completed the abridged questionnaire found no evidence of a difference in the prevalence of caseness using the 14-item PCL (0%, 95% CI–1.2 to 1.2%) or the GHQ-4 (0.9%, 95% CI–2.0 to 3.9%), but the five physical symptom criterion identified a higher prevalence of caseness in the full questionnaire (3.8%, 95% CI–2.1 to 5.5%). The performance of the shortened PCL and GHQ versions was similar to the full versions, but the five physical symptoms assessment was less satisfactory, thus we decided to use it only as independent variable in the analysis.

The follow-up questionnaire included the full version of the same psychological scales used in the baseline study, as in a larger cross-sectional study (Hotopf et al., 2006). The deployment exposures and perception of unit support questions are shown in Tables 1–3. These questions were based on those used in the Land Combat Study (Hoge et al., 2004) and the U.S. Deployment Experiences Survey (Iversen et al., 2008). For those not deployed, information on combat exposure and unit support was not asked in the questionnaire. Information was obtained on gender, age, rank, the number of previous deployments, and in the baseline study, medical downgrading, an assessment of fitness and employability in the UK military.

Data Analysis

Multiple logistic regressions were carried out with PCL and GHQ in the second survey as outcomes. We did two analyses: one based on the total sample and another restricted to those deployed to Iraq only, using questions common to the full and abridged baseline questionnaires for both. We used robust between-cluster estimates of variance for cluster-correlated data with baseline units as the clusters (Williams, 2000). The method allows the variance to be heteroscedastic, both between and within clusters, and allows for an arbitrary dependence structure among observations within a cluster. We present results of regression analyses comparing two models for each outcome: Model 1, assessing the effects of combat exposure and measures of unit support, deployment status, service, rank, and possible confounders (age, sex, and number of recent deployments at baseline); Model 2, adding to the first model baseline PCL, GHQ caseness, physical symptoms, and self-perception of health. The aim of Model 2 was to assess the impact of baseline psychological status and physical symptoms on outcomes independent of other factors, and to ascertain if the inclusion of these factors attenuated the associations of unit support and combat exposure variables on the outcomes. The PCL and GHQ variables used in the analyses for baseline and follow-up measures were the same. Those who deployed, but did not provide answers to the combat exposure questions, were excluded from the analyses. We included in the analyses deployed and nondeployed personnel to provide a larger number in the reference group, allowing a more precise estimation of the risk factor effects. As the questions on unit support have five alternatives, we dichotomized them considering the intermediate category as a "no." The effects of the unit support and combat exposure variables were estimated in those subjects who were deployed. The effect of deployment was estimated separately. Combat exposure variables tended to be correlated with each other, as were unit support variables. Thus within each of these groups of variables we did not adjust for each of the other variables in the group. In addition to the 95% CI for each variable in the regression model, we also evaluated the significance of combat exposure variables as a group, and unit support variables as a group. We also carried out multiple regression analyses using continuous outcome measures for PCL and GHQ scores, avoiding making an assumption about suitable threshold for caseness and increasing statistical power. We focused the analyses on main effects because the sample size was too small to assess effect modifications with precision. Effect sizes were based on odds ratios (OR) as follows: small OR = <2.00, moderate = 2.00 to 3.99, and high = ≥ 4.00, or their reciprocals in relation to unit support variables. All analyses were performed using Stata software (Stata Corporation, College Station, TX).

RESULTS

There were 1,885 (67%) responders out of the 2,820 invited to participate in this follow-up survey, but between 89 and 95 deployed servicemen were excluded because of missing data on deployment related exposures. The responders in this study represented the relative strength of each service. The distribution of demographic characteristics and psychological problems between responders and nonresponders at follow-up was similar, except that responders were slightly older (responders 33.0 years and nonresponders

Table 1. New Onset and Persistent PTSD and GHQ Caseness According to Combat Experience and Unit Support. Values Are Numbers (Percentages)

	Not PTSD at baseline		PTSD at baseline		Total		Not GHQ case at baseline		GHQ case at baseline		Total	
	n	New onset at follow-up	*n*	Persistent status at follow-up	*n*	PTSD at follow-up	*n*	New onset at follow-up	*n*	Persistent status at follow-up	*n*	GHQ case at follow-up
Total	1828	47 (2.6)	45	12 (26.7)	1873	59 (3.2)	1496	199 (13.3)	377	153 (40.6)	1873	352 (18.8)
Not deployed	975	29 (3.0)	28	9 (32.1)	1003	38 (3.8)	780	101 (12.9)	224	99 (44.2)	1,004	200 (19.9)
Deployed (to Iraq and elsewhere)	853	18 (2.1)	17	3 (17.6)	870	21 (2.4)	716	98 (13.7)	153	54 (35.3)	869	152 (17.5)
Deployed to Iraq	657	14 (2.1)	13	1 (7.7)	670	15 (2.2)	557	74 (13.3)	111	40 (36.0)	668	114 (17.1)
Thought might be killed	351	12 (3.4)	11	3 (27.3)	362	15 (4.1)	285	51 (17.9)	77	28 (36.4)	362	79 (21.8)
Saw personnel wounded or killed	230	11 (4.8)	8	3 (37.5)	238	14 (5.9)	186	34 (18.3)	52	21 (40.4)	238	55 (23.1)
Came under small arms fire	196	11 (5.6)	5	3 (60.0)	201	14 (7.0)	167	30 (18.0)	34	14 (41.2)	201	44 (21.9)
Came under mortar, SCUD or artillery fire	295	10 (3.4)	6	1 (16.7)	301	11 (3.7)	249	32 (12.9)	51	19 (37.3)	300	51 (17.0)
Experienced hostility from civilians	316	12 (3.8)	9	2 (22.2)	325	14 (4.3)	253	45 (17.8)	71	31 (43.7)	324	76 (23.5)
Was in forward area in close contact with enemy	314	12 (3.8)	8	3 (37.5)	322	15 (4.7)	259	37 (14.3)	63	22 (34.9)	322	59 (18.3)
Felt comradeship with others in unit	664	10 (1.5)	14	2 (14.3)	678	12 (1.8)	561	69 (12.3)	118	37 (31.4)	679	106 (15.6)
Could go to most people in unit with personal problems	370	5 (1.4)	5	0 (0.0)	375	5 (1.3)	314	35 (11.1)	60	14 (23.3)	374	49 (13.1)
Seniors were interested in what I did or thought	465	7 (1.5)	8	1 (12.5)	473	8 (1.7)	398	43 (10.8)	76	23 (30.3)	474	66 (13.9)
Felt well informed about what was going on	478	7 (1.5)	10	1 (10.0)	488	8 (1.6)	416	42 (10.1)	72	24 (33.3)	488	66 (13.5)

Note. PTSD = Posttraumatic stress disorder; GHQ = General Health Questionnaire.

31.4 years) and a higher percentage of commissioned officers than other ranks completed the questionnaire (22.5% of responders and 17.5% of nonresponders). Firing a weapon in direct combat, coming under mortar attack, and spending time in a forward area were more common in TELIC 1, but experiencing hostility from civilians was more frequently reported in TELIC 2 and later (not shown). Those who had been deployed on a major operation other than Iraq reported a lower rate of combat exposures, except for experiencing a landmine strike.

With few exceptions, PTSD at follow-up was more common for most combat exposures and unit support characteristics in those who had PTSD at baseline (Table 1). Likewise GHQ caseness at follow-up was more common in those who were already cases at baseline (Table 1). "Saw personnel wounded or killed," "came under small arms fire," and "was in forward area in close contact with the enemy" were associated with a higher PTSD prevalence than were other types of exposure.

Most combat exposures were positively associated with PTSD at follow-up (Table 2). The effect size of the associations was particularly large for "discharge weapon in combat," "saw personnel wounded or killed," "came under small arms fire," "experienced landmine strike," and "was in a forward area and in close contact with enemy." Unit support variables as a group were borderline nonsignificant, but "sense of comradeship with others" was negatively associated with PTSD at follow-up and the effect size was large. Rank below commissioned officer was positively associated

Table 2. The Association of Vulnerability (Psychological Symptoms at Baseline Including Full and Abridged Questionnaires), Unit Support, and Deployment Exposures With PTSD at Follow-Up ($N = 1{,}791$)[a]

	Model 1[b]			Model 2[b]		
	OR (95% CI)	χ^2	(df)		χ^2	(df)
Psychological symptoms (baseline)						
PTSD				3.6 (1.4–9.5)	6.86**	(1)
GHQ caseness				3.1 (1.5–6.3)	10.18**	(1)
Physical symptoms				2.0 (0.8–4.6)	2.40	(1)
Self-perception of health				1.4 (0.6–3.2)	0.64	(1)
Unit support[c]		9.27	(4)		8.40	(4)
Sense of comradeship with others in unit	0.1 (0.0–0.5)			0.1 (0.0–0.5)		
Could go to most people in unit with personal problems	0.3 (0.1–1.5)			0.3 (0.1–1.6)		
Seniors were interested in what I did or thought	0.4 (0.1–1.5)			0.4 (0.1–1.5)		
Felt well informed about what was going on	0.4 (0.1–1.4)			0.4 (0.1–1.5)		
Combat exposure[c]		58.51***	(10)		58.43***	(10)
Discharged weapon in combat	17.5 (4.9–62.8)			14.4 (4.2–49.2)		
Thought might be killed	4.4 (1.2–15.5)			4.1 (1.1–15.3)		
Saw personnel wounded or killed	9.3 (3.4–25.7)			8.9 (3.2–24.8)		
Handled bodies	1.5 (0.2–11.5)			1.6 (0.4–7.3)		
Aided wounded	1.8 (0.7–4.8)			1.8 (0.8–4.1)		
Came under small arms fire	12.2 (4.0–36.8)			15.3 (4.9–47.9)		
Came under mortar, SCUD or artillery fire	4.7 (1.3–17.5)			4.3 (1.2–15.2)		
Experienced landmine strike	10.7 (3.3–34.6)			7.7 (1.6–36.5)		
Experienced hostility from civilians	2.5 (1.1–5.7)			2.7 (1.0–6.8)		
Was in a forward area and in close contact with enemy	9.3 (2.8–31.6)			10.4 (3.0–36.2)		
Deployment status		5.60	(3)		3.25	(3)
Era	1.0			1.0		
Era-deployed	0.5 (0.1–3.7)			0.5 (0.1–3.6)		
TELIC 1	0.1 (0.0–0.9)			0.1 (0.0–1.4)		
TELIC 2 or later	0.3 (0.1–1.9)			0.4 (0.1–2.4)		
Service		0.34	(2)		1.13	(2)
Army	1.0			1.0		
Royal Navy	1.0 (0.4–2.5)			1.2 (0.5–3.0)		
Royal Air Force	1.3 (0.5–3.1)			1.6 (0.7–4.1)		
Rank below officer	5.1 (1.2–21.1)	4.97*	(1)	3.7 (0.9–15.8)	3.13	(1)

Note. PTSD = Posttraumatic stress disorder; GHQ = General Health Questionnaire.

[a]Deployed personnel who did not provide answers to the combat exposure questions were excluded from the analysis. [b]Models 1 and 2 adjusted for the variables in the table, and baseline number of deployments, sex, medically downgraded status, and age. In addition, psychological symptoms at baseline were included in Model 2. [c]χ^2 value shows contribution of all group cohesion variables or combat exposures to the regression model. Odds ratios show the effect of an individual group cohesion variable or combat exposure as if this is the only group cohesion variable or combat exposure in the model.

$^{*}p < .05$. $^{**}p < .01$. $^{***}p < .001$.

with PTSD at follow-up. The addition of psychological health at baseline (Model 2) decreased only slightly the impact of combat exposure and unit support on PTSD at follow-up. Posttraumatic stress disorder and GHQ caseness at baseline were associated with PTSD at follow-up and the effect sizes were moderate.

When we repeated the analysis of PTSD using PCL scores, the unit support variables made a statistically significant contribution in addition to the combat exposure variables and baseline psychological symptom variables (results not shown). Analyses of the binary PTSD outcome restricted to those who were deployed to Iraq produced similar results to the unrestricted analyses, but with wider confidence intervals (results not shown).

Several measures of combat exposure and unit support were associated with GHQ caseness at follow-up (Table 3). The effect size of each of the combat exposure and unit support items was

Table 3. The Association of Vulnerability (Psychological Symptoms at Baseline Including Full and Abridged Questionnaires), Unit Support, and Deployment Exposures With GHQ Caseness at Follow-Up ($N = 1{,}790$)[a]

	Model 1[b]			Model 2[b]		
	OR (95% CI)	χ^2	(df)		χ^2	(df)
Psychological symptoms (baseline)						
PTSD				3.3 (1.7–6.5)	12.67***	(1)
GHQ caseness				3.2 (2.4–4.3)	61.62***	(1)
Physical symptoms				1.8 (1.3–2.6)	11.02***	(1)
Self-perception of health				1.3 (0.9–2.0)	1.82	(1)
Unit support[c]		18.26**	(4)		15.80**	(4)
Sense of comradeship with others in unit	0.6 (0.4–0.9)			0.6 (0.4–0.9)		
Could go to most people in unit with personal problems	0.6 (0.4–0.8)			0.6 (0.4–0.8)		
Seniors were interested in what I did or thought	0.6 (0.4–1.0)			0.6 (0.4–1.0)		
Felt well informed about what was going on	0.6 (0.4–0.9)			0.6 (0.4–0.9)		
Combat exposure[c]		15.64	(10)		15.54	(10)
Discharged weapon in combat	1.0 (0.5–2.1)			0.8 (0.4–1.7)		
Thought might be killed	1.7 (1.1–2.5)			1.5 (1.0–2.3)		
Saw personnel wounded or killed	1.7 (1.1–2.5)			1.6 (1.1–2.4)		
Handled bodies	1.3 (0.7–2.4)			1.0 (0.6–1.9)		
Aided wounded	1.7 (1.0–3.0)			1.5 (0.8–2.7)		
Came under small arms fire	1.5 (1.0–2.3)			1.6 (1.1–2.5)		
Came under mortar, SCUD or artillery fire	1.1 (0.7–1.7)			1.1 (0.7–1.8)		
Experienced landmine strike	3.8 (1.2–12.2)			3.9 (1.1–13.6)		
Experienced hostility from civilians	1.8 (1.1–3.0)			1.6 (1.0–2.7)		
Was in a forward area and in close contact with enemy	1.2 (0.8–1.7)			1.1 (0.8–1.7)		
Deployment status		0.83	(3)		1.47	(3)
Era	1.0			1.0		
Era-deployed	1.2 (0.7–2.1)			1.3 (0.7–2.3)		
TELIC 1	1.0 (0.6–1.9)			1.2 (0.6–2.2)		
TELIC 2 or later	1.1 (0.7–2.0)			1.4 (0.8–2.4)		
Service		1.10	(2)		3.33	(2)
Army	1.0			1.0		
Royal Navy	1.1 (0.8–1.7)			1.2 (0.8–1.9)		
Royal Air Force	1.2 (0.9–1.6)			1.3 (1.0–1.9)		
Rank below officer	1.9 (1.3–2.9)	10.43***	(1)	1.7 (1.1–2.6)	6.30*	(1)

Note. PTSD = Posttraumatic stress disorder; GHQ = General Health Questionnaire.

[a]Deployed personnel who did not provide answers to the combat exposure questions were excluded from the analysis. [b]Models 1 and 2 adjusted for the variables in the table, and baseline number of deployments, sex, medically downgraded status, and age. In addition, psychological symptoms at baseline were included in Model 2. [c]χ^2 value shows contribution of all group cohesion variables or combat exposures to the regression model. Odds ratios show the effect of an individual group cohesion variable or combat exposure as if this is the only group cohesion variable or combat exposure in the model.

$^{*}p < .05$. $^{**}p < .01$. $^{***}p < .001$.

small. As a group unit support, but not combat exposure, was significantly associated with GHQ caseness at follow-up. The inclusion of psychological symptoms at baseline did not change the pattern of associations in Model 1. Posttraumatic stress disorder, GHQ caseness, and physical symptoms at baseline were associated with GHQ caseness at follow-up. When GHQ score was analyzed, just as was the case with the binary GHQ outcome, the unit support variables made a statistically significant contribution, as did baseline psychological symptom variables, but not combat exposure variables (results not shown). Analyses of the binary GHQ outcome restricted to those who were deployed to Iraq found that the overall contribution of combat exposure variables was significant, but the overall contribution of unit support variables was not (results not shown).

DISCUSSION

This prospective study has shown that psychological symptoms at baseline, factors related to combat exposure, and unit support play a role in the etiology of PTSD symptoms and psychological distress (GHQ caseness) in the context of the Iraq War. Posttraumatic stress disorder, GHQ caseness, and to a lesser extent physical symptoms at baseline made an independent contribution to psychological symptoms at follow-up, but only slightly decreased the associations of combat exposure and unit support with psychological symptoms at follow-up both when using a binary or a continuous score outcome. Many combat exposure items were highly associated with PTSD, but fewer were associated with psychological distress. Unit support was a protective factor for psychological distress in the total sample.

In our analysis, the independent factors would broadly correspond to the classification of predictors used by Brewin and colleagues (2000) as (a) a person's previous history as psychological symptoms before the TELIC deployment and sociodemographic factors, (b) trauma severity as perceived combat exposure and deployment status, and (c) social support as unit support. However, we have used sociodemographic factors such as sex, age, rank, and service as confounding factors following the framework used by Ozer and colleagues (2003).

Baseline psychological health has an effect on PTSD symptoms and psychological distress at follow-up. Others have reported these associations, but they were unable to exclude recall bias; in other words, it remained possible that retrospective accounts reflected current mental status (Adler, Vaitkus, & Martin, 1996; King, King, Foy, Keane, & Fairbank 1999). In longitudinal studies, many psychological symptoms including previous PTSD have been shown to be associated with PTSD (Bramsen et al., 2000; Brewin et al., 2000; Levev et al., 1979; Macklin et al. 1998; O'Toole, Marshall, Schureck, & Dobson, 1998; Schnurr et al., 1993; Smith et al., 2008). Although the precise variables are not the same, our results given in Table 1 are equivalent to the results of the Millennium Cohort (Smith et al., 2008). In our study the associations with PTSD were more related to some specific combat exposures than deployment status, indicating that experiences during deployment may have triggered PTSD symptoms, especially being in close contact with the enemy. In our study, the GHQ caseness as a measure of psychological distress would be a proxy for depression and physical symptoms a measure of somatization. Thus, our study confirms that many previous psychological symptoms may, in part, explain PTSD symptoms following a traumatic experience. There is transferability of psychological features over time. This has been shown by Norris and colleagues (2005) who demonstrated that PTSD symptoms before deployment were associated with physical symptoms as an outcome. Our findings can be extended to psychological distress and PTSD.

Rank and service were associated with our psychological measures as outcomes, but they would be poor predictors of PTSD, as already shown by Brewin and colleagues (2000) in relation to military studies.

In this analysis we have shown that combat and associated perceived exposures during TELIC operations were related to PTSD and psychological distress, as was shown for PTSD in a larger Iraq War study, carried out simultaneously (Iversen et al., 2008), but adds to that study by demonstrating that combat exposure variables remain associated with PTSD after adjusting for baseline psychological symptoms. This persistent association was only marginal for psychological distress.

There are several possible interpretations of our findings. First, baseline psychological symptoms may correspond to an ongoing issue unrelated to combat exposures. Second, although baseline psychological symptoms are part of the chain of events in relation to perceived combat exposure, the great majority of those with the outcome of interest are new cases. Third, the majority of soldiers with psychological symptoms experience recurrent rather than persistent symptoms; thus, they may have been missed as cases in our baseline assessment. Our findings may explain the contrasting results of Hoge, Auchterlonie, and Milliken (2006) showing a high prevalence of PTSD and other mental illness with those of Hotopf and colleagues showing lower prevalence. The Hoge et al. study focused on combat troops in Iraq, whereas Hotopf and colleagues (2006) included all services and trades (combat and non-combat). However, it is worth noting that when we compare the prevalence of PTSD in our study with that in the Millennium Cohort the differences in the prevalence of PTSD was less marked (Smith et al., 2008).

It has been shown that unit support is conducive to task motivation and enthusiasm to achieve military goals (Britt & Dickinson 2006; Maguen & Litz, 2006). In a companion study (Iversen et al., 2008), group cohesion was associated with PTSD, and in this study was associated with psychological distress and to a lesser extent, with PTSD. We have demonstrated that adjustment for psychological symptoms at baseline decreases only marginally the association between perception of unit support and mental health problems. It is worth noting that for most of the last century our results would have been seen as confirming the conventional wisdom—that soldiers are supported by and support the small group in which they live and fight, and that breakdown becomes more likely when they cease to be part of that group (Wessely, 2006). However, though the emergence of the diagnosis of PTSD has had many benefits, not least as an impetus to research trauma, it has also meant that this perspective has become less prominent.

The main strength of this study is its longitudinal design; it is one of the few to have available information on psychological symptoms before preparation for a recent major deployment (Bramsen et al., 2000; Kaplan et al., 2002; Schnurr et al., 1993; Smith et al., 2008). Those who were followed-up had a similar distribution in relation to gender, rank, and Service to those who did not participate in the follow-up phase and to the UK Armed

Forces as a whole. However, those who were followed-up were slightly older.

A note of caution in our interpretation of results is that recall bias may explain some of our results as our outcomes at follow-up were assessed simultaneously with the items on combat exposure and unit support. It is possible that the mental state of those completing the follow-up questionnaire has influenced their perceptions of unit support and combat exposure. This limitation is common to studies in the military, but we are in the advantageous position of at least being able to adjust for previous psychological symptoms. Another limitation of our study, in common with most longitudinal studies, is attrition. The response rate in this study was reasonably high in comparison to other studies (Barrett et al., 2002). Although underreporting symptoms is possible in serving personnel, such behavior would be similar in deployed and nondeployed personnel. Thus, the net effect would make it more difficult to reject the null hypothesis. The results of the logistic regression analysis of PTSD should perhaps be interpreted with caution because of the small number of cases ($n = 59$) relative to the number of effects being estimated. However, the same associations with combat exposure variables were also found in a linear regression analysis of PCL score.

Our results are consistent with the view that multiple factors, including prior psychological health, are involved in the etiology of PTSD following a traumatic exposure. This helps in understanding why predeployment screening for a specific feature, such as PTSD, would be unlikely to prevent PTSD cases in combat (Bliese, Wright, Adler, & Thomas, 2006; Rona et al., 2006). We have clearly shown that the strongest predictor of PTSD is trauma itself, as also shown by others (Dohrenwend et al., 2006; Hoge et al., 2006; Hotopf et al., 2006; O'Toole et al., 1998). The effect of combat exposure was more specific to PTSD as the effect size was considerably larger than for psychological distress.

An effort to increase unit support may play a role in preventing psychological symptoms. Prior psychological symptoms are associated with subsequent psychological symptoms, but do not explain the associations between combat experience and mental health, especially PTSD.

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