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Peace and War: Trajectories of Posttraumatic Stress Disorder Symptoms Before, During and After Military Deployment in Afghanistan.

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Abstract

PTSD-symptoms in 746 Danish soldiers were measured on five occasions before, during, and after deployment to Afghanistan. Using latent class growth analysis we identify six trajectories of change in PTSD-symptoms: Two resilient trajectories had low levels across all five times, a new-onset trajectory started low and showed a marked increase of PTSD-symptoms. Three temporary-benefit trajectories, not previously described, showed decreases in PTSD-symptoms during (or immediately after) deployment followed by an increase after return. Pre-deployment emotional problems and pre-deployment traumas, especially childhood adversities, were predictors for inclusion in the non-resilient trajectories, whereas deployment-related stress was not. The findings challenge standard views of PTSD by showing (1) that factors other than immediately preceding stressors are critical for PTSD-development with childhood adversities being central, and (2) that the PTSD-symptom development shows heterogeneity, indicating the need for multiple measurements to understand PTSD and identify those in need of treatment.

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Peace and War: Trajectories of Posttraumatic Stress Disorder Symptoms Before, During and After Military Deployment in Afghanistan.

Soldiers deployed to service in war zones experience many situations involving life danger and potential injury, which may lead to Posttraumatic Stress Disorder (PTSD, American Psychiatric Association, 2000). Still, the majority (ranging from 98% to 76% across different studies and wars) returns from service without PTSD (Magruder & Yeager, 2009).

According to the current understanding, the main cause for deployment-related PTSD is exposure to combat and other war atrocities (such as coming under hostile fire or witnessing aggression against civilians). Thus, following this view, soldiers with more exposure to combat (e.g., more episodes involving fire fights with perceived life threat) and other war atrocities are more likely to develop PTSD than soldiers with less. The symptoms are assumed to follow a homogeneous pattern across individuals: For those who develop PTSD, the symptoms will show shortly after the traumatic event and persist over time. Others will show resilience by never developing symptoms or by rapidly decreasing symptom severity.

Testing this understanding requires a tracking of symptom severity at multiple occasions before, during and after deployment in war zones. However, in spite of 30 years of PTSD research, such data do not exist for combat soldiers. We here provide them for the first time for a population of Danish combat soldiers deployed to Afghanistan. We include five points of measurement, before, during and after deployment. This number of measurements is unique in the literature. Our findings challenge two important and interrelated assumptions in PTSD-research. One is the assumption of an immediately preceding traumatic event as the causal factor for PTSD-development. The other is the assumption of homogeneity in the development of PTSD-symptoms after a stressful event. We describe these two assumptions in more detail in the following.

The Assumption of a Recent Traumatic Event as the Cause for PTSD-Symptoms

According to the diagnosis (American Psychiatric Association, 2000) PTSD is preceded by a stressful event involving life danger and intense fear, horror and helplessness. Numerous studies have shown that traumatic events are indeed often followed by PTSD-symptoms (see McNally, 2003). At the same time, several studies suggest that certain predisposing factors render some individuals more vulnerable than others to the development of PTSD (Brewin, Andrews, & Valentine, 2000; Ozer, Best, Lipsey, & Weiss, 2003) and that the memory of the event rather than the event *per se* may be the main cause for the symptoms (Rubin, Berntsen, & Bohni, 2008). However, because traumatic events usually come unexpectedly, most studies have no measurements of PTSD-symptoms and potential predisposing factors *before* the traumatic event and thus suffer from a baseline problem.

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In contrast to most other victims of trauma, combat soldiers are expected to be exposed to stressful events; i.e., military deployment to war zones is likely to involve episodes with life danger, and fear. Therefore, combat soldiers can be used as a test for many assumptions associated with PTSD which otherwise would be hard to examine due to the generally unforeseen nature of traumatic events. Earlier studies of combat-related PTSD did not include pre-deployment measures, often because the deployment predated the diagnosis (e.g., Beckham et al., 1998). A few more recent studies have addressed this baseline problem by either comparing PTSD-symptoms in deployed versus non-deployed soldiers (Fear et al., 2010; Hoge, 2004; Smith, Ryan et al., 2008; Vasterling et al., 2010) or by comparing symptoms measured before deployment with PTSD-symptoms measured after return (Polusny et al., 2011; Rona et al., 2009; Smith, Ryan et al., 2008; Vasterling et al., 2010). The goal of such studies has been to identify new onsets of PTSD (i.e., cases with PTSD after, but not before, deployment) and their possible predictors. Many have found deployment and self-reported combat exposure to be associated with increased levels of PTSD-symptoms after deployment (Polusny et al., 2011; Rona et al., 2009; Smith, Ryan et al., 2008; Vasterling et al., 2010) but not all studies have found this relationship (Fear et al., 2010), and only a limited range of potential risk factors have been measured. Notably, only a few studies have included measures of early traumatic events, such as childhood abuse (Polusny et al., 2011).

The Assumption of Homogeneity in the Development PTSD-symptoms

According to the dominant understanding, the development of PTSD shows the same relatively homogeneous pattern across individuals: Those who develop PTSD will show elevated levels of symptoms immediately after the traumatic event, which will persist over time. Others will show resilience by never, or only temporarily, developing symptoms (Horowitz, 1986).

Although a few studies have challenged this view by showing heterogeneity in the pattern of symptom development (for review see Bonanno, Westphal, & Mancini, 2011) the assumption of homogeneity generally goes unchallenged because testing it requires several occasions of measurements, which most studies do not have. This limitation also applies to studies of deployment-related PTSD with pre-deployment measurements. Although these studies are a major improvement over studies with no baseline PTSD measures, most include only one pre- and one post-deployment measure. This means that possible heterogeneity in PTSD development cannot be considered, although heterogeneity has been found in US soldiers deployed to peace keeping (Dickstein, Suvak, Litz, & Adler, 2010) and in US military service members deployed to Afghanistan and Iraq (Bonnano et al., 2012). It also means that variations in symptom level during and after deployment are usually not analyzed, for which reason at least some cases identified as new onsets of PTSD may reflect a temporary increase in symptoms rather than reliable new cases. In other words, the identification of new onset cases may vary as a function of when post-deployment measures are taken (Andrews, Brewin, Stewart, Philpott, & Heidenberg, 2009; Gray, Bolton, & Litz, 2004). Studies with only two measurements are of course also unable to show curvilinear trajectories in the development of PTSD-symptoms.

The present study addresses these limitations in several important ways. We measure PTSD-symptoms in a team of soldiers deployed to Afghanistan at five different time points before, during and after deployment. We employ latent class growth modeling (Muthén & Muthén, 2000; Nagin & Land, 1993) to empirically determine statistically distinct trajectories of change in PTSD-symptoms over the five times, whereby we are able to identify resilient versus non-resilient groups, and to identify specific patterns of non-resilient PTSD developments. Furthermore, we include measures of a wide range of relevant risk factors by which we predict membership in each of six groups representing reliably different developmental trajectories.

Methods

Analysis sample and study design. The entire team of 746 Danish soldiers belonging to the Danish Contingent of the International Security Assistance Force 7 (ISAF 7) were asked to answer questionnaires addressing PTSD and measures of health and risk factors on five occasions related to a six month deployment to Afghanistan in 2009: before deployment (Pre-deployment), during deployment (Deployment), 1-3 weeks after return from deployment (Return), 2-4 months after return (Return+3 months), and 7-8 months after return (Return+7 months). [Coincidentally, soldiers from this team took part in the award-winning documentary, Armadillo, providing a graphic description of their conditions on the Helmand frontline in Afghanistan (Fridthjof & Pedersen, 2010).]

We estimated trajectories characterizing severity of PTSD-symptoms from prior to deployment to at least three months after return, to allow for the possibility of nonlinearity. We required at least three Posttraumatic Stress Disorder Checklist (PCL) scores at particular assessments. Specifically, in order to be retained in the analysis sample respondents must have provided data at the Pre-deployment assessment, at either the Deployment assessment or at the Return assessment, and at one of the assessments that took place months after their return (Return+3months or Return+7 months). Of the 746 respondents who provided data on at least one occasion, 144 (19%) did not provide PCL data at the Pre-deployment assessment and were therefore excluded from the growth analyses. An additional 235 (32%) did not provide PCL data at both assessments during and immediately after deployment or both assessments following their return home (of these, 37 were not deployed and thus only answered the Pre-deployment assessment, 2 were killed, 2 were injured during combat, 6 were injured during work, leisure activities or in traffic accidents, 5 were repatriated for psychological reasons and 11 were repatriated for other, unknown reasons). Of the remaining respondents, pre-deployment PCL data for one participant were exceptionally high. Removal of this influential case resulted in an analysis sample of 366 soldiers (24 females, mean age = 26.59 years) for whom PCL scores were available prior to deployment, during their tour in Afghanistan, and after their return home (Figure 1). PCL scores were available for all five assessments for 125 respondents. For the remainder, missing data were managed according to the strategy described below and in the Supporting Online Information.

Procedure and material. Data for the Pre-deployment assessment were collected by military psychologists 5-6 weeks before deployment during group sessions at a military camp in Denmark. The soldiers were informed about the study including the fact that their responses were anonymous, would not be accessed by their leaders in the military and would be used for research purposes only. Data for the Deployment assessment were collected in Afghanistan. All respondents had been deployed for at least two and less than five months, when they answered this set of questionnaires. The questionnaires were handed out by military personnel at Camp Bastion, Kabul International Airport, or Kandahar Airfield before the soldier went home on leave. The soldiers submitted their answers in closed envelopes in secured (locked) mail boxes. The locked mail boxes were transported to the research team in Denmark. The data for the Return assessment were collected at a standard homecoming meeting organized by military psychologists and physicians. This data collection took place 1-3 weeks after the soldiers had returned from deployment. The data for the Return+3 months assessment were collected at different military camps in Denmark, or through mail for those who had returned to civilian life, roughly 2-4 months after return from deployment. The data for the Return+7 months assessment were all collected through mail as part of a routine follow up investigation of the soldiers. This data collection took place 6-8 months after the soldiers had returned from their deployment. All respondents contacted by mail received two cinema tickets for their participation.

In order to track the soldiers across the five of sets of data collections they entered their personal ID number (CPR-number) on the front page of the questionnaires. At each data collection they were informed that this page would be separated from their responses, not entered in the database, not stored together with their responses, and that their responses would be accessed only by the research team.

The assessments included many measures, of which only some are relevant to the present analyses: Posttraumatic Stress Disorder Checklist, Civilian version (PCL; Blanchard, Jones-Alezander, Buckley, & Forneris,1996), Beck's Depression Inventory (BDI-II; Beck, Steer, & Brown, 1996), the scale for Neuroticism derived from the NEO-FFI (Costa & McCrae,1989), Traumatic Life Event Questionnaire (TLEQ; Kubany et al., 2000) with 20 items accommodated to a population of Danish soldiers, Combat Exposure Scale (Keane et al., 1989) and a Danger/Injury Exposure Scale constructed by the Danish military for the present and similar studies, consisting of 10 items measuring the degree of perceived war zone stress but not direct combat. In addition, the following single item measures were used: *Earlier Problems* addressed whether the person had previously received psychological or psychiatric treatment for any personal problems (1=yes, 0=no), *Emotional Stress* measured how often emotionally stressful situations have been experienced during deployment, range from 1 (never) to 4 (very often), *Times with Life Danger* measured frequency of experiencing one's own life being in direct danger or witnessing others' lives being in direct danger, range from 0 (never) to 6 (more than 5 times), *Wounded/Injured* addressed whether the soldier was wounded or injured during deployment (1=yes, 0=no), *Did you Kill?* addressed whether the soldier killed an enemy during deployment (1=yes, 0=no; see the Supporting Online Information).

Latent class growth modeling. The analysis sample differed only slightly from the sample of individuals excluded from the analysis, and only few differences were found between individuals with complete data and those for whom one or more values would be imputed in the statistical modeling. Importantly there were no differences in the PCL scores. We sorted the sample into the nine possible patterns of missingness and compared means or frequencies on the 56 variables. These comparisons yielded 15 small but significant differences. These variables were included as auxiliary variables in the growth models, increasing the likelihood that any systematic missingness could be treated as ignorable (Graham, 2003; see Supporting Online Information).

We used latent class growth analysis to model trajectories of PTSD-symptoms from Pre-deployment to Return+ 7 months (Kreuter & Muthén, 2007). We used FIML estimation for all models. All models included auxiliary variables (see Supporting Online Information). We included linear and quadratic terms, and estimated models assuming from 1 to 10 classes. Fit indices associated with these models are shown in Table 1.

Simulation studies suggest that the sample-sized adjusted Bayesian information criterion (BIC_{SSA}) performs best in terms of model selection based purely on statistical information. As can be seen in Table 1, the values of BIC_{SSA} favor a model with nine classes (as indicated by the increase for a model with 10 classes). Examination of the fitted curves and distribution of respondents across classes for this model suggested against it, with some curves differing only slightly and membership in some classes being very low. We examined more closely the results of models with fewer classes, focusing specifically on models with between five and eight classes. Ultimately, we selected a model with six classes, which balanced fit, interpretability, and distribution of respondents. The entropy value of this model was .91, suggesting good classification (i.e., probability near 1.0 for assignment to most probable class and near zero for assignment to other classes (see Supporting Online Information).

Results

The latent class growth modeling of PTSD-symptoms yielded six groups of PTSD-symptom trajectories, see Figure 2. The majority of the sample (n = 306, 84%) fell into one of two resilient groups showing low levels of PTSD-symptoms with no change

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over the five times (Figure 2, top panel). The other four groups deviated from the resilient groups in unique ways. We identified a New-Onset Group showing little PTSD-symptoms at Pre-deployment and Deployment, after which symptom levels increased considerably up to those normally consistent with a diagnosis of PTSD at Return+7 months (Figure 2, top panel). The remaining three groups (Figure 2, bottom panel) all showed temporary beneficial effects associated with deployment in that they all had high or moderate levels of PTSD-symptoms at Pre-deployment, which decreased either at Deployment or at Return or at Return+3 months. For all three Benefit Groups, PTSD symptom level increased again after deployment either at Return+3 months or at Return+7 months. This pattern is most pronounced in the Strong Benefit Group as compared to the Mild Benefit Group (showing the same pattern in a milder form) and the Late Benefit Group (showing a later onset of the beneficial effect).

Resilient versus non-resilient groups. Table 2 shows the means of health and risk factors for the six groups and the group differences. We first examined the overall differences between the two resilient groups versus the four non-resilient groups in a series of contrast analyses (or χ^2 tests when appropriate). The results are shown in Table 2. We then conducted a logistic regression analysis predicting resilient versus non-resilient group membership with the significant pre-deployment measures (except PTSD-symptoms, which defines the groups) and the significant stressors measured at Return as the independent variables, which showed an effect of depression (*Wald*(1)=15.17, B = -.17, p<.0001, odds ratio=.84; [95% C.I.=.77-.92]), Neuroticism (*Wald*(1)=17.53, B = -.22, p<.0001, odds ratio=.80 [95% C.I.=.72-.89]), previous traumas (*Wald*(1)=10.35, B = -.10, p<.005, odds ratio=.90 [95% C.I.=.85-.96]) and previous emotional problems (*Wald*(1)=4.76, B = -1.09, p<.05, odds ratio=.34 [95% C.I.=.13-.90]).

Of interest is how each of the four non-resilient groups uniquely differed from the resilient groups. We use the Resilient Group as our comparison because this group is similar to the New-Onset Group with regard to pre-deployment PTSD-symptom level, age, military rank, and number of combat soldiers; and similar to the three benefit groups with regard to age, military rank, number of combat soldiers and years spent in the military (see Table 2 and below).

Resilient versus New-Onset group. The New-Onset Group is of key theoretical interest for understanding the development of PTSD because it includes soldiers with no PTSD before deployment but high symptom-levels after return. This group differed from the Resilient Group by having spent more years in the military (t(359)=2.85, p<.01), by reporting more previous traumas (t(352)=3.07, p<.01) and more cases with earlier emotional problems for which they had received help (t(358)=3.70, p<.0001). They did not differ from the Resilient Group with regard to any other pre-deployment health or personality measure, or any deployment stressors measured during deployment and at return (see Table 2).

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An analysis of the scores for specific event categories in the Traumatic Life Event Questionnaire (TLEQ) showed that the New-Onset Group differed from the Resilient Group with regard to four categories, of which three were associated with interpersonal violence, especially in childhood: Being physically punished while growing up in a way that resulted in bruises, burns, cuts, or broken bones ($t(360)=3.91$, $p<.0001$), witnessing family violence while growing up ($t(360)=5.57$, $p<.0001$) and being slapped, punched, kicked, beaten up, or otherwise physically hurt by a spouse or an intimate partner ($t(360)=3.26$, $p<.005$) and you and your partner having an abortion ($t(360)=3.67$, $p<.0001$). A logistic regression analysis with these trauma measures as predictor variables and New-Onset versus Resilient group as the dependent variable showed a significant effect of witnessing family violence while growing up (*Wald*(1)=5.39, B = .65, $p<.01$, odds ratio=1.92; [95% C.I.=1.11-3.33]).

Resilient versus Benefit Groups. The three benefit groups were a surprising finding because they suggest temporary emotional improvements associated with deployment. We compared the three benefit groups with the Resilient Group in a series of contrast analyses. The three benefit groups had higher levels of pre-deployment PTSD-symptoms ($t(360)=21.99$, $p<.0001$), higher levels of pre-deployment depression ($t(350)=11.25$, $p<.0001$), higher levels of neuroticism ($t(341)=3.89$, $p<.0001$), reported more previous traumas ($t(352)=5.25$, $p<.0001$), more previous emotional problems ($t(358)=3.35$, $p<.005$), and more cases with low education ($t(358)=4.00$, $p<.0001$). The benefit groups did not differ from the Resilient Group on any deployment-related stressor measured during deployment and at return.

With regard to the specific previous traumas reported in the TLEQ, the benefit groups differed from the Resilient Group by reporting more pre-deployment incidences with interpersonal violence, including someone threatened to kill you or cause you serious physical harm ($t(358)=3.91$, $p<.0001$), being physically punished while growing up in a way that resulted in bruises, burns, cuts, or broken bones ($t(360)=4.21$, $p<.0001$), witnessing family violence while growing up ($t(360)=4.58$, $p<.0001$), being stalked ($t(360)=3.26$, $p<.005$) and accidents with serious injury ($t(360)=3.10$, $p<.005$). They also more frequently had events they could not talk about ($t(305)=4.24$, $p<.0001$). A logistic regression analyses with these trauma measures as predictor variables and Benefit versus Resilient group as the dependent variable showed a significant effect of witnessing family violence while growing up (*Wald*(1)=4.32, B = .55, $p<.05$, odds ratio=1.74; [95% C.I.=1.03-2.94]) and a marginally significant effect of being stalked (*Wald*(1)=3.74, B = 1.01, $p=.05$, odds ratio=2.76; [95% C.I.=.99-7.71]).

Comparison with traditional analytic strategies. Only few studies have examined pre- to post deployment changes in PTSD-symptoms. Most have used a single before and after measure and found combat-related stress to be a significant predictor of post-deployment PTSD (Polusny et al., 2011; Rona et al., 2009; Smith, Ryan et al., 2008;

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Vasterling et al., 2010). We replicated these findings here for 2 of 3 post-deployment PTSD measures using similar analytic strategies: We conducted three multiple linear regression analyses with post-deployment PTSD-symptoms measured at Return, Return+3months and Return+7months as the dependent variables, respectively. Each analysis included the commonly used predictors combat exposure, pre-deployment PTSD, age, gender, enlisted rank, level of education and years in the military. The analyses showed significant effects of combat exposure for PTSD-symptoms measured at Return ($t(399)=3.20$, $p<.005$) and Return+7months ($t(179)=2.96$, $p<.005$) but not at Return+3 months ($t(219)=0.16$, $p>.8$). Similar results were obtained if we limited the regression analyses to those who had answered the PCL at all three post-deployments occasions indicating this is not reflecting sampling bias due to non-response. Thus, we replicated the predictive value of combat exposure if using analytic strategies similar to the ones used in previous prospective studies, but also found that the predictive value of combat exposure varied with the timing of measuring post-deployment PTSD-symptoms.

Discussion and Conclusion

Using latent class growth modeling we identified six reliably different developmental trajectories yielding two resilient groups, one new-onset group and three groups showing temporary benefits of deployment. The majority of the sample fell into one of the two resilient groups, consistent with previous work (Bonnano et al., 2012; Dickstein et al., 2010). Resilience was negatively related to depression, neuroticism, previous traumatic events and emotional problems prior to deployment. Deployment-related stressors did not predict non-resilient symptom patterns, consistent with some previous work (Fear et al., 2010).

The New-Onset Group had the same low level of PTSD-symptoms before and during deployment as did the Resilient Group. However, the symptoms showed a marked linear increase through Return, Return+3 months and Return+7 months, indicating that cases identified as new onsets in the present study were reliable (and not due to fluctuation and/or the timing of the post-deployment measurement). The number of New-Onset cases (4%) in the present study is comparable to previous work (Rona et al., 2009; Smith, Ryan et al., 2008). A key variable differentiating the New-Onset and the Resilient Group was number of previous traumas. Traumas involving interpersonal violence experienced in childhood appeared especially central. This adds to previous work showing the importance of childhood traumas as a risk factor for PTSD later in life (Bremner, Southwick, Johnson, Yehuda, Charney, 1993; Iversen et al., 2007; Polusny et al., 2011; Smith, Wingard et al., 2008) although this effect may be limited to childhood traumas involving PTSD (Breslau, Peterson, & Schultz, 2008). No effects were observed of deployment-related stressors, such as combat exposure.

We identified three groups that have hitherto been overlooked in studies of deployment-related PTSD, although they accounted for 13% of the sample. All three

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groups showed temporary beneficial effects of deployment. They differed from the Resilient group by having more emotional problems, depression, PTSD-symptoms and previous traumas before deployment and by being less well educated. In these benefit groups, 55% had no completed education beyond 9-10 years of obligatory public school. In the general Danish population of males at their age (20-25 years) only 35% (Statistics Denmark, 2011) have no education beyond public school (χ^2=6.09, p<.05). The three benefit groups were thus less well educated than their cohort in general. Traumatic events with interpersonal violence, especially when growing up, were commonly reported in the three benefit groups. The low educational level combined with pronounced emotional problems before deployment leaves the impression of a group who may experience more social support and life-satisfaction within their team of fellow soldiers during military deployment than at home. Thus, recognition and comradeship in the unit may be central factors for the temporary mental health benefits. Hughes et al. (2005) also found beneficial effects of military deployment on mental health, but it is not clear whether this effect was temporary, because only one post-deployment measure was obtained in their study.

Our findings have important implications. First, other factors than immediately preceding stressors are critical for new cases of PTSD after deployment with childhood stressors appearing to be a key factor. This does not defy a dose-response view of PTSD (e.g., Neuer et al., 2006) but suggests such a view be considered in a more complex life-span developmental perspective (e.g., Bremner, et al., 1993; Breslau et al., 2008; Koenen, Moffit, Poulton, Martin, & Caspi, 2007). Second, the predictive value of combat exposure varies as a function of when post-deployment measures were taken. This shows that several measurements are needed to disentangle this complex relation and may resolve some of the conflicting findings in earlier work (Fear et al., 2010; Polusny et al., 2011; Rona et al., 2009; Smith, Ryan et al., 2008; Vasterling et al., 2010). Third, the development of PTSD-symptoms in combat soldiers shows heterogeneity, indicating that multiple measurements of the same individuals are necessary in order to understand the complexity of the disorder and to identify those in need of treatment.

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References

American Psychiatric Association (2000). *Diagnostic and statistical manual of mental disorders* (4th ed. Text Revision). Washington, DC: American Psychiatric Association.

Andrews, B., Brewin, C. R., Stewart, L., Philpott, R., & Heidenberg, J. (2009). Comparison of immediate-onset and delayed-onset posttraumatic stress disorder in military veterans. *Journal of Abnormal Psychology, 118,* 767-777.

Beck, A. T., Steer, R .A., & Brown, G.K. (1996). Beck Depression Inventory Manual (2nd ed.). San Antonio: The Psychological Corporation.

Beckham, J. C., Feldman, M. E., & Kirby, A .C. (1998). Atrocities exposure in Vietnam combat veterans with chronic posttraumatic stress disorder: relationship to combat exposure, symptom severity, guilt, and interpersonal violence. *Journal of Traumatic Stress, 11,* 777-785.

Blanchard, E. B., Jones-Alezander, J., Buckley, T. C., & Forneris, C. A. (1996). Psychometric properties of the PTSD checklist (PCL). *Behaviour Research and Therapy, 34,* 669-673.

Bonnano, G. A., Mancini, A. D., Horton, J. L., Powell, T. M., LeardMann, C. A., Boyko, E. J., …Smith, T. C. (2012). Trajectories of trauma symptoms and resilience in deployed US service members: prospective cohort study. *The British Journal of Psychiatry, 200,* 317-323.

Bonanno G. A., Westphal. M., & Mancini, A. D. (2011). Resilience to loss and potential trauma. *Annual Review of Clinical Psychology, 7,* 511-535.

Brewin, C. R., Andrews, B., & Valentine, J. D. (2000). Meta-analysis of risk factors for posttraumatic stress disorder in trauma-exposed adults. *Journal of Consulting and Clinical Psychology, 68,* 748-766.

Bremner, J. D., Southwick, S. M., Johnson, D. R., Yehuda, R., & Charney, D.S. (1993). Childhood sexual abuse and combat-related Post-traumatic Stress Disorder in Vietnam Veterans. *American Journal of Psychiatry, 150,* 235-239.

Breslau, N., Peterson, E. L., & Schultz, L. R. (2008). A second look at prior trauma and the Posttraumatic Stress Disorder effects of subsequent trauma. *Archives of General Psychiatry, 65*, 431-437.

Costa, P. T., & McCrae, R. R. (1989). The NEO-PI/NEO-FFI Manual supplement. Odessa, FL: Psychological Assessment Resources.

Dickstein, B. D., Suvak, M., Litz, B.T., & Adler, A. B. (2010). Heterogeneity in the course of posttraumatic stress disorder: Trajectories of symptomatology. *Journal of Traumatic Stress, 23,* 331-339.

Fear, N. T., Jones, M., Murphy, D., Hull, L., Iversen, A.C, Coker, B.,…Wessely, S. (2010) What are the consequences of deployment to Iraq and Afghanistan on the mental health of UK armed forces? A cohort study. *Lancet. 375,* 1783-1797

Fridthjof, R. (Producer) & Pedersen, J. M. (Director). (2010). *Armadillo* [Motion picture]. Denmark: Fridthjof Film.

Graham, J.W. (2003). Adding missing-data-relevant variables to FIML-based structural equation models. *Structural Equation Modeling, 10*, 80-100.

Gray, M. J., Bolton, E. E., & Litz, B. T. (2004). A longitudinal analysis of PTSD symptom course: Delayed-onset PTSD in Somalia peacekeepers. *Journal of Consulting and Clinical Psychology, 72*, 909-913.

Hughes, J. H., Cameron, F., Eldridge, R., Devon, M., Wessely, S., & Greenberg, N. (2005). Going to war does not have to hurt. Preliminary findings from the British employment to Iraq. *The British Journal of Psychiatry*, *186*, 536-537.

Hoge, C. W, Castro, C. A., Messer, S. C., McGurk, D., Cotting, D. I., & Koffman, R .L. (2004). Combat duty in Iraq and Afghanistan, mental health problems and barriers to care. *New England Journal of Medicine, 351*, 13-22.

Horowitz, M. J. (1986). *Stress response syndromes* (2nd ed.). New York: Jason Aronson.

Iversen, A. C., Fear, N. T., Simonoff, E., Hull, L., Horn, O., Greenberg, N.,…Wessely, S. (2007). Influence of childhood adversity on health. *British Journal of Psychiatry, 191*, 506-511

Keane, T., Fairbank, J., Caddell, J., Zimering, R., Taylor, K., & Mora, C. (1989). *Clinical evaluation of a measure to assess combat exposure*. Psychological Assessment, *1*, 53-55.

Koenen, K .C., Moffit, T. E., Poulton, R., Martin, J., & Caspi, A. (2007). Early childhood factors associated with the development of post-traumatic stress disorder: results from a longitudinal birth cohort. *Psychological Medicine, 37*, 181-192.

Kreuter, F., & Muthén, B. (2007). Longitudinal modeling of population heterogeneity: Methodological challenges to the analysis of empirically derived criminal trajectory profiles. In G. R. Hancock & K. M. Samuelsen (Eds.), *Advances in latent variable mixture models* (pp. 53-75). Charlotte, NC: Information Age Publishing.

Kubany, E. S., Haynes, S. N., Leisen, M. B., Owens, J. A., Kaplan, A. S., Watson, S. B., & Burns, K. (2000). Development and preliminary validation of a brief broad-spectrum measure of trauma exposure: The Traumatic Life Events Questionnaire. *Psychological Assessment, 12*, 210-224.

Magruder, K & Yeager, D.E. (2009). The prevalence of PTSD across war eras and the effects of deployment on PTSD: a systematic review and meta-analysis. *Psychiatric Annals*, *39***,** 778-788.

McNally, R. J. (2003). Progress and controversy in the study of posttraumatic stress disorder. *Annual Review of Psychology, 54*, 229-252.

Muthén B. ,& Muthén, L. (2000). Integrating person-centered and variable-centered analyses: Growth mixture modeling with latent trajectory classes. *Alcoholism: Clinical and Experimental Research, 24,* 882-891

Nagin, D. S., & Land, K. C. (1993). Age, criminal careers, and population heterogeneity: Specification and estimation of a nonparametric, mixed Poisson model. *Criminology, 31,* 327–362.

Neuer, F., Schauer, M., Karunakara, U., Klaschik, C., Robert, C., & Elbert T. (2004). Psychological trauma and evidence for enhanced vulnerability for posttraumatic stress disorder through previous trauma among West Nile refugees. *BMC psychiatry, 4, 34.*

Ozer, E. J., Best, S. R., Lipsey, T. L., & Weiss, D. S. (2003). Predictors of posttraumatic stress disorder and symptoms in adults: A meta-analysis. *Psychological Bulletin, 129,* 52-73.

Polusny, M. A., Erbes. C. R., Murdoch, M., Arbisi, P. A., Thuras, P., & Rath, M. B. (2011). Prospective risk factors for new-onset post-traumatic stress disorder in National Guard soldiers deployed to Iraq. *Psychological Medicine, 41,* 687-699.

Rona, R. J., Hooper, R., Jones. M., Iversen, A.C., Hull, L., Murphy, D., …Wessely, S., (2009). The contribution of prior psychological symptoms and combat exposure to post Iraq deployment mental health in the UK military. *Journal of Traumatic Stress, 22,* 11-19

Rubin, D.C., Berntsen, D., & Bohni, K.M. (2008). A Memory Based Model of Posttraumatic Stress Disorder: Evaluating Basic Assumptions Underlying the PTSD Diagnosis. *Psychological Review, 115,* 985-1011.

Smith, T.C., Ryan, M.A.K., Wingard, D.L., Slymen, D.J., Sallis, J.F., & Kritz-Silverstein, D. (2008). New onset and persistent symptoms of post-traumatic stress disorder and self reported after deployment and combat exposures: prospective population based US military cohort study. *British Medical Journal, 336,* 366-371.

Smith, T.C., Wingard, D. L., Ryan, A. K., Kritz-Silverstein, D., Slymen, D.J., & Sallis, J.F et al. (2008). Prior Assault and Posttraumatic Stress Disorder after combat deployment. *Epidemiology, 19,* 505-512

Statistics Denmark http://www.statistikbanken.dk/statbank5a/default.asp?w=1400

Vasterling, J. J., Proctor, S. P., Friedman, M. J., Hoge, C. W., Heeren, T. King, L.A., & King, D.W. (2010). PTSD symptom increases in Iraq-deployed soldiers: Comparison with nondeployed soldiers and associations with baseline symptoms, deployment experiences and postdeployment stress. *Journal of Traumatic Stress, 23,* 41-51

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Table 1

Fit Indices for Estimated Growth Mixture Models

N of classes	Log Likelihood	AIC	BIC	BIC_{SSA}
1	-5104.52	10225.65	10256.87	10231.49
2	-4833.80	9691.60	9738.43	9700.36
3	-4749.40	9530.81	9593.25	9542.49
4	-4687.64	9415.28	9493.33	9429.88
5	-4653.92	9355.84	9449.50	9373.36
6	-4625.35	9306.70	9415.97	9327.14
7	-4601.09	9266.19	9391.07	9289.55
8	-4595.31	9262.62	9403.12	9288.90
9	-4563.08	9206.16	9362.27	9235.36
10	-4571.58	9231.16	9402.87	9263.28

Note. *N* = 366. AIC = Akaike information criterion; BIC = Bayesian information criterion; BIC_{SSA} = sample-size adjusted Bayesian information criterion.

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Table 2.

Means of Risk Factors for the Six Groups as Assessed Before Deployment (Pre-deployment), During Deployment (Deployment) and at Return (Return).

	Resilient		Non-resilient				Group differences	
	Extreme	Resilient	New Onset	Benefit-s	Benefit-m	Benefit-l	All groups	Resilient vs Non
	Pre-deployment measures						F(5,360-341) / χ^2	t(360-341) / χ^2
Age	27.65	24.39	28.29	22.63	22.45	22.93	4.99**	1.70
Female %	5.10	5.88	14.29	25.00	8.33	14.29	8.21	5.38*
Enlisted %	86.17	92.16	78.57	87.50	100.00	92.86	6.36	0.95
Combat soldier %	34.65	56.86	42.86	37.50	75.00	85.71	31.82***	14.54**
Earlier missions	1.19	0.54	0.54	0.29	0.54	0.46	2.96*	1.62
Years in military	7.09	3.31	9.54	3.75	2.13	2.07	5.84***	0.73
PTSD-symptoms (PCL)	19.35	23.13	23.45	50.00	34.25	35.36	234.65***	26.53***
Depression BDI-II	3.35	5.88	7.71	20.83	12.55	13.42	39.94***	11.25***
Neuroticism	28.55	31.08	32.71	36.57	35.65	36.08	14.72***	6.08***
Earlier traumas (TLEQ)	8.59	7.78	15.71	23.25	16.00	13.50	9.84***	6.65***
Low education %	22.13	17.65	28.57	75.00	45.83	42.85	21.11**	14.80**
Earlier problems %	15.35	14.00	57.14	50.00	33.33	42.85	28.59***	25.12***
	Stressors during deployment (Deployment)						F(5,312-288)	t(288-312)
Combat exposure	10.59	14.62	12.00	7.00	15.72	16.17	4.00**	0.08
Danger/injury exposure	18.31	19.64	18.25	19.71	19.90	19.92	1.26	0.61
Emotional stress	1.75	2.17	2.50	2.29	1.87	2.23	6.29***	2.26*
Times with life danger	2.96	3.45	2.58	2.29	2.74	3.38	0.77	-1.23

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	Stressors 1-3 weeks after return (Return)						F(5,300-277) / χ^2	t(300-277) / χ^2
Combat exposure	14.88	19.95	17.56	11.00	21.64	21.64	3.62**	0.22
Danger/injury exposure	19.87	21.24	20.30	20.71	22.25	22.92	1.95	1.16
Emotional stress	2.03	2.28	2.50	2.40	2.23	2.54	2.76*	1.99*
Times with life danger	3.37	4.44	3.30	3.16	5.00	4.62	3.52**	0.27
Wounded/injuried %	12.92	18.60	30.00	33.33	31.82	7.69	9.33	4.28*
Did you kill? %	20.69	25.00	30.00	33.33	40.91	53.85	11.15*	8.83**

Note: *p<.05, **p<.01, ***p<.0001, All t-tests are based on contrast analyses within the overall design; χ^2 tests are used for all reports of frequencies

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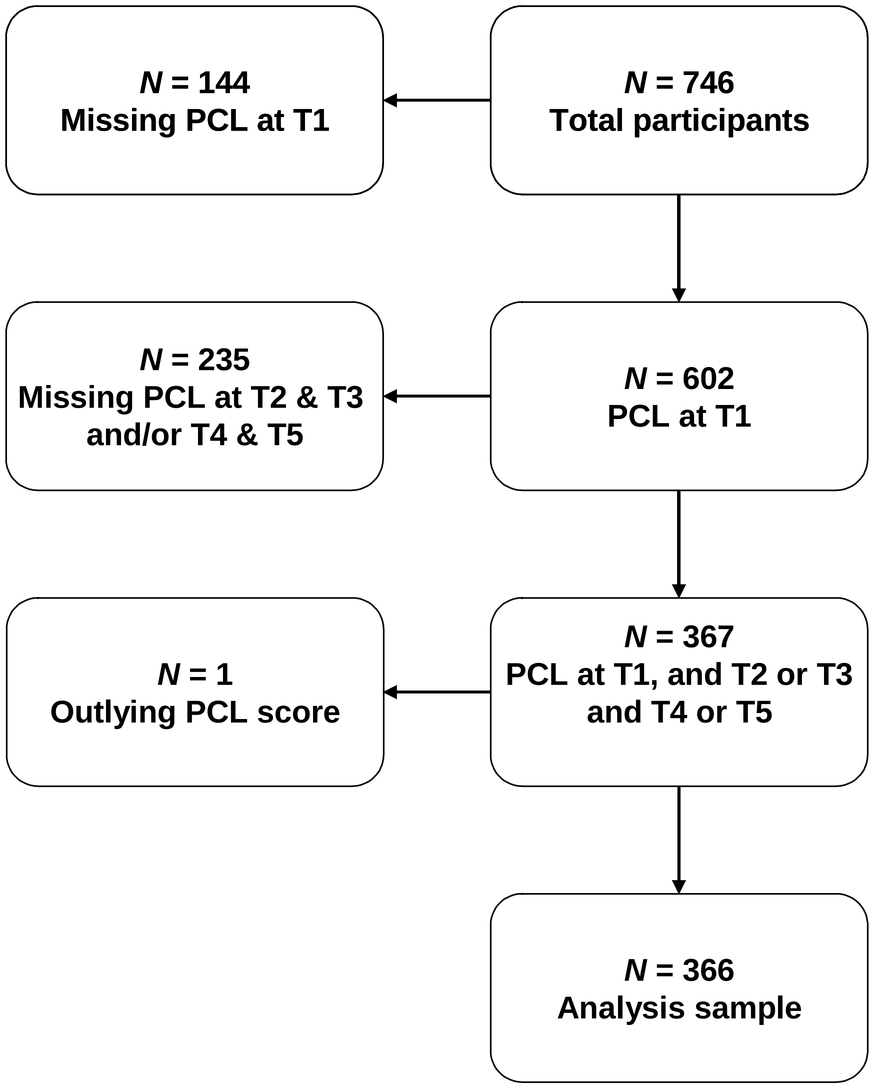

Figure 1: Summary of the analysis sample

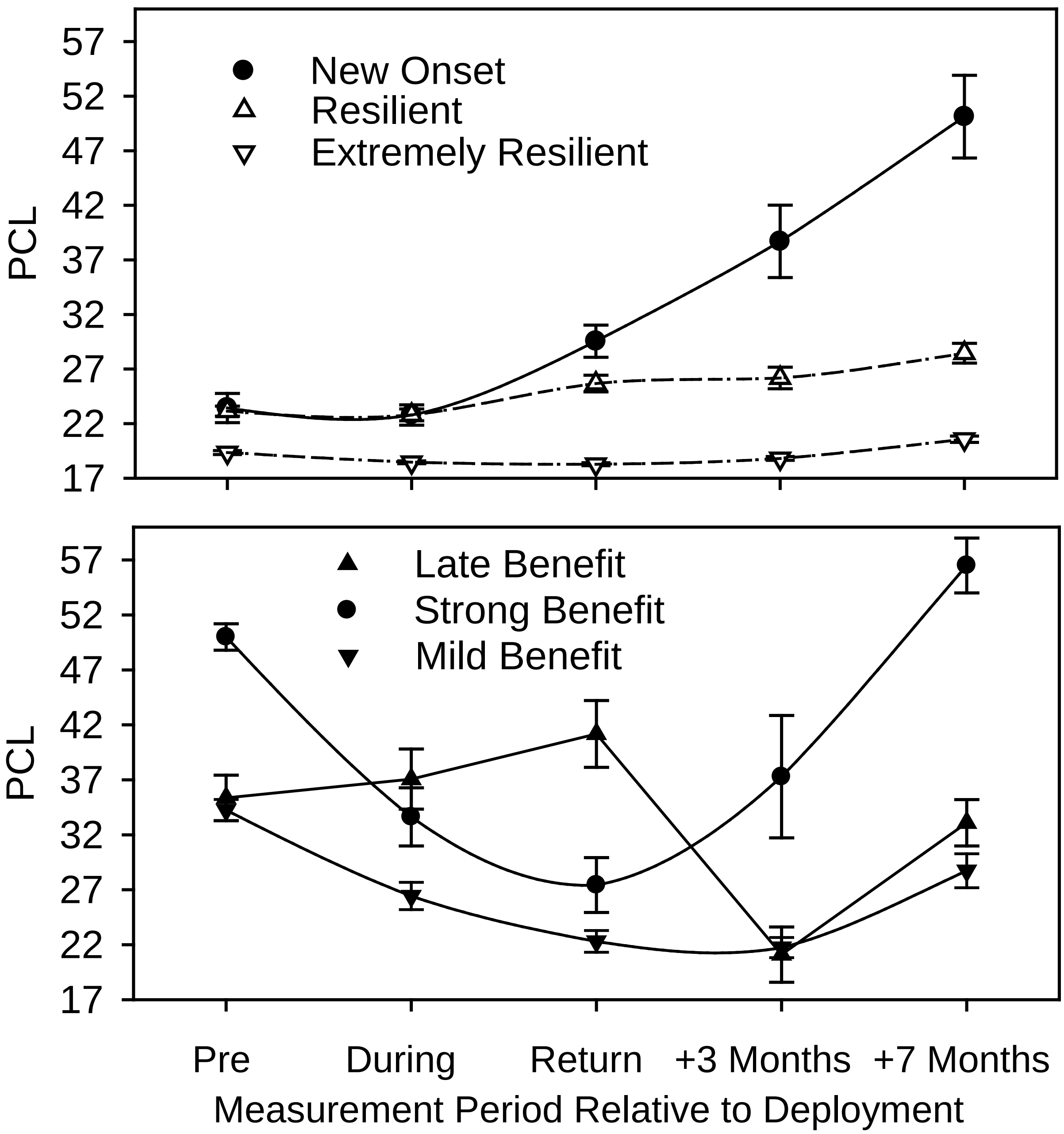

Figure 2. Developmental trajectories of PTSD-symptoms at five times before, during and after deployment: Each line represents a group of soldiers with a different trajectory of PTSD-symptoms: Extremely Resilient Group (n= 255, 70%), Resilient Group (n=51, 14%), New-Onset Group (n=14, 4%), Strong Benefit Group (n=8, 2%), Mild Benefit Group (n=24, 7%), Late Benefit Group (n=14, 4%).

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Supporting Information

Online-only material

Dependent variables

The data collections included many different psychometric measures some of which are irrelevant to the present analyses. The following criteria were used in selecting variables for the present analyses. For the stressor variables in Table 2, we include ones that are clearly related to deployment for which we have the most responses. Because our stressor measures are subjective assessments, we use the ones obtained at Deployment and Return in order to reduce retrospection as much as possible. For the pre-deployment measures, we included the ones that are theoretically and empirically most closely associated with PTSD. We left out variables that were either highly correlated with the ones included, or were obtained from military data files with many missing data points, or were theoretically less relevant for the present analyses.

PCL-C. Posttraumatic Stress Disorder Checklist, Civilian version (Blanchard et al., 2006) is a standardized checklist for PTSD symptoms, which has been used in previous studies of deployment-related PTSD. The scale consists of 17 items (equivalent to the 17 PTSD symptom categories in the DSM-IV) with a possible sum score ranging from 17 to 85 (Cronbach's Alpha = .88).

BDI-II. Beck's Depression Inventory (BDI-II; Beck et al., 1996) measures level of depression. The inventory consists of 21 items with a possible sum score ranging from 0 to 63 (Cronbach's Alpha = .85).

Neuroticism. The scale for Neuroticism is one of the five personality factors measured by the NEO-FFI (Costa & McCrae,1989). The neuroticism factor consists of 12 items with a possible sum score ranging from 12 to 60. (Cronbach's Alpha = .77)

TLEQ. Trauma Life Experience Questionnaire (TLEQ; Kubana et al., 2000) was here accommodated to a Danish population of soldiers. Here it consists of 20 questions addressing different types of traumas. The questionnaire measures how often (from never to more than 5 times) different traumas have been experienced with a possible sum score ranging from 0 to 100 (Cronbach's Alpha = .70).

Combat Exposure Scale (Keane, 1989) is a standard measure of exposure to combat such as episodes with hostile fire, firing at the enemy or fellow soldiers being injured or killed during combat. The scale consists of 7 items, possible sum score ranges from 7 to 35. (Cronbach's Alpha = .83).

The Danger/Injury Exposure Scale was constructed by the Danish military for the present and similar studies. It measures the degree of perceived war zone stress but not direct combat (e.g. aggressive locals, being threatened with a weapon, seeing dead or injured people). The scale consists of 10 items with a possible sum score range from 10 to 40.

Single Items used in the present study. Single item questions were included to supplement the psychometric scales without increasing overall length of the questionnaire. *Earlier Problems* addresses participants previously had received psychological or psychiatric treatment for any personal problems (yes/no answer), *Emotional Stress* refers to how often emotionally stressful situations have been experienced during deployment, range from 1 (never) to 4 (very often), *Times with Life Danger* refers to how often a soldier felt that his or her life was in direct danger or how often a soldier witnessed others' lives being in direct danger, range from 0 (never) to 6 (more than 5 times), *Wounded/Injured* addresses whether the soldier reported being wounded or injured during deployment (yes/no answer), *Did you Kill?* addresses whether the soldier reported having killed an enemy during the deployment (yes/no answer).

Patterns of Missing Data

A critical concern is the degree to which those soldiers included in the analysis sample are representative of the full sample. In order to address this concern, we conducted a series of statistical comparisons between subsets of the full sample based on their pattern of missingness. Here, because there was less theory to guide us, and because we wanted to err, if at all, in the direction of including more variables than necessary in statistical adjustments, comparisons were made on a larger number of variables than in our hypothesis testing, 56 in total, that ranged from demographic characteristics to prior experiences of trauma to basic personality. The results of these analyses both address concerns about systematic missingness and provide a basis for choosing auxiliary variables to be included in the latent class growth models for the purpose of ensuring that missingness is ignorable.

We first compared means or frequencies for the 366 individuals in the analysis sample and the 380 individuals excluded due to a lack of sufficient data. Of the 56 comparisons, 12 were statistically significant. When the twelve were entered simultaneously in an equation predicting whether they were in or out of the analysis sample the total R^2 was .10 and only the gender and extraversion variables remained predictive. Thus, the analysis sample differed only slightly from the sample of individuals excluded from the analysis, and the nature of the difference was that the analysis sample was slightly more female and slightly less extraverted.

We next focused on differences within the analysis sample between individuals with complete data and those for whom one or more values would be imputed in the statistical modeling. Although not a definitive analysis, the results of these analyses suggest whether one or more of the missing patterns were systematic or nearly random. The most basic comparison is between the 125 individuals with complete data and the 241 missing one or two scores. This comparison across the 56 variables yielded only four significant effects, of which none were large (e.g., the strongest effect, at $p < .01$, was a difference of 2 scale points on conscientiousness, which could range from 12 to 60; individuals with complete data were slightly more conscientious that individuals missing one or two PCL scores). Importantly, there were no differences on PCL scores. Satisfied that the pattern of missingness was not highly systematic, we next focused on determining which variables might be included in the latent class growth models as auxiliary variables. We sorted the sample into the nine possible patterns of missingness and compared means or frequencies on the 56 variables. These comparisons yielded 15 small but significant differences. These variables were included as auxiliary variables in the latent class growth models, increasing the likelihood that any systematic missingness could be treated as ignorable.

Missing Data Estimation Strategy

We used state-of-the-science methods of managing missing data when estimating models. All models were estimated using full information maximum likelihood (FIML) as implemented in the M*plus* computer program. FIML produces unbiased parameter estimates when the missing data mechanism is missing at random (Rubin, 1976). Although the determination of whether the pattern of missingness is random cannot be determined with certainty, the likelihood is increased when potential reasons for missing data that are correlated with the outcome variables (PCL scores in our case) are accounted for in the model. As noted earlier, we examined a large number of variables and found small differences on a few. These variables were included as auxiliary variables in all estimated models. Auxiliary variables are those variables in the data set that either are correlated with missingness or correlated with variable on which there is missing data. To the extent these variables have been measured and are included in the model when FIML is applied, the missing data pattern can be made missing at random and therefore ignorable (Graham, 2003).

Latent Class Growth Modeling

The goal of our analyses was to model trajectories of PTSD symptoms from pre-deployment to six months after return from combat. We suspected significant variability in trajectories. Thus, our analytic strategy focused on estimating individual trajectories then probing for a set of distinct patterns that would allow for the classification of soldiers in terms of the trajectory of their PTSD symptoms across the time period.

We used latent class growth modeling, which includes elements of latent variable modeling and latent class analysis (Kreuter & Muthén, 2007). In terms of latent variables, variance in intercept (the first assessment in our models) and trajectory shape variables are modeled as latent influences on the pattern of PCL scores. We allowed for the possibility of nonlinearity by including both linear and quadratic latent variables in all models. In terms of latent classes, growth mixture modeling assumes significant and systematic heterogeneity in the latent growth variables that can be explained by an unmeasured class variable. A key concern in growth mixture modeling is determining the number of classes evident in the individual trajectories. Once the number of classes has been determined, individuals in the sample can be grouped according to latent class. These groups can then be characterized both in terms of the shape of their trajectory and in comparison to other groups on variables of interest.

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We used full information maximum likelihood estimation for all models. All models included auxiliary variables as detailed earlier. We included linear and quadratic terms, and estimated models assuming from 1 to 10 classes. Fit indices associated with these models are shown in Table 1. There are no hard and fast rules for selecting an appropriate number of latent classes. As with, for example, exploratory factor analysis, selection involves a combination of factors, including statistical information, information about the data, and the substantive focus of the research. We consulted the fit information shown in Table S1 then, for models producing the best statistical fit, examine fitted growth curves and the distribution of respondents across class.

Simulation studies suggest that the sample-sized adjusted Bayesian information criterion (BIC_{SSA}) performs best in terms of model selection based purely on statistical information. As can be seen in Table 1, the values of BIC_{SSA} favor a model with nine classes. Examination of the fitted curves and distribution of respondents across classes for this model suggested against it, with some curves differing only slightly and membership in some classes very low. We examined more closely the results of models with fewer classes, focusing specifically on models with between five and eight classes. Ultimately, we selected a model with six classes, which balanced fit, interpretability, and distribution of respondents. The entropy value of this model was .91, suggesting good classification (i.e., probability near 1.0 for assignment to most probable class and near zero for assignment to other classes).[1]

The six fitted trajectories are displayed in Figure S1, overlaying the observed data. Class sizes ranged from N = 8 for the U-shaped trajectory (Strong Benefit Group) to N = 255 for the relatively straightly trajectory at the PCL minimum (Extremely Resilient Group). A class membership was created in the master data set, and the focal analyses involved comparing soldiers in the different trajectory classes on variables likely to differentiate them.

Supplementary regression analyses

A logistic regression analysis with New Onset versus Resilient group as the dependent measure, and years in the defense and amount of previous traumas as predictors showed a significant effect for amount of previous traumas ($Wald(1)=7.22$, B = .10, $p<.01$, odds ratio=1.10; [95% C.I.=1.03-1.18]) and years in the defense ($Wald(1)=6.69$, B = .21, $p<.05$, odds ratio=1.24; [95% C.I.=1.05-1.46]).We did not include earlier emotional problems as a predictor because of a high conceptual and empirical overlap between this categorical variable and the continuous measure of

[1] Entropy values for the 7- and 8-class models were .92 and .91, respectively. In the 7-class model the group in the small U-shaped trajectory class in the 6-class solution split into two smaller classes that differed primarily with reference to the severity of the U shape. In the 8-class solution, another small class emerged that differed only in intercept from the class characterized by a slight, primarily linear decrease over time.

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previous traumas and the few degrees of freedom in the analysis. If included both it and previous traumas were marginally significant (*p*s<.06).

A logistic regression analysis with Benefit versus Resilient group as the dependent measure and pre-deployment depression, neuroticism and previous traumas as predictor variables (but not pre-deployment PTSD symptoms and earlier emotional problems for reasons given above) showed significant effects of all three variables: Neuroticism (*Wald*(1)=11.00, *B* = .24, *p*<.005, odds ratio=1.27; [95% C.I.=1.10-1.46]), depression (*Wald*(1)=9.02, *B* = .19, *p*<.005, odds ratio=1.21; [95% C.I.=1.07-1.36]) and previous traumas (*Wald*(1)=8.01, *B* = .11, *p*<.01, odds ratio=1.12; [95% C.I.=1.04-1.21]).

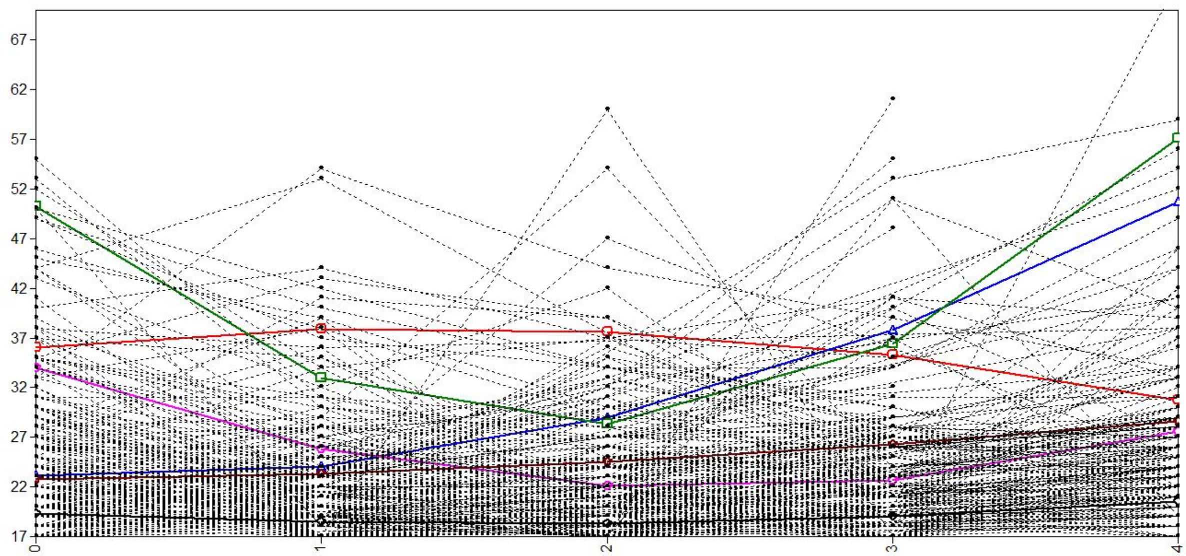

Figure S1. Raw PCL scores overlaid by fitted curves for the six latent classes.

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References

Beck, A.T., Steer, R.A., & Brown, G.K. (1996). Beck Depression Inventory Manual (2nd ed.). San Antonio: The Psychological Corporation.

Blanchard, E. B., Jones-Alezander, J., Buckley, T. C., & Forneris, C. A. (1996). Psychometric properties of the PTSD checklist (PCL). *Behaviour Research and Therapy, 34,* 669-673.

Costa, P. T., & McCrae, R. R. (1989). The NEO-PI/NEO-FFI Manual supplement. Odessa, FL: Psychological Assessment Resources.

Graham, J.W. (2003). Adding missing-data-relevant variables to FIML-based structural equation models. *Structural Equation Modeling, 10*, 80-100.

Keane, T., Fairbank, J., Caddell, J., Zimering, R., Taylor, K., & Mora, C. (1989). *Clinical evaluation of a measure to assess combat exposure*. Psychological Assessment, *1,* 53-55.

Kreuter, F., & Muthén, B. (2007). Longitudinal modeling of population heterogeneity: Methodological challenges to the analysis of empirically derived criminal trajectory profiles. In G. R. Hancock & K. M. Samuelsen (Eds.), *Advances in latent variable mixture models* (pp. 53-75). Charlotte, NC: Information Age Publishing.

Kubany, E. S., Haynes, S. N., Leisen, M. B., Owens, J. A., Kaplan, A. S., Watson, S. B., & Burns, K. (2000). Development and preliminary validation of a brief broad-spectrum measure of trauma exposure: The Traumatic Life Events Questionnaire. *Psychological Assessment, 12*, 210-224.

Rubin, D.B. (1976) Inference with missing data. *Biometrika, 63,* 581-592.