Journal of Traumatic Stress
June 2020, *33,* 285–295

ISTSS International Society for Traumatic Stress Studies

Effect of Predeployment Psychiatric Diagnoses on Postdeployment Long-Term Sickness Absence and Mental Health Problems Among Danish Military Personnel

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Military personnel may withhold information on mental health problems (MHPs) for fear of not being permitted to deploy. Past or current MHPs may, however, increase the risk of postdeployment MHPs. Using psychiatric diagnoses rather than self-report assessments in predeployment screening may be a more effective screening strategy for determining deployment fitness. This retrospective follow-up study investigated (a) the extent to which predeployment childhood and adult psychiatric diagnoses predicted postdeployment MHPs, measured as psychiatric diagnosis and the purchase of psychiatric drugs, and long-term sickness absence among formerly deployed Danish military personnel and (b) whether perceived combat exposure moderated or mediated the effect of predeployment psychiatric diagnoses. Complete data were available for 7,514 Danish military personnel who answered questions on perceived combat exposure between 6–8 months after returning from their first deployment to the Balkans, Iraq, or Afghanistan. Data on all psychiatric diagnoses given at Danish hospitals, all medicine purchases, and all sickness absences were retrieved from nationwide research registers. Personnel with predeployment psychiatric diagnoses had a statistically significant higher risk for both postdeployment long-term sickness absence, hazard ratio (HR) = 2.06, 95% CI [1.52, 2.80]; and postdeployment MHPs, HR = 2.38, 95% CI [1.73, 3.27], than personnel without a predeployment psychiatric diagnosis. Personnel with a predeployment psychiatric diagnosis demonstrated a higher risk of reporting high levels of perceived combat exposure. Perceived combat exposure was not found to moderate or mediate the effect of a predeployment psychiatric diagnosis on the two outcomes. Additional findings, limitations, and implications are discussed.

Military personnel returning from deployments to conflict areas are at an increased risk of developing mental health problems (MHPs) compared with both their own baseline levels (Hoge, Auchterlonie, & Milliken, 2006; Hoge et al., 2004) and to nondeployed military personnel (Ramchand, Karney, Osilla, Burns, & Caldarone, 2008). One frequently studied potential risk factor for the development of postdeployment MHPs is predeployment MHPs (Ramchand, Rudavsky, Grant, Tanielian, & Jaycox, 2015; Xue et al., 2015). Although there is increasing evidence that predeployment MHPs constitute a risk factor for postdeployment posttraumatic stress disorder (PTSD) (Brewin, Andrews, & Valentine, 2000; Xue et al., 2015), a limited amount of evidence has indicated that disallowing deployment on the basis of predeployment MHPs may effectively reduce the risk of postdeployment MHPs (Jones, Hyams, & Wessely, 2003; Rona et al., 2006; Warner, Appenzeller, Parker, Warner, & Hoge, 2011). Notably, predeployment screening and rejection based on MHPs takes place in several countries, including the United States and Canada. One possible reason that predeployment screening and rejection has been found to be ineffective may be that predeployment screening methodologies primarily rely on self-administered questionnaires and interviews (Jones et al., 2003; Nevin, 2009; O'Donnell, Dell, Fletcher, & Forbes, 2014), and military personnel who wish to deploy may withhold information they think may jeopardize their deployment (Nevin, 2009).

The present research was supported by a research grant at the Frederiksberg and Bispebjerg Hospital.

[The copyright line for this article was changed on 3 October, 2020 after original online publication.]

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DOI: 10.1002/jts.22498

The Danish Defense conducts a similar predeployment screening program for MHPs that is based on a short interview. However, in 2016, Danish media reports documented several cases in which military personnel had had severe MHPs before being deployed, which has led to calls for improved screening of deployed personnel (Ritzau, 2016). Using clinical psychiatric diagnoses registered before deployment as a screening tool might be a more reliable screening strategy than self-administered questionnaires and interviews. Some studies have found deployed military personnel with predeployment psychiatric diagnoses to be at increased risk of subsequent MHPs (Crain, Larson, Highfill-McRoy, & Schmied, 2011; Lyk-Jensen, Weatherall, & Jepsen, 2016; Schmied, Highfill-McRoy, Crain, & Larson, 2013; Taubman, 2009). Crain et al. (2011) found U.S. Marines with predeployment psychiatric diagnoses to be 3.6 times more likely to have postdeployment MHPs compared with marines with no predeployment psychiatric diagnoses. Similarly, Lyk-Jensen and colleagues (2016) found that deployed Danish soldiers who used mental health services before the age of 18 years were at a higher risk for postdeployment MHPs compared to those who had not used such services. However, none of these studies adjusted for level of combat exposure during deployment, which is a major risk factor for postdeployment MHPs. A recent study that included data from 434 Danish military personnel deployed to the Balkans, Iraq, or Afghanistan found that, after adjusting for perceived combat exposure (PCE), there was no statistically significant effect for having received psychological treatment before deployment (Møller et al., 2019). Furthermore, a meta-analysis by Xue et al. (2015) demonstrated that factors related to combat and traumatic events during deployment were much stronger predictors of PTSD than predeployment MHPs. For example, the risk of PTSD was found to be higher for individuals who had discharged a weapon, odds ratio (OR) = 4.32; 95% CI [2.60, 7.18], than for those who reported predeployment psychological problems, $OR = 1.49$, 95% CI [1.22, 1.82]. Other studies have also found moderating effects in the relation between prior trauma exposure, deployment trauma, and the existence of postdeployment MHPs (Searle et al., 2017; Vest, Hoopsick, Homish, Daws, & Homish, 2018). However, to our knowledge, only one study has investigated whether PCE moderates the effect of predeployment MHPs on postdeployment MHPs (Searle et al., 2017). The authors of that investigation found no such moderation, but the study only measured postdeployment MHPs shortly after homecoming. Thus, further research is necessary to corroborate these findings.

It is possible that combat exposure can have both mediating and moderating effects on the relation between predeployment psychiatric diagnoses and postdeployment MHPs (Brewin et al., 2000). A moderating effect could be the case if the co-occurrence of predeployment psychiatric diagnoses and combat exposure had a synergistic effect on postdeployment MHPs. Such an effect has been found between childhood and combat trauma on lifetime drug use (Vest et al., 2018). A mediating effect could be the case if predeployment MHPs caused military personnel to perceive events during deployment as more traumatic, leading to more postdeployment MHPs. Identifying either type of effect may help inform screening policies both before and after deployment.

To date, most studies in this area have used self-report measures to estimate the effect of deployment on mental health, and such measures may be subject to recall and information bias (Nissen et al., 2016; Xue et al., 2015). Using register data may limit such biases (Johannesdottir et al., 2012). Two frequently used types of outcomes in health research are clinically registered diagnoses (Schmidt et al., 2015) and sickness absence (Stapelfeldt, Jensen, Andersen, Fleten, & Nielsen, 2012). Although sickness absence may be caused by many types of social and health-related problems, MHPs are the leading cause of sickness absence in Europe, and several types of MHPs have been found to strongly predict long-term sickness absence (LTSA; Thorsen, Rugulies, Hjarsbech, & Bjorner, 2013; van Hoffen, Joling, Heymans, Twisk, & Roelen, 2015). Furthermore, because MHPs frequently go untreated and undiagnosed (Cully et al., 2008), cases of LTSA may reflect MHPs that have not been registered elsewhere.

The aims of this retrospective cohort study were therefore to investigate (a) the extent to which a predeployment clinical psychiatric diagnosis would predict postdeployment LTSA and postdeployment MHPs among deployed Danish military personnel and (b) possible mediation and moderation effects of PCE on the relation between predeployment psychiatric diagnoses and postdeployment LTSA and MHPs. We tested four hypotheses. First, based on the literature, we expected that military personnel who had a predeployment psychiatric diagnosis would have an increased risk of postdeployment LTSA and MHPs compared with personnel without a predeployment psychiatric diagnosis. Second, we expected to find an increased risk of both outcomes, regardless of whether the latest predeployment psychiatric diagnosis was received during childhood or adolescence or during adulthood. A study by Taubman (2009) demonstrated that the recency of the last predeployment psychiatric diagnosis was a strong predictor of postdeployment psychiatric diagnosis. Therefore, establishing whether childhood and adolescent diagnoses as well as adult diagnoses are associated with an increased risk for postdeployment MHPs is important to inform future screening programs. Third, we further hypothesized that personnel with a predeployment psychiatric diagnosis would report higher levels of PCE than those without a predeployment psychiatric diagnosis. Finally, we hypothesized that the level of PCE would influence the relation between predeployment psychiatric diagnosis and both postdeployment LTSA and MHPs through moderation or mediation.

Method

Participants and Procedure

The study population was defined by merging two data sources: (a) the Psychological Reactions following International Missions (PRIM) questionnaire, which since 1998 has

been sent to Danish army military personnel 6 months after their return from deployment on an international mission and (b) The Danish Veteran Centre's Deployment Database, which contains information on all international deployments of Danish military personnel since 1992. Approximately 14,000 Danish army personnel, representing a response rate of approximately 65%, responded to the PRIM questionnaire regarding deployments from 1997 to 2013 (Nissen et al. 2017). A total of 8,278 individuals answered the PRIM questionnaire after being deployed to their first international mission to the Balkans, Iraq, or Afghanistan and could be matched with a deployment date in the Deployment Database. There were 29 individuals who were excluded because they answered the PRIM questionnaire two or more times during the same year, with no indication which questionnaire matched their first deployment. A total of 532 individuals were excluded because they were redeployed before answering the PRIM questionnaire. A further three individuals were excluded because their follow-up time started after the end of follow-up in the Psychiatric Central Register (PCR). Finally, 200 potential participants were excluded because of missing data on either PCE, socioeconomic status (SES), or marital status.

A total of 7,514 military personnel deployed between January 1997 and December 2011 were included in the analyses. The majority (65.2%) of the included participants had been deployed to the Balkans, 14.3% to Iraq, and 20.5% to Afghanistan. Only 6.8% of the sample were women, 89.4% of participants were unmarried, more than two-thirds were less than 25 years of age at first deployment, and 74.3% were employed and had a low SES. A total of 3.0% had received a psychiatric diagnosis prior to their first deployment; of these individuals, 63.0% received one or more psychiatric diagnoses before turning 18 years of age, but none thereafter. Most participants in the sample reported a low PCE level, with a median score of 9 on the Exposure to Danger and Combat Scale (EDCS; total possible scale range: 6–24). Table 1 displays the differences in the characteristics between the individuals who received a predeployment psychiatric diagnosis and those who did not. The odds of having received a predeployment psychiatric diagnosis were 1.64 times higher for women compared with men, $OR = 1.64$, 95% CI [1.06, 2.53], and more military personnel with a first deployment to Afghanistan had received a predeployment psychiatric diagnosis compared with personnel with a first deployment to the Balkans, $OR = 2.56$, 95% CI [1.92, 3.42].

Information on the study population's pre-, peri-, and postdeployment factors were retrieved from the PRIM questionnaire and the Deployment Database as well as from six nationwide health and administrative registers. The national personal identification number (i.e., a unique number assigned to all individuals who reside or work in Denmark) linked the registers to the study population. Because the PRIM questionnaire is filled out 6–8 months after homecoming (Karstoft, Andersen, & Nielsen, 2017), the study population was followed in the registers beginning 8 months after they returned from their first deployment. This study was registered according to the rules of the Danish Data Protection Agency. According to Danish law, studies based exclusively on questionnaires and register data require no approval by a research ethics committee.

Measures

Predeployment psychiatric diagnosis. Information on predeployment psychiatric diagnosis was retrieved from the PCR and the Danish National Patient Register (NPR). The PCR contains information on all inpatient admissions to psychiatric wards since 1970, and outpatient and emergency room activities have also been included since 1995 (Mors, Perto, & Mortensen, 2011). The NPR contains information on diagnoses given to inpatients on all Danish somatic wards since 1978. Since 1995, all diagnoses given to outpatients, emergency room contacts, and contacts with psychiatric wards have been included in the register (Lynge, Sandegaard, & Rebolj, 2011; Schmidt et al., 2015). Until 1993, diagnoses were registered using the eighth version of the *International Classification of Disease* (*ICD-8*), and from 1994 onward, the 10th revision of the *ICD* (*ICD-10*) has been used. All main (i.e., first-listed) psychiatric diagnoses were included except for diagnoses related to isolated episodes of excessive drinking. The codes used to identify psychiatric diagnoses were *ICD-8* codes 290.09–315.99, except code 303.90 (i.e., for a drunkenness event), and *ICD-10* codes F00– F999, except for group F100 (i.e., for acute alcohol intoxications; see the Supplementary Materials for more details). Events of drunkenness and acute alcohol intoxication were excluded as these diagnoses do not necessarily entail addiction (Søndergaard et al., 2015). To distinguish the possible differences between the effect of childhood or adolescent diagnoses and diagnoses given to adults, a three-category predictor variable was created containing the following categories: 0 (*no predeployment psychiatric diagnosis*), 1 (*psychiatric diagnosis before age 18 years*), and 2 (*psychiatric diagnoses at/after age 18 years*). The age of 18 years is the age of majority in Denmark and is commonly used to delineate childhood and adolescent psychiatric diagnoses from adult psychiatric diagnoses (see e.g. Thorup et al., 2017).

Perceived combat exposure (PCE). Information on participants' PCE was taken from the EDCS that is based on six items assessing exposure to combat and aggression. The EDCS has recently been validated using Rasch models (Karstoft, Nielsen, & Nielsen, 2018). The total EDCS score ranges from 6 to 24, with higher scores indicating more perceived exposure to danger and combat during deployment. The continuous version of the EDCS was used in most analyses, and for the current sample, Cronbach's alpha was .75. However, for some analyses, the EDCS scores were divided in thirds using tertiles, resulting in category groups comprising low (6–7), medium (8–9), and high scores (10–24).

Postdeployment mental health problems. Postdeployment MHPs were measured as whether individuals received

Table 1
Demographic Characteristics and Predeployment Psychiatric Diagnosis

	Predeployment psychiatric diagnosis[a]					
	No		Yes			
Characteristics	*n*	%	*n*	%	*OR*	95% CI
Sex						
Male	6,797	97.1	203	2.9	1.00	
Female	490	95.3	24	4.7	1.64	[1.06, 2.53]*
Age group (years)						
< 22	2,775	96.7	94	3.3	1.00	
22–24	2,329	97.2	66	2.8	0.83	[0.61, 1.15]
≥ 25	2,183	97.0	67	3.0	0.91	[0.66, 1.25]
Marital status[b]						
Nonmarried	6,519	97.0	201	3.0	1.00	
Married	768	96.7	26	3.3	1.10	[0.73, 1.66]
Ethnicity[c]						
Danish or Western	7,224	97.0	224	3.0	1.00	
Non-Western	63	95.5	3	4.5	1.54	[0.48, 4.93]
SES[d]						
High	292	97.0	9	3.0	1.00	
Medium	501	98.4	8	1.6	0.52	[0.20, 1.36]
Low; employed	5,399	96.7	183	3.3	1.10	[0.56, 2.17]
Low; transfer income	1,095	97.6	27	2.4	0.80	[0.37, 1.72]
Deployment area						
Balkan	4,790	97.8	109	2.2	1	
Iraq	1,039	96.9	33	3.1	1.40	[0.94, 2.07]
Afghanistan	1,458	94.5	85	5.5	2.56	[1.92, 3.42]***

Note. SES = socioeconomic status.
[a]Excluding *ICD-8* code 303.90 and *ICD-10* code group F100. [b]Registered as of January 1 on the year of deployment. [c]Western countries include the European Economic Area, Andorra, Monaco, San Marino, Switzerland, Vatican City State, Canada, United States, Australia, and New Zealand. [d]SES from the year prior to deployment.
*$p < .05$. **$p < .01$. ***$p < .001$.

a psychiatric diagnosis or purchased any antidepressant, anxiolytic, hypnotic, or sedative drug from a Danish pharmacy after the start of the follow-up. Information on psychiatric diagnoses was retrieved from the NPR and the PCR, and we used the same diagnoses and diagnosis codes we used to assess predeployment psychiatric diagnoses. Information on psychiatric drug purchases was obtained from the Danish National Prescription Register, which contains data on all prescription drugs sold in pharmacies in Denmark since 1995. In Denmark, the purchase of psychiatric drugs requires a prescription from a medical doctor. Although having received a prescription for a psychiatric drug does not constitute absolute evidence of a mental health problem, it is a strong indicator of the presence of such a problem. The following anatomical therapeutic chemical classification codes were used: antidepressants (group N06A), anxiolytics (group N05B), and hypnotics and sedatives (group N05C).

Postdeployment long-term sickness absence (LTSA). Data on sickness absence were obtained from the Danish Register for Evaluation of Marginalization, which contains information on all transfer payments in Denmark per weekly since 1991 and includes sickness benefits. We defined LTSA as a period of more than 8 weeks of receiving a sickness benefit.

Demographic and deployment-related variables. Data on sex, birth year, deployment year, job function, deployment area, and deployment unit were retrieved from the Deployment Database. A deployment era variable was generated and included as a potential confounder in the analyses to control for differences in changes over time in types of conflict and changes in the use of psychiatric medicine and diagnoses. The deployment era variable was generated by arbitrarily splitting deployment year into 3-year periods: 1997–1999, 2000–2002, 2003–2005, 2006–2008, and 2009–2011. Data on ethnicity and predeployment marital status were retrieved from the Population Statistics Register, and data on predeployment SES were retrieved from the Employment Classification Module.

Data Analysis

Logistic regression was used to test for differences in the characteristics of military personnel with versus without a

predeployment psychiatric diagnosis. Hazard ratios (*HR*s) were calculated using Cox proportional hazard (PH) regression analyses to investigate our first hypothesis—namely, whether predeployment psychiatric diagnoses would predict (a) time to postdeployment LTSA and (b) time to postdeployment MHPs. The follow-up in these and all other Cox PH regression analyses ended with the occurrence of either the event of interest, any subsequent deployment or death, or the end of the follow-up in the relevant registers, which was June 21, 2015, for LTSA and December 10, 2012, for MHPs. Because the effects of the first deployment may extend well beyond any subsequent deployments, sensitivity analyses were conducted, in which the follow-up continued through subsequent deployments. We tested our second hypothesis, that there would be an increased risk of both outcomes in individuals with a previous diagnosis regardless of whether the latest predeployment psychiatric diagnosis was received during childhood or adolescence or during adulthood, with two Cox PH regression analyses that included the same outcomes but used the three-category predeployment psychiatric diagnosis variable as a predictor. Our third hypothesis, that individuals with a predeployment psychiatric diagnosis would report higher levels of PCE, was tested using multinomial logistic regression analysis in which the three-category version of the PCE variable was the dependent variable and the binary predeployment psychiatric diagnosis variable was the independent variable. To further explore this association, we also conducted an originally unplanned logistic regression analysis to test whether individuals with a predeployment psychiatric diagnosis were more likely to be deployed in combat units than in logistic, administrative, or other noncombat units. Our fourth hypothesis stated that PCE would either moderate or mediate the relation between predeployment psychiatric diagnosis and the two outcomes. Moderation was tested by entering an interaction term into the Cox PH regression models, where the binary version of the predeployment psychiatric diagnosis was the predictor. Furthermore, the moderation effect was portrayed in a stratified table, with separate hazard ratios calculated for each stratum.

To examine whether PCE mediated the effect of predeployment psychiatric diagnosis on the two outcomes, we used the product-of-coefficients method, which tests the indirect effect of predeployment psychiatric diagnoses on PCE and of PCE on the two outcomes (Preacher & Hayes, 2008). To investigate the path from predeployment psychiatric diagnosis to PCE, data on PCE were dichotomized using the median as a cutoff. The estimate of the indirect effect and bias-corrected 95% confidence intervals were bootstrapped using 10,000 resampling iterations. In addition, we estimated the percentage of excess risk mediated (PERM) (Global Burden of Metabolic Risk Factors for Chronic Diseases Collaboration (BMI Mediated Effects), 2014; Lin, Fleming, & De Gruttola, 1997) by PCE as:

$$\text{PERM (PCE)} = 100 \times \frac{\text{HR(confounder adjusted)} - \text{HR(confounder and mediator adjusted)}}{\text{HR(confounder adjusted)} - 1}$$

To assess the uncertainty of PERM, confidence intervals were calculated by bootstrap resampling of 10,000 samples, estimating PERM for each sample and calculating the 2.5th and 97.5th percentile of the PERMs.

Adjustment for sex, age group, marital status, SES, PCE, deployment area, and deployment era was conducted in all Cox PH regression analyses that included the estimations of PERM. Due to the small number of military personnel with a non-Western background, adjustment for ethnicity could not be conducted in the PERM analyses. Fulfilment of the PH assumption was assessed for each independent variable included in the Cox PH regression models by testing for independence between scaled Schoenfeld residuals and time. If the PH assumption was not met for one or more independent categorical variables, stratification on these was conducted instead. If the PH assumption was not met for the continuous variable PCE, the follow-up time was split into appropriate periods for which the PH assumption was met. Investigation of the PH assumption was not conducted in the calculation of PERM. All statistical analyses were conducted in R (Version 3.5.1) and SPSS (Version 24).

Results

A total of 831 individuals in the sample fulfilled the criteria for LTSA during follow-up. There was considerable overlap between postdeployment LTSA and postdeployment MHPs—34.1% of included military personnel with postdeployment LTSA also had an MHP during follow-up, compared with just 6.2% among those without postdeployment LTSA. The risk of postdeployment MHPs was 7.8 times higher among individuals with postdeployment LTSA, $OR = 7.84$, 95% CI [6.58, 9.34]. The numbers of postdeployment psychiatric diagnoses and medicine purchases observed during follow-up are shown in Table 2. The diagnoses and medicine purchases accrued over an average follow-up time of 4.8 years. A total of 9.3% of the sample had either received a psychiatric diagnosis or purchased an antidepressant, anxiolytic, hypnotic, or sedative drug during follow-up. The use of one of these psychiatric drugs was 3.5 times more common than receiving a psychiatric diagnosis postdeployment. Antidepressants were purchased by 6.3% of the sample and were the most frequently purchased type of drug. The most common group of diagnoses given were "reactions to severe stress and adjustment disorders," which were received by 1.3% of the sample. Of the 186 individuals who received a postdeployment psychiatric diagnosis, 74.2% also purchased an antidepressant, anxiolytic, hypnotic, or sedative drug.

Table 3 shows the relation between PCE and the two outcomes, postdeployment LTSA and MHPs, stratified by predeployment psychiatric diagnosis. In total, 19.4% of individuals with a predeployment psychiatric diagnosis had LTSA and 18.1% had an MHP during follow-up; the rates for personnel without a predeployment psychiatric diagnosis were 10.8% and

Table 2
Postdeployment Psychiatric Diagnoses and Medicine Purchases Among 7,514 Deployed Danish Military Personnel

Postdeployment psychiatric diagnoses and medicine purchase	*n*	%
All personnel with psychiatric diagnoses[a]	186	2.5
Mental and behavioral disorders due to psychoactive substance use[a] (F10–F19)	20	0.3
Mood (affective) disorders[b] (F32–F39)	46	0.6
Agoraphobia, social phobias, and other anxiety disorders (F400, F401, F41)	11	0.1
Reaction to severe stress, and adjustment disorders (F43)	96	1.3
Other mental and behavioral disorders[a]	64	0.9
All personnel having purchased antidepressants, anxiolytics, hypnotics, or sedatives	648	8.6
Antidepressants (N06A)	475	6.3
Anxiolytics (N05B)	113	1.5
Hypnotics and sedatives (N05C)	230	3.1
All personnel with psychiatric diagnoses or medicine purchase	696	9.3

Note. Some personnel had more than one mental and behavioral disorder and used more than one psychiatric drug. See supplementary materials for more details on the included diagnoses.
[a]Excluding acute alcohol intoxications (F100). [b]Excluding manic episode (F30) and bipolar affective disorder (F31).

9.0%, respectively. This finding also demonstrates that among individuals with a predeployment psychiatric diagnosis, 80.6% experienced no LTSA and 81.9% experienced no MHP during follow-up. When the two outcomes were combined, 71.4% of included personnel with a predeployment psychiatric diagnosis experienced neither LTSA or an MHP during follow-up compared with 83.8% among personnel without a predeployment psychiatric diagnosis. Among personnel with both a predeployment psychiatric diagnosis and a high level of PCE, 20.9% had postdeployment LTSA and 18.3% had postdeployment MHPs during follow-up.

Effect of Predeployment Psychiatric Diagnosis on Postdeployment Long-Term Sickness Absence and Mental Health Problems

Table 4 shows the results of the Cox PH analyses for the binary predeployment psychiatric diagnosis variable. Individuals who had received a predeployment psychiatric diagnosis were found to have a statistically significant higher risk of both postdeployment LTSA, $HR = 2.06$, 95% CI [1.52, 2.80]; and postdeployment MHP, $HR = 2.38$, 95% CI [1.73, 3.27], compared with personnel without a predeployment psychiatric

Table 3
Relations Among Perceived Combat Exposure (PCE), Postdeployment Long-Term Sickness Absence, and Postdeployment Mental Health Problems in Deployed Danish Military Personnel With and Without Predeployment Psychiatric Diagnosis

	Postdeployment long-term sickness absence						Postdeployment mental health problems					
	No		Yes				No		Yes			
Predeployment psychiatric diagnosis and PCE	*n*	%	*n*	%	*HR*[a]	95% CI	*n*	%	*n*	%	*HR*[a]	95% CI
No												
Low	1984	90.0	220	10.0	1.00		2029	92.1	175	7.9	1.00	
Medium	2009	88.9	252	11.1	0.95	[0.78, 1.15]	2046	90.5	215	9.5	1.02	[0.82, 1.25]
High	2507	88.8	315	11.2	1.22	[0.99, 1.49]	2557	90.6	265	9.4	1.30	[1.04, 1.62]*
Total	6500	89.2	787	10.8			6632	91.0	655	9.0		
Yes												
Low	46	83.6	9	16.4	1.00		47	85.5	8	14.5	1.00	
Medium	46	80.7	11	19.3	0.61	[0.22, 1.64]	45	78.9	12	21.1	1.11	[0.37, 3.28]
High	91	79.1	24	20.9	0.96	[0.38, 2.40]	94	81.7	21	18.3	1.99	[0.66, 6.02]
Total	183	80.6	44	19.4			186	81.9	41	18.1		

Note. HR = hazard ratio.
[a]Adjusted for sex, age group, ethnicity, marital status, socioeconomic status, deployment area, and deployment era.
$^{*}p < .05$. $^{**}p < .01$. $^{***}p < .001$.

Table 4
Hazard Ratios (HRs) for the Effect of Predeployment Psychiatric Diagnosis and Perceived Combat Exposure on Postdeployment Long-Term Sickness Absence and Postdeployment Mental Health Problems in Deployed Danish Military Personnel

	Postdeployment long-term sickness absence		Postdeployment mental health problems	
Variable	*HR*[a]	95% CI	*HR*[a]	95% CI
Predeployment psychiatric diagnosis				
No	1.00		1.00	
Yes	2.06	[1.52, 2.80]***	2.38	[1.73, 3.27]***
Perceived combat exposure	1.06	[1.03, 1.09]***	1.07	[1.03, 1.11]***

Note. [a]Estimates are mutually adjusted for predeployment psychiatric diagnosis and perceived combat exposure as well as for sex, age group, ethnicity, marital status, socioeconomic status, deployment area, and deployment era.
*$p < .05$. **$p < .01$. ***$p < .001$.

diagnosis. The hazard ratio of 2.38 for postdeployment MHPs shows that at any time during follow-up, the rate of postdeployment MHPs among personnel with a predeployment psychiatric diagnosis was 2.38 times that of personnel without a predeployment psychiatric diagnosis.

Table 5 shows the results of the Cox PH regression analyses with a predeployment psychiatric diagnosis before and at or after age 18 years as the predictor. For postdeployment MHP, having received a predeployment psychiatric diagnosis only before age 18 years was associated with a statistically significant hazard ratio of 1.85, 95% CI [1.18, 2.90], compared with individuals who had not received a predeployment psychiatric diagnosis. Having received a predeployment psychiatric diagnosis at or after age 18 years was associated with a statistically significant hazard ratio of 3.28, 95% CI [2.10, 5.10], for postdeployment MHPs compared with individuals who had not received a predeployment psychiatric diagnosis. For the LTSA, the hazard ratios for personnel with a predeployment psychiatric diagnosis before and at or after age 18 years were more comparable: The hazard ratio of approximately 2 was statistically significant for both groups.

Effect of Predeployment Psychiatric Diagnosis on Perceived Combat Exposure

The odds of reporting a high level of PCE were 1.63 times higher for individuals who had a predeployment psychiatric diagnosis than for those without a predeployment psychiatric diagnosis, $OR = 1.63$, 95% CI [1.18, 2.26]. Furthermore, military personnel with a predeployment psychiatric diagnosis were not more likely to be deployed in combat units compared to personnel without a predeployment psychiatric diagnosis, $OR = 0.90$, 95% CI [0.68, 1.19].

Moderation and Mediation

We did not find a statistically significant interaction term between predeployment psychiatric diagnosis and PCE on either outcome. Furthermore, among individuals without a predeployment psychiatric diagnosis, a high level of PCE, compared to a lower level, was associated with a higher risk of postdeployment MHPs (Table 3). However, among the 227 individuals who had a predeployment psychiatric diagnosis, no statistically significant differences between the PCE levels were observed.

Mediation was present for both outcomes when we tested for mediation using the product-of-coefficients method that does not adjust for potential confounders. The value of the product-of-coefficients was 0.11, 95% CI [0.03, 0.21], for postdeployment LTSA and 0.13, 95% CI [0.04, 0.25], for postdeployment MHP. Because the confidence intervals did not include zero, both mediations were statistically significant. However, when we calculated PERM, we further adjusted for sex, age group, marital status, SES, deployment area, and deployment era. In these analyses, PCE mediated neither the effect of predeployment psychiatric diagnosis on postdeployment LTSA, 3.7%, 95% CI [−0.5%, 10.0%] nor the effect on postdeployment MHP, 3.1%, 95% CI [−1.4%, 8.4%]. Because both confidence intervals for the mediations extended below 0, the mediations were statistically insignificant in these adjusted analyses.

Sensitivity Analyses

The sensitivity analyses, in which follow-up was allowed to continue past any subsequent deployments, were conducted on all analyses (Tables 3–5) and the mediation analyses. Because PCE did not fulfill the PH assumption in the models with postdeployment LTSA as an outcome, we split the time into two periods for this outcome: One period for the effect of PCE in the first 5 years and one period for the effect of PCE in any remaining time period. The results of the sensitivity analyses did not depart notably from the results presented in Tables 3–5. As PCE did not fulfill the PH assumption in the analyses with postdeployment LTSA as an outcome, we did not calculate PERM for this outcome. For postdeployment MHP, the mediation analysis generated similar results.

Table 5
Hazard Ratios (HRs) for the Effect of Predeployment Psychiatric Diagnosis Before and At or After Age 18 Years and Perceived Combat Exposure on Postdeployment Long-Term Sickness Absence and Postdeployment Mental Health Problems in Deployed Danish Military Personnel

	Postdeployment long-term sickness absence		Postdeployment mental health problems	
Variable	*HR*[a]	95% CI	*HR*[a]	95% CI
Predeployment psychiatric diagnosis				
No	1.00		1.00	
Yes <18 years	1.95	[1.32, 2.89]***	1.85	[1.18, 2.90]**
Yes ≥18 years	2.24	[1.40, 3.59]***	3.28	[2.10, 5.10]***
Perceived combat exposure	1.06	[1.03, 1.09]***	1.07	[1.03, 1.11]***

Note. [a]Estimates are mutually adjusted for predeployment psychiatric diagnosis and perceived combat exposure as well as for sex, age group, ethnicity, marital status, socioeconomic status, deployment area, and deployment era.
*$p < .05$. **$p < .01$. ***$p < .001$.

Discussion

The present findings showed a predeployment psychiatric diagnosis to be a statistically significant risk factor for both postdeployment LTSA and MHPs in Danish military personnel who were first deployed to either the Balkans, Iraq, or Afghanistan. At any time during follow-up, the rate of postdeployment LTSA for individuals who had a predeployment psychiatric diagnosis was 2.1 times that of those without a predeployment psychiatric diagnosis, and the rate of postdeployment MHPs for individuals with a predeployment psychiatric diagnosis was 2.4 times that of those without a predeployment psychiatric diagnosis. These findings add to the increasing body of literature that has identified a predeployment psychiatric diagnosis as a risk factor for postdeployment MHPs (Crain et al., 2011; Lyk-Jensen et al., 2016; Schmied et al., 2013); this is in contrast to the study by Møller and colleagues (2019) in which the authors found no statistically significant effect of having received psychological treatment before deployment, after adjustment for PCE (Møller et al., 2019). The present findings are also in line with meta-analyses that have examined risk factors for PTSD among both civilian and military populations, which have also identified prior MHPs as a risk factor (Brewin et al., 2000; Xue et al., 2015). Although LTSA may be caused by both mental and somatic health problems, the increased risk of LTSA found among personnel with predeployment psychiatric diagnoses indicates an important mental health component in LTSA for previously deployed Danish military personnel. Furthermore, the similar results found for both LTSA and MHPs and the overlap between these two outcomes strengthen the reliability of these findings.

The effect of predeployment psychiatric diagnosis on LTSA and MHPs was statistically significant both for individuals who received their predeployment psychiatric diagnoses before 18 years of age and for personnel who received such diagnoses at or after age 18. Individuals who received a diagnosis at or after 18 years of age tended to have a higher rate of postdeployment MHPs compared with those who received a diagnosis before age 18. These results are similar to the results reported by Taubman (2009), who found that the recency of the last predeployment psychiatric diagnosis strongly increased the probability of receiving a postdeployment psychiatric diagnosis.

We did not find any synergistic or other types of interaction effect between predeployment psychiatric diagnosis and PCE on postdeployment LTSA or MHPs. Notably, when we tested for differences between the three-category version of the PCE variable, we only found statistically significant differences for individuals without a predeployment psychiatric diagnosis. Several studies have investigated the interaction effects between prior trauma exposure and deployment-related trauma exposure on postdeployment mental health, with conflicting results (Searle et al., 2017). Most of these studies have, however, been cross-sectional, and the differing results may, therefore, have been caused by biased recall of past events relating to the respondents' current health status (Searle et al., 2017; Vest et al., 2018). The prospective study by Searle and colleagues also found no interaction between predeployment PTSD or depression symptoms and deployment-related trauma exposure on postdeployment PTSD or depression symptoms (Searle et al., 2017). The lack of a moderation effect could be due to the short follow-up time of the study, which assessed PTSD or depression symptoms at a time within 4 months of homecoming. Other studies have also examined the effect of predeployment MHPs on postdeployment MHPs while controlling for deployment-related trauma but have not investigated interaction effects between predeployment MHPs and PCE (O'Toole, Marshall, Schureck, & Dobson, 1998; Sandweiss et al., 2011).

The results of the present study also demonstrated that individuals with a predeployment psychiatric diagnosis had a risk of reporting a high level of PCE that was 1.63 times higher than those without a predeployment psychiatric diagnosis. A study by Wilson et al. (2008) also found that military

personnel with predeployment MHPs reported more combat-related exposures compared with those without predeployment MHPs. Taken together, these findings indicate that military personnel with predeployment psychiatric diagnoses may either perceive potentially traumatic events during deployment as more intense or have better recollections of these events (Wilson et al., 2008). However, as we found no interaction between predeployment psychiatric diagnosis and PCE, the difference in the perception of the events does not seem to affect the risk of postdeployment LTSA or MHPs.

After adjusting for potential confounders, PCE was not found to mediate the relations between predeployment psychiatric diagnoses and postdeployment LTSA or between predeployment psychiatric diagnosis and postdeployment MHPs. We found no other studies that had investigated whether PCE mediates the association between predeployment MHPs and postdeployment MHPs; thus, we cannot compare our results to the literature. However, the present results indicate that the statistically significant effects of predeployment psychiatric diagnoses and PCE on the two outcomes are largely independent of one another.

If the existence of a prior psychiatric diagnosis is revealed in the predeployment screening program conducted by the Danish Defense, the individual in question is generally not allowed to deploy. The results of the present study indicate that added screening on the basis of a registered predeployment psychiatric diagnosis, in which military personnel with such diagnosis would not have been allowed to deploy, could have reduced postdeployment LTSA from the 19.4% we found among the 227 personnel with a predeployment psychiatric diagnosis to the 10.8% that was found among those without a predeployment psychiatric diagnosis during follow-up. Similar reductions for postdeployment MHPs (18.1% to 9.0%) could also potentially be obtained. Of course, we do not know whether the 18.1% of the 227 personnel with a predeployment psychiatric diagnosis would still have experienced MHPs had they not deployed. Furthermore, because most of the 71.4% of deployed military personnel with a predeployment psychiatric diagnosis experienced neither postdeployment LTSA nor MHPs during follow-up, such a screening would also exclude many individuals with no postdeployment MHPs. Indeed, the main critique against predeployment mental health screening has been the lack of accuracy of past instruments, and in terms of the number of false positives found in the present study, the results of screening for psychiatric diagnoses were comparable to those reported in studies in which screening was based on self-report measures (Jones et al., 2003; Rona et al., 2006). Another caveat regarding screening for psychiatric diagnoses relates to the possible negative consequences on help-seeking among military personnel. A major concern among military personnel with an MHP is that seeking help would harm their career (Hoge et al., 2004). Added screening of a registered predeployment psychiatric diagnosis could, therefore, lead to reduced care-seeking for MHPs.

The present study had several limitations. First, the sample of military personnel answered the PRIM-questionnaire 6–8 months after returning from their first deployment. Whether similar results could be obtained among nonresponders could not be investigated because we had no reports on the nonresponders' combat experiences. Second, we only had information on diagnoses at Danish hospitals, and outpatient diagnoses were not registered prior to 1994. We also had no data on diagnoses from the primary health sector or on psychological treatment administered by the Danish Defense, which treats a substantial share of previously deployed military personnel each year (Madsen, Andersen, & Karstoft, 2016). This limitation may have led to some misclassification of individuals who actually had a psychiatric diagnosis but were classified as not having one. Psychological treatment by the Danish Defense of military personnel before their first deployment is rare, but the lack of data regarding postdeployment treatment by the Danish Defense most likely led to some level of misclassification in the measure of postdeployment MHPs. However, because the Danish Defense offers no medical treatment of MHPs, many cases, including the most serious, would have been referred to the public healthcare system. Third, our measure of combat exposure was based on self-report and administered 6–8 months after homecoming; it therefore may have been subject to recall bias. Other studies have found that self-report measures of combat exposure may, to some extent, be affected by the respondents' concurrent PTSD symptoms (Koenen, Stellman, & Dohrenwend, 2007; Wilson et al., 2008). This could have led to overestimations concerning the associations between PCE and the two study outcomes.

The current study also had important strengths. This retrospective cohort study included a large sample of military personnel deployed to recent international conflicts. Both pre- and postdeployment mental health measures and the measure of LTSA were based on high-quality register data, helping to avoid the risk of recall bias and underreporting due to stigma, to which many other studies have been subjected. Furthermore, although our measure of postdeployment MHPs covered an unknown portion of the actual postdeployment MHPs, our LTSA measure captured all actual LTSA during follow-up. Therefore, the similar results we found across the two outcomes strengthen the findings of this study.

In conclusion, the results of the present study demonstrate an association between predeployment psychiatric diagnoses and an increased risk for both postdeployment LTSA and MHP and suggest that screening for registered psychiatric diagnoses could have identified personnel with increased risk of postdeployment LTSA and MHPs. However, because more than 70% of the military personnel in the sample who had a predeployment psychiatric diagnosis neither had postdeployment LTSA nor MHPs, screening out personnel based on predeployment psychiatric diagnosis data is not recommended as a standalone screening strategy. Furthermore, because PCE was not found to moderate the existing negative effect of predeployment psychiatric diagnoses on postdeployment LTSA and MHPs, combat exposure does not appear to worsen the past or existing MHPs in Danish military personnel. Information on psychiatric

diagnoses may still prove useful as one component in a larger assessment as part of predeployment screening. Further research should investigate this possibility. If predeployment screening of psychiatric diagnoses is initiated, careful attention should be paid to negative externalities, such as reduced care-seeking due to increased stigma among military personnel and other possible implications of employers requiring access to military personnel mental health records.

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