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Effects of OEF/OIF Deployment Intensity on PTSD Diagnoses Among Still Active Population: Analysis of Enlisted and Officer Populations 2001-2006*

by

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13. ABSTRACT (Maximum 200 words.)

This study estimates the effect of deployment location and length on the risk of being diagnosed with PTSD, relative to what it would be from the normal military operations; and examines the comorbidity distribution within the PTSD population. We use a random sample of active-duty personnel serving between 2001 and 2006. We identify PTSD cases from TRICARE medical records and link deployment information from Contingent Tracking System. We estimate logistic regressions to assess the effect of deployment intensity on the rate of PTSD. Among the enlisted population, comparing to those in other duties around the world, deployment to Iraq/Afghanistan increases the odds of developing PTSD substantially, with the largest effect observed for the Navy (OR=9.06, $p<0.01$) and the smallest effect for the Air Force (OR=1.25, $p<0.01$). A deployment longer than 180 days increases the odds of PTSD by 1.11 times to 2.84 times, depending on the service, compared to a tour under 120 days. For the Army and the Navy, a deployment to Iraq/Afghanistan further exacerbates the adverse effect of tour length. We observe similar adverse effects among the officers although the magnitude of the deployment effect is smaller.

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Abstract

Background

Military personnel serving in Operation Enduring Freedom (OEF) and Operation Iraqi Freedom (OIF) have been exposed to an increased risk of PTSD. Yet no study has used a proper comparison group to estimate the effect of deployment intensity on the risk of PTSD. This study estimates the effect of deployment location and length on the risk of being diagnosed with PTSD, relative to what it would be from the normal military operations.

Methods

We use a random sample of active-duty personnel serving between 2001 and 2006. We identify PTSD cases from TRICARE medical records and link deployment information from Contingent Tracking System. We compare rates of PTSD diagnoses based on deployment locations across services, and estimate logistic regressions to assess the effect of deployment intensity on the rate of PTSD. We also provide a descriptive analysis of the comorbidity distribution among the PTSD population. We conduct separate analyses for enlisted and officer populations.

Results

Among the enlisted population, comparing to those in other duties around the world, deployment to Iraq/Afghanistan increases the odds of developing PTSD substantially, with the largest effect observed for the Navy (OR=9.06, $p<0.01$) and the smallest effect for the Air Force (OR=1.25, $p<0.01$). A deployment longer than 180 days increases the odds of PTSD by 1.11 times to 2.84 times, depending on the service, compared to a tour under 120 days. For the Army and the Navy, a deployment to Iraq/Afghanistan further exacerbates the adverse effect of tour length. We observe similar adverse effects among the officers although the magnitude of the deployment effect is smaller.

Conclusions

Our research identifies the extent of PTSD across services and quantifies the risks associated with OEF/OIF deployment intensity. Further research is needed for effective monitoring and preventive measures of PTSD on the active duty population.

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Introduction

Recent research suggests that the wars in Afghanistan and Iraq, also known as Operation Enduring Freedom (OEF) and Operation Iraqi Freedom (OIF), pose substantial mental health challenges to U.S. military service members and mental health systems (Erbes, Westermeyer, Engdahl, & Johnsen, 2007; Hoge, Auchterlonie, & Milliken, 2006; Hoge et al., 2004; R. A. Rosenheck & Fontana, 2007; Seal, Bertenthal, Miner, Sen, & Marmar, 2007; Tanielian & Jaycox, 2008). Post-traumatic stress disorder (PTSD), in particular, has risen steadily, with heavy combat typically being cited as a leading cause of PTSD (CDC, 1988; Helzer, Robins, & McEvoy, 1987; Hoge, et al., 2004; Kang, Natelson, Mahan, Lee, & Murphy, 2003; Prigerson, Maciejewski, & Rosenheck, 2002; The Iowa Persian Gulf Study Group, 1997). This study examines the effects of the location and duration of OEF/OIF deployments (particularly to Afghanistan and Iraq) on the probability of being diagnosed with PTSD for still-active military personnel.

A recent comprehensive review of the literature by Rand found a wide range of PTSD rates among those serving in Iraq and Afghanistan, with estimates ranging from 4% to 45%, depending on the samples and how PTSD was measured (Tanielian & Jaycox, 2008). Many studies used anonymous survey responses from convenience samples of Army soldiers who were deployed in either Iraq or Afghanistan from 2003 to 2005 (Erbes, et al., 2007; Grieger et al., 2006; Helzer, et al., 1987; Hoge, et al., 2004; Vasterling et al., 2006). Some analyzed the mental health issues using post-deployment health assessment surveys collected by the Mental Health Advisory Team (MHAT), which measured PTSD by primary-care PTSD screening questions (Hoge, et al., 2006; Shen, Arkes, & Pilgrim, 2009; U.S. Army, 2003, 2005, 2006a, 2006b), while a few used actual medical records from the VA health care system.

With the Global War on Terrorism going into its 9th year and with a planned surge of forces in Afghanistan being considered, it is critical to evaluate the prevalence of PTSD among the active

duty population and how the deployment intensity in OEF/OIF affect the mental health readiness of the Armed Forces. While previous studies have provided important information on PTSD in the current operations, they have several shortcomings. First, the previous studies have been descriptive analyses except for a study analyzing UK solders and one focusing on the US Navy enlisted personnel (Rona et al., 2007; Shen, et al., 2009). Second, most studies focus on just the Army and Marine Corps. Yet the rates of PTSD among those deployed in Iraq and Afghanistan could be different across services because of different types of assignments, and such differences are important to identify in evaluating total force readiness. Third, most studies used convenience samples on those returning from OEF/OIF, without a comparable control group of personnel who were not deployed under OEF/OIF. Thus, while these studies indicate the frequency of PTSD for those deployed under OEF/OIF, they cannot speak to the effect of being deployed under OEF/OIF relative to their risk of PTSD under other military operations. Fourth, studies using surveys often had to rely on screening questions (such as PCL-DSM IV), which are typically short and simple to administer but likely miss some cases of PTSD and misdiagnose PTSD in other cases (Kimerling et al., 2006; Ramchand, Karney, Osilla, Burns, & Caldarone, 2008). Finally, previous studies focus on the effect of the deployment location (i.e, Iraq or Afghanistan) with little attention paid to the duration of deployment or the cumulative effect of multiple deployments on the PTSD occurrence. However, deployment duration and frequency are equally important deployment dimensions to consider when designing the optimal deployment strategy.

In this study, we address the shortcomings of the previous literature with a random sample based on all active duty personnel serving between 2001 and 2006. We merge data on PTSD diagnoses from the TRICARE medical records and deployment records from the Contingency Tracking System. We then examine the effects of OEF/OIF deployment intensity for officer and enlisted personnel separately for the four services (Army, Marines, Navy, and Air Force). We

analyze two dimensions of deployment intensity: location and duration. Lastly, we focus on the PTSD population and conduct a descriptive analysis of the severity of their illnesses. Specifically, we address the following research questions:

1. What are the rates of PTSD diagnoses among all active duty officer and enlisted personnel and how do the rates differ by service and deployment characteristics?
2. How do deployment location and length of deployment affect the probability of being diagnosed with PTSD?
3. Is there an interactive effect between a deployment's length and location? In particular, do longer deployments to Iraq or Afghanistan exacerbate the risk of PTSD?
4. Among the active duty population who are diagnosed with PTSD, what is the comorbidity distribution?

The statistical methods we use were built upon our prior study that examined deployment intensity on the rate of PTSD among Navy personnel.(Shen, et al., 2009) This study differs in several important dimensions. First, while our prior study examined only sailors, in this study we compare the PTSD rates and deployment effects across all four services. Second, the prior study is based on the Post Deployment Health Assessment (PDHA) that were only filled by people who were deployed on GWOT missions, thus it cannot compare the rate of PTSD between those who were deployed and those who were sent on other missions. The current study addresses this shortcoming as discussed below. Third, the prior study can only capture PTSD cases right after the deployment based on four screening questions (since PHDA has to be filled out 30 days from the return of the deployment), while the current study allows us to have a much longer look-forward window to capture the PTSD cases and identify PTSD cases through clinical diagnoses. Lastly, it is important to keep in mind that in this study we focus on TRICARE eligible population (i.e., people who are still serving in the military during the study period, including ones with PTSD diagnoses),

and our results give a sense of the mental health readiness among the still active personnel.

Data and Methods

Methods Overview. Our sample is based on all individuals who were active duty service members of the US Armed Forces between 2001 and 2006. The outcome of interest is whether the individual was diagnosed with PTSD within the TRICARE system. We first use a descriptive analysis to compare the rate of PTSD among different branches of the Armed Services by deployment location. We then estimate two multivariate models using logistic regressions to assess the effect of deployment intensity (location, duration) under OEF/OIF on the rate of PTSD diagnoses. These regression models address the policy question of how much an Iraq/Afghanistan (or other OEF/OIF) deployment increases the risk of being diagnosed with PTSD later relative to the risk military personnel would have had if they had not been deployed to OEF/OIF missions. We estimate our models separately for each service (Army, Air Force, Marines, and Navy) and separately for officers and enlisted personnel. We provide more details on the model specifications below. Lastly, we focus on the PTSD population and study their comorbidity distribution.

Data and Sample. We use a random sample of activity-duty personnel serving between September 2001 and December 2006 because the GWOT started in 2001 and 2006 is the year for which the latest data are available. We combine several data sources from TRICARE and the Defense Manpower Data Center (DMDC) to form the basis of our analysis. First, we identify the active duty personnel population and obtain demographic and service information (such as age, gender, race, rank) from the Defense Enrollment Eligibility Reporting System (DEERS). Second, depending on where PTSD was diagnosed (military treatment facility or TRICARE civilian provider) and whether it was identified from inpatient or outpatient claims, we identify the date that PTSD was first diagnosed and related health information from the following sources: the Standard

Inpatient Data Record, the Standard Ambulatory Data Record, and the TRICARE Encounter Data. Third, we obtain OEF/OIF deployment characteristics and military occupational specialty (MOS) codes between 2001 and 2006 from the Contingency Tracking System (CTS). The CTS Deployment Files were used to track personnel involved in contingency operations and report all personnel who have been deployed in support of GWOT since September 11, 2001. CTS data contain information on deployment location, start and end dates of the deployment. A person would have multiple sets of deployment records in CTS if he were deployed multiple times during the study period. The study received expedited IRB approval.

Each observation in our data represents unique personnel. Based on the TRICARE medical records and monthly DEERS records, we first identify all personnel who were diagnosed with PTSD and take their demographic and rank information from DEERS the month they were diagnosed. Next, for the remaining active duty population (those without PTSD), we randomly select a month from each individual's monthly DEERS records for their demographic and rank information. We then draw a 25 percent random sample of this population from each service (regardless of whether they used TRICARE services). For all personnel in our sample, we extract complete deployment information from CTS. At the end, our data consist of 678,227 unique enlisted personnel and 95873 unique officers from all services. This represents a 25% random sample of the active-duty population without PTSD and 100% of the PTSD population. We weight all of our comparisons and empirical models to reflect this sampling scheme so our estimated numbers are representative of all personnel from each service.

Outcome measures. The dependent variable in our analysis is whether an active duty person was diagnosed with PTSD anytime between 2001 and 2006 (i.e., if the ICD-9 code of the principal diagnosis is 309.81)(American Psychiatric Association, 2000).

Statistical Models. After an initial set of descriptive analyses for raw comparisons of PTSD

rates for different types of deployments across services, we conduct regression models in order to control for relevant factors. Because our outcome is binary, we estimate logistic regression models. In the primary models, we focus on deployment characteristics of the last deployment. For example, if a person was included in the analytical sample on March 2004 and his/her most recent deployment prior to this date was July 2003, we would use deployment information from the July 2003 deployment in this set of models. Our key variables of interest in Model 1 are the deployment location and duration (details below). In Model 2, we estimate an interaction effect between deployment duration and deployment location (in particular, Iraq and Afghanistan) to test whether longer deployments as a result of OIF and OEF magnifies the effect of such a deployment on the probability of being diagnosed with PTSD.

As a sensitivity analysis on the location effect, we also estimate a model based on the locations of all past deployment, since PTSD is not necessarily triggered by the last deployment and often emerges or is diagnosed after a long delay. Specifically, if a person was included in the sample on March 2004, we identify the locations for all deployments between 2001 and March 2004. The key variable of interest in this sensitivity model is whether a person was ever deployed to a given location (details below). In all models, we control for service and demographic characteristics as explained below.

Explanatory variables. There are three categories of variables that we include in the models: deployment characteristics, service characteristics, and demographic information. Summary statistics of these measures are presented in Table 1. We describe here the different types of variables.

We classify three categories of deployment locations: not deployed under OEF or OIF (the reference group), deployed to Iraq/Afghanistan, deployed on other OEF/OIF missions (such as

Kuwait, Qatar, Saudi Arabia, Turkey).[1] For the duration of the last deployment, we classify the deployment length into three categories: "short" if the length of the last deployment is less than 120 days (the reference group), "medium" if the length of last deployment is between 120 and 180 days, and "long" if the duration is greater than 180 days. In the sensitivity analysis, we define four mutually exclusive categories of all past deployment location indicators: ever deployed to Iraq or Afghanistan (but not other locations), ever deployed on other OEF/OIF missions, ever deployed to Iraq/Afghanistan as well as other OEF/OIF missions, and never deployed on any OEF/OIF mission (the reference group).

For service characteristics, we include rank and military occupation specialty (MOS) categories. Studies have shown that soldiers in combat divisions and those in medical service tend to have different rates of PTSD than non-combat specialties (Martin, 2007; Tanielian & Jaycox, 2008). We categorize military occupational specialty codes into the following categories: Combat arms (reference group), combat support, combat service support, aviation, medical, and other MOS. Note that the four service branches use different sets of military occupation codes. The Army and Marine Corps use a Military Occupational Specialty (MOS) code, while a system of Air Force Specialty Codes (AFSC) is used in the Air Force. The Navy uses a system of naval ratings and designators along with the Naval Enlisted Classification (NEC) system. For some service branches, some of the categories are merged due to small numbers of observations in the individual categories and some categories are missing (for example, Marines and Air Force do not have medical MOS

To control for demographic characteristics, we include the following demographic information in the models: gender, race (with White as the reference group, African-American, Hispanic, Asian, and other races), marital status (single or married), and age. Lastly, we include year

[1] We do not define more detailed location categories because sample size would be too small for the finer categorization.

indicators to control for possible macro trends in the PTSD rate in the general active duty population. In the sensitivity analysis section, we also briefly discuss the results in which we take out the year indicators from the model, since later years is likely associated with increased deployment intensity.

Results

Characteristics of the Active Duty Enlisted Population. Table 1 presents the descriptive statistics of the enlisted sample by service branches. We focus our discussion on the deployment characteristics. The majority of the active duty personnel were not deployed under OEF/OIF: the percentages range from 61.5% in Air Force to 78% in Army. However, while not shown, this rate did vary by year as increasing numbers of Army and Marine Corps personnel were deployed under OEF/OIF in later years. Not surprisingly, the service with the highest share of its enlisted members sent to Iraq/Afghanistan is the Army (11.3%), followed by the Marine Corps (8.6%). The Navy and Air Force appear to serve a more supporting role, with 35% and 33%, respectively, of their enlisted population being sent on OEF/OIF missions other than to Iraq/Afghanistan. Among those deployed, large proportions of Army and Marine Corps personnel had been deployed more than 180 days in their most recent deployment prior to being included in the sample (58% and 48%, respectively), whereas 65% of deployed Air Force personnel had a tour length under 120 days.

The next set of summary statistics report the proportions of those ever deployed under OEF/OIF who were ever deployed to a given location since September 11, 2001. We categorize the past deployment location indicators into three mutually exclusive categories to allow for easier comparison (i.e., the three rows add up to 100%). With the Army, for example, 31% of solders ever deployed under OEF/OIF were sent to Iraq/Afghanistan (but not on other OEF/OIF missions), 45% were sent on other OEF/OIF missions, and the remaining 24% have been to Iraq/Afghanistan

as well as other OEF/OIF missions. The rest of Table 1 provides summary statistics of service and demographic characteristics, which are representative of the US Armed Forces active duty population.

Characteristics of the Active Duty Officer Population. Table 2 presents the descriptive statistics of the officer sample by service branches. Similar to the enlisted population, the majority of the active duty officers were not deployed under OEF/OIF: the percentages range from 62.5% in Air Force to 74.7% in Army. Not surprisingly, the service with the highest share of its officer members sent to Iraq/Afghanistan is the Army (10.5%), followed by the Marine Corps (9.0%). Similar to the enlisted population, the Navy and Air Force appear to serve a more supporting role, with 31.4% and 33%, respectively, of their officer population being sent on OEF/OIF missions other than to Iraq/Afghanistan. Among those deployed, almost half of Army and Marine Corps personnel had been deployed more than 180 days in their most recent deployment prior to being included in the sample, whereas 72% of deployed Air Force personnel had a tour length under 120 days.

PTSD Rate By Deployment Characteristics. Table 3 reports the proportion of the active duty population who were diagnosed with PTSD for each service, with the top panel presenting results of the enlisted population and the bottom panel presenting results of the officer population. The first row presents the PTSD percentage for the entire active duty population, regardless of their deployment status, and ranges from 0.6% for the Air Force to 1.4% for the Army. The next set reports the PTSD rate by the last deployment location. People deployed to Iraq/Afghanistan had much higher rates of being diagnosed with PTSD compared to those not deployed under OEF or OIF (4.4% vs. 0.6% for the Army, 3.5% vs. 0.5% for the Marines, 6.5% vs. 0.5% for the Navy, and 1.3% vs. 0.6% for the Air Force; $p<0.01$ for statistical tests of all of these differences). Army and Marine Corps personnel deployed on other OEF/OIF missions also have higher rates of PTSD

compared to those not deployed under OEF/OIF (3.8% for Army, 2.3% for Marines), but the opposite is the case for the Navy and Air Force. Among those deployed under OEF/OIF, the PTSD rate increases as the tour length increases. With the Army, for example, the proportion of enlisted personnel who were later diagnosed with PTSD is 2.9% among those with a short tour length (1-120 days), and the rate increases to 3. 5% in the medium length category (120-180 days) and to 4.8% for long tours (>180 days). We observe similar, but not as stark, patterns for the other three services.

The next set of statistics in the top panel of Table 3 reports the PTSD rate by whether a person was ever deployed to a given location. With the Army, the proportion of enlisted personnel ever deployed to Iraq/Afghanistan (but not on other OEF/OIF missions) who were diagnosed with PTSD is 3.5%. The number is slightly lower for those who were deployed on OEF/OIF missions other than to Iraq/Afghanistan (3.4%). The rate of PTSD is even higher (6.2%) for those who have been to Iraq/Afghanistan, as well as on other OEF/OIF missions. We observe similar pattern for the other three branches.

The rate of PTSD is much lower in the officer population (bottom panel of Table 3), with the overall PTSD rate ranging from 0.29% in the Air Force to 0.66% in the Army. People deployed to Iraq/Afghanistan had much higher rates of being diagnosed with PTSD compared to those not deployed under OEF or OIF although the magnitude difference is not as stark as in the enlisted population (1.6% vs. 0.4% for the Army, 1% vs. 0.2% for the Marines, 1.4% vs. 0.2% for the Navy, and 0.9% vs. 0.3% for the Air Force; $p<0.01$ for statistical tests of all of these differences). Similar to the enlisted population, among those deployed under OEF/OIF, the PTSD rate increases as the tour length increases. With the Army, for example, the proportion of officers who were later diagnosed with PTSD is 0.90% among those with a short tour length (1-120 days), and the rate increases to 1.32% in the medium length category (120-180 days) and to 1.88% for long tours (>180

days). When examining the rate of PTSD by deployment history (the last set of statistics), we observe a similar pattern in the officer population as we had in the enlisted population. For example, the proportion of Army officers ever deployed to Iraq/Afghanistan (but not other OEF/OIF missions) who were diagnosed with PTSD is 1.45%. The number is slightly lower for those who were deployed on OEF/OIF missions other than to Iraq/Afghanistan (1.26%). The rate of PTSD almost doubles for those who have been to Iraq/Afghanistan and on other OEF/OIF missions. We observe similar pattern in Marines and Navy, but not in Air Force.

Multivariate Analysis of Deployment Intensity on PTSD Rates—Enlisted Population. The raw proportions of personnel being diagnosed with PTSD shown in Table 3 provide a good comparison across services of the prevalence of PTSD based on types of deployments. We next report, in Table 4, the logistic regression results that compare, across services, the effect of the OEF/OIF deployment on the risk of being diagnosed with PTSD relative to the risk enlisted personnel would have had in the more typical military missions around the world. We present the results in terms of odds ratios and focus only on the effects of deployment characteristics in Table 4 (the complete regression results for Model 1 are included in the Appendix). The top panel of Table 4 reports the main effect of the last deployment's location and duration. With the Army, the first row indicates that the odds of being diagnosed with PTSD is 3.96 times higher among those deployed to Iraq/Afghanistan compared to those not deployed under OEF/OIF ($p<0.01$). Being deployed on other OEF/OIF missions also increases the odds of PTSD by the same magnitude ($OR=3.97$, $p<0.01$).

The effects of being deployed to Iraq/Afghanistan and on other OEF/OIF missions are comparable for the Marines, as it increases the odds of being diagnosed with PTSD by 4.57 and 3.51 times ($p<0.01$ for both), respectively. For the Navy, being deployed to Iraq/Afghanistan also carries a very high risk of getting PTSD ($OR=9.06$, $p<0.01$) compared to those not deployed under

OEF/OIF. Iraq/Afghanistan missions appear to have the smallest impact for Air Force, as the odds of being diagnosed with PTSD among those deployed to Iraq/Afghanistan is only 1.25 times higher than those not deployed ($p<0.05$). For the Navy and Air Force, the risk of being deployed on other OEF/OIF missions is actually lower than for those not deployed on an OEF/OIF mission (OR=0.54 and 0.44, respectively, both $p<0.01$).

Model 1 also shows that the tour length matters. Compared to those who have a short tour length (<120 days), Army soldiers whose last deployment was between 120-180 days are 1.18 times more likely to get PTSD ($p<0.01$) and those whose last deployment was more than 180 days have an odds ratio of 1.62 ($p<0.01$). Similar adverse effects of longer tours are observed for the Navy and Air Force. For the Marine Corps, the duration effect only shows up if they have been deployed more than 180 days (OR=1.11, $p<0.10$). It is worth noting that the adverse effects of deployment location and length are present even after we control for MOS, and not surprisingly, those in combat arms specialty (the reference group) have the highest odds of being diagnosed with PTSD (see the Appendix).

For Model 2, presented in the lower panel of Table 3, we add an interaction effect between the Iraq/Afghanistan location and the deployment duration variables to test whether long deployments exacerbate the effects of deployments to these two countries. For the Army, the 1.53 odds ratio on the "long" duration variable now indicates that those whose OEF/OIF deployment to locations other than Iraq/Afghanistan lasted more than 180 days are 1.53 times more likely to be diagnosed with PTSD than those whose last tour to those locations were under 120 days. The odds ratio on the Iraq/Afghanistan indicator now essentially compares the rate of PTSD between those deployed to Iraq/Afghanistan under 120 days and those not deployed to OEF/OIF missions. Even with a short tour, deployment to Iraq still results in an odds ratio of 3.70 ($p<0.01$). The same applies to the Marine Corps and Navy, but the Air Force still has a smaller effect of an

Iraq/Afghanistan deployment.

The key variables are the last two rows of Model 2. Among soldiers whose last deployment was to Iraq/Afghanistan, those that lasted more than 180 days had a 1.15 times higher risk of being diagnosed with PTSD ($p<0.10$) compared to those with a short (less than 120-day) deployment, which is in addition to the main Iraq/Afghanistan effect of 3.96). For the Army, a medium-length deployment had no additional effect on the risk of being diagnosed with PTSD. We observe additive effects for the Navy (OR for the interactive terms on medium and long duration are 2.50 and 2.47, respectively, $p<0.01$), but not for the Marine Corps or Air Force.

Next, due to the potential lags in the onset and diagnosis of PTSD, we examine, in Model 3, how previous OEF/OIF deployments affect the probability of being diagnosed with PTSD. The results in Table 5 are similar to Model 1 (where we only capture the location of the last deployment). The odds ratio of being diagnosed with PTSD for those deployed to Iraq/Afghanistan (but not on other OEF/OIF missions) compared to those never deployed under OEF/OIF ranges from 1.85 times for the Air Force to 10.34 times for the Navy ($p<0.01$ for all services). The highest increased risk of PTSD occurs for those who were deployed to Iraq/Afghanistan as well as on other OEF/OIF missions: the odds ratio of being diagnosed with PTSD ranges from 1.92 for the Air Force to 9.65 for the Navy ($p<0.01$ for all services) compared to those never sent on an OEF/OIF missions.

Model 4, in the bottom panel of Table 5, refines Model 3 further by incorporating frequency to a given location. For example, for Marines (2nd column), being deployed to Afghanistan or Iraq (regardless of frequency) increases the odds of getting PTSD by 4.04 times ($p<0.01$) compared to those never deployed to OEF/OIF missions. But, if the soldier deployed more than once to Afghanistan or Iraq, his odds of getting PTSD nearly double, increasing by *another* 1.91 times ($p<0.01$). Interestingly, for the Army, there is not an additive effect of more than one deployment to Afghanistan or Iraq. There are, however, similar adverse frequency effects in the other two

location categories in Marines and Army. We do not observe this kind of adverse frequency effect for Navy or Air Force.

In a sensitivity analysis, we address the empirical issue that the year variables could be highly correlated with the -OEF/OIF missions, thus causing multicollinearity and perhaps leading to an underestimation of the deployment effect on the risk of being diagnosed with PTSD. Thus we estimated models that excluded the year dummies, and the estimated effects of an Iraq/Afghanistan deployment on the risk of being diagnosed with PTSD were about 10-15 percent higher than our main models.

Multivariate Analysis of Deployment Intensity on PTSD Rates—Officer Population. We next report, in Table 6, the logistic regression results for officers, which is similar to what we have in Table 4 for enlisted personnel. Model 1 (the first panel) indicates that the effect of deployment intensity is a lot less severe in the officer population than in the enlisted population, with the exception of Marines. With the Army, the first row indicates that the odds of being diagnosed with PTSD is 1.81 times higher (compared to the odds of 3.96 in the enlisted population) among those deployed to Iraq/Afghanistan compared to those not deployed under OEF/OIF ($p<0.01$). Being deployed on other OEF/OIF missions increases the odds of being diagnosed with PTSD by a similar magnitude (OR=1.64, $p<0.01$). For the Marine officers, being deployed to Iraq/Afghanistan increased the odds of PTSD by 3.54 times ($p<0.01$). The odds are slightly lower (2.13, $p<0.05$) if the deployment is on other OEF/OIF missions. For Navy officers, the odds ratio is 2.05 for Iraq/Afghanistan deployments, but it is not statistically significant. Tour length matters for Army and Navy officers, but not for Marine or Air Force officers. A long tour (>180 days) carries 2.11 and 2.64 times higher risks of being diagnosed with PTSD for Army and Navy officers, respectively.

The second panel of Table 6 shows that there is little additive effect of deployment length

on the location effect for officers, as long deployments to Iraq and Afghanistan carry similar odds of being diagnosed with PTSD as short deployment. However, it is important to note that for Navy officers, due to the small sample size, the interaction term's coefficient, though having an odds ratio of 16.32, also carries an extremely large standard error so that statistical inference is not possible. We report the results from Model 3 in the last panel in Table 6. The location effects are larger than those estimated in Model 1 (where we only capture the location of last deployment). The odds ratio of being diagnosed with PTSD for those ever deployed to Iraq/Afghanistan (but not other OEF/OIF locations) compared to those never deployed under OEF/OIF ranges from 2.04 times for the Marines to 3.66 times for the Navy. The odds of being diagnosed with PTSD by those who were deployed to Iraq/Afghanistan as well as on other OEF/OIF missions ranges from 1.27 for the Air Force (not statistically significant) to 5.16 for the Marine ($p<0.01$) compared to those never sent on an OEF/OIF mission. Due to the sample size, we cannot refine Model 3 further to incorporate the frequency of deployments to a given location as we did with the enlisted population.

Descriptive Analysis of PTSD Population Comorbidity Distribution. For the last analysis of this report, we focus on just the PTSD population and provide a preliminary analysis of the mental health comorbidity in this population. Table 7 reports the results from the enlisted population. The table is divided into two panels. The first panel shows the percentage of PTSD population with other mental health diagnoses, separately for each service and separately for patients who were admitted to inpatient and outpatient settings. Not surprisingly, patients who were diagnosed with PTSD in an inpatient setting have a higher percentage of also having other mental health illnesses. Based on the prior literature, we classify the comorbidity into the following categories: major depression, substance abuse, other psychosis, other mental health illness, and unspecified mental/behavioral problems.(R. Rosenheck & Fontana, 2003) Among these five categories, depression and substance abuse are the top clinical diagnoses—over one third of

inpatient patients have depression and 23-39 percent were diagnosed with substance abuse (although we cannot ascertain whether the PTSD caused the substance abuse or they were concurrent mental health problems). In addition, 25-33 percent of inpatient patients have other mental health illnesses. Among the outpatient PTSD population, 13-20 percent also have depression, 8-26 percent were diagnosed with substance abuse, and between a quarter and a third of this population have other mental health illnesses. The distribution of these comorbidity categories is not very different across the services.

Another way to examine the severity of the PTSD case is by looking at number of mental health comorbidity in addition to PTSD (second panel of Table 7). Among the inpatient PTSD population, over 85 percent has at least one comorbidity with a substantial minority (14-17 percent, depending on the service) having two or more mental health illnesses in addition to PTSD. Among the outpatient PTSD population, between 45 percent (Navy) to 54 percent (Army) have a simple case of PTSD without any additional mental health comorbidity, but about 10 percent still have two or more additional mental health diagnoses.

Table 8 provides the same comorbidity information for the officer population. Similar to the enlisted population, depression remain the top category of comorbidity, and a substantial share of PTSD officers also suffer from other mental health illness (that are not substance abuse or psychosis). Unlike the enlisted population, substance abuse is not a common comorbidity of PTSD among officers. The count of comorbidity distribution is also similar. Among the inpatient PTSD population, the majority (ranging from two-thirds in Navy to 100 percent in Marines) have at least one comorbidity in addition to PTSD. Among the outpatient PTSD population, between 55 percent (Air Force) to 60 percent (Marines) have a simple case of PTSD with no additional mental health comorbidity. Note that the officer PTSD population is a lot smaller (especially among the inpatient population), and some of the reported distribution is based on very few cases.

Comments

In this study, we link deployment information and TRICARE health records for a random sample of active duty population to examine the relationship between deployment intensity and PTSD. We find that the percentage of PTSD diagnoses among the active duty population varies by service, but are all below one percent among those not deployed on OEF/OIF missions. But, those deployed to Iraq/Afghanistan have a much higher probability of being diagnosed with PTSD, with the percentages ranging from 1.3% for the Air Force to 6.5% for the Navy in the enlisted population, and 1%-2% for the officer population. Those deployed on other OEF/OIF missions, on the other hand, have higher PTSD rates relative to those not deployed on OEF/OIF missions only for the Army and Marine Corps.

While those comparisons describe the actual rates of PTSD across the services for different types of deployments, our regression models further explore how the deployment location and duration affect the risk of being diagnosed with PTSD, relative to what it would have been in other typical world-wide missions of the U.S. military. A deployment to Iraq/Afghanistan increases the odds of being diagnosed with PTSD substantially for the enlisted population, with the largest effect observed for the Navy (OR=9.06) and the smallest effect for the Air Force (OR=1.25). For officers, the adverse effects of location are much smaller, ranging from an odds ratio of 1.81 for the Army to an odds ratio of 3.54 for the Marines. The tour length also matters for all services in the enlisted population, as a deployment lasting longer than 180 days increases the odds of PTSD by 1.11 times to 2.84 times, depending on the service, compared to a short tour. Furthermore, for the Army and Navy, a deployment to Iraq/Afghanistan further exacerbates the adverse effect of tour length. For the officers population, tour length only appears to matter for Army and Navy, but not for Marines nor Air Force. The sizable adverse effect of deployment location persists when we considered all past deployments, not just the previous deployment.

Our overall rates of PTSD are much lower than previously reported based on surveys or on VA data (Ramchand, et al., 2008). There are several important factors that contribute to the differences. First, our sample is active duty personnel who are still deemed fit to serve in the military, whereas people who show up in the VA health care system are those who had left the military because they have serious physical or mental health problems that prevent them from continuing to serve. Second, compared to PTSD rates reported in anonymous surveys, which lack clinical details in the screening questions, our PTSD rates are based on clinical diagnoses. Military personnel may be more willing to admit to PTSD symptoms, even if they were mild, on an anonymous survey than they would to military health officials. Third, for people who have the desire to continue serving (and thus stay within the TRICARE system), the stigma of PTSD often prevents them from seeking care when needed since this information would then go on the service person's record.

It is also important to keep in mind the following limitations of this study. First, even though we were able to include military occupational specialty categories, we do not have details on the specific assignments. The lack of details on assignments might contribute to the lower odds ratios we observe among Navy and Air Force personnel who were deployed on OEF/OIF missions that are not in Iraq or Afghanistan.[2] Second, since our intention is to look at the prevalence of PTSD among the population of personnel who are still in service, we most likely miss severe cases of PTSD since those would show up in the VA system unless they were first diagnosed inside the TRICARE system. Lastly, using clinical diagnosis in a system that is not explicitly screening for PTSD has its own shortcoming. For example, using a sample of veterans studied before the VA instituted mandatory screening, Magruder and colleagues found that less than 1 in 5 cases of PTSD

[2] For example, in the Navy the reference group is mostly people on routine shipboard operation (although they might also be on their shore rotation). Personal communications with the sailors reveal that the living condition on ship is usually horrendous, and a ground OIF assignment in places like Quatar or Kuwait might actually be better compared to life on ship.

were detected among those seen only in primary care setting (Magruder, et al., 2004). Even though we have complete history of medical encounters during the study period (both inpatient and outpatient records), using clinical diagnoses to identify PTSD population is likely underestimate PTSD's true prevalence among still active population. However, we don't expect the degree of underestimation to differ by the deployment characteristics, therefore the odds ratios we estimated for the effect of deployment intensity on PTSD would not be biased.

With these caveats in mind, there are several important policy implications from our findings. First, the adverse effects of deployment location and duration are much larger in the enlisted population than in the officer population. This is most likely due to the differences in the tasks assigned to the two populations. Such findings do raise the question of whether additional mental health preparation is needed for the enlisted population. Second, while the adverse effects of Iraq/Afghanistan deployments across all services is expected, it might be surprising that such deployments cause the highest PTSD rates for the Navy enlisted personnel. This might be due to many sailors deployed to Iraq or Afghanistan being what the military calls Individual Augmentees (IA), who are those deployed individually or in a small group to assist Army and Marines. The IAs are subject to additional stress as they are thrust into an unfamiliar environment away from their parent command. It may be important to train these personnel for not just the additional physical skills but also mental health readiness for such assignments. In addition, the adverse effect of tour length is observed across all services in the enlisted population—and for the Air Force, longer durations are more likely to lead to PTSD than being deployed in Afghanistan/Iraq. While a recommendation of the optimal tour length for each branch is beyond the scope of this study, our findings do suggest that efforts to keep OEF/OIF deployments to reasonable lengths could help reduce PTSD rates.

Given the continuing nature of the Global War on Terror, it is unavoidable that many still

active personnel will be subjected to multiple deployments to OEF/OIF locations. We can expect thousands of new cases of PTSD, and it is imperative to monitor these soldiers' mental health. The DoD has begun to address this issue by introducing the Post-Deployment Health Reassessment (PDHRA, DD2900) in March 2005, and DoD mandates the completion of this re-assessment at 90-180 days after a deployment (US Department of Defense, 2008). However, our data show that almost 75 percent of the PTSD population in our sample did not get diagnosed with PTSD until 200 days after their last deployment—the average lapse between the last deployment and the first diagnosis of PTSD is 291 days. Further research effort should look into the extent of the effect due to repeated deployments and explore how effective PDHRA is in identifying PTSD cases, as well as more effective monitoring methods beyond the 180 day mandated surveys.

PTSD leads to a host of long-term family and workplace problems and is often associated with other psychiatric and physical disorders. As our descriptive analysis of the PTSD population shows, a substantial share of those with PTSD diagnoses has at least one other mental health comorbidity condition, with major depression and substance abuse being the top two associated diagnoses. Our research identifies the extent of the PTSD problem within the still active population and highlights how certain personnel regardless of their rank, based on their deployment characteristics, are at higher risks of developing this disorder. Further research into preventive measures and effective treatments of PTSD on the active duty population, especially the higher risk groups, needs to remain a focus within the Department of Defense. In addition, our study only focuses on active duty population and excludes the Reserve population that got activated. That population might have higher propensity of developing mental health illnesses after deployment, since their military trainings would not be as comprehensive as the active duty population. Future analysis examining the Reserve components would provide important information on the mental health readiness of this increasingly important segment of the military population. Lastly, while

PTSD remains the focus of media attention, other mental health illness such as depression and substance abuse have higher prevalence in the active duty population, and are just as costly to the individuals, military health system, and the society. A comprehensive analysis of other mental health illness would help the evaluation of total force readiness.

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Table 1.Descriptive Statistics of Enlisted Personnel Characteristics

	Army	Marines	Navy	Air Force
Deployment Characteristics				
Location of Last OEF/OIF Deployment				
Not deployed under OEF/OIF	77.9%	75.3%	64.3%	61.5%
Afghanistan or Iraq	11.3%	8.6%	1.0%	5.4%
Other countries under OEF/OIF	10.8%	16.0%	34.7%	33.1%
Duration of Last OEF/OIF Deployment				
Short (1-120 days)	28.0%	25.6%	31.4%	64.5%
Medium (120-180 days)	14.2%	26.0%	23.2%	24.7%
Long (more than 180 days)	57.7%	48.4%	45.4%	10.8%
Deployment History				
Ever deployed under OEF/OIF	22.1%	24.7%	35.7%	38.5%
Ever deployed to Afghanistan or Iraq only	31.4%	22.2%	2.0%	9.4%
Ever deployed to other OEF/OIF countries except Afghanistan or Iraq	45.0%	64.2%	97.0%	84.9%
Ever deployed to Afghanistan or Iraq, and other OEF/OIF countries	23.6%	13.6%	1.0%	5.7%
Service Characteristics				
Military Occupational Specialty*				
Combat Arms	28.9%	38.4%	4.9%	10.6%
Combat Support	10.9%	16.8%	10.0%	0.2%
Combat Service Support	26.7%	28.0%	5.6%	79.0%
Aviation	-	15.0%	3.4%	-
Medical	10.1%	-	3.0%	-
Other MOS	23.0%	1.3%	72.8%	9.8%
Rank				
E1-E3	33.6%	61.4%	38.2%	32.4%
E4	28.0%	17.0%	19.9%	18.7%
E5	17.4%	11.0%	20.4%	23.0%
E6	11.1%	5.6%	13.7%	14.5%
E7-E9	8.0%	4.4%	7.3%	11.5%
Demographic Characteristics				
Gender				
Male	88.7%	96.3%	87.4%	84.1%
Female	11.3%	3.7%	12.6%	15.9%
Marital Status				
Single	53.0%	69.0%	55.0%	48.2%
Married	47.0%	31.0%	45.0%	51.8%
Race				
White	63.9%	71.2%	57.2%	74.0%
Black	19.5%	10.3%	21.7%	15.3%
Hispanic	6.8%	8.2%	7.2%	3.4%
Asian	3.9%	2.8%	6.0%	2.2%
Other races	5.9%	7.6%	8.0%	5.0%
Age	27.7	23.4	27.0	28.5
Sample Size	332970	98695	134095	112467

Table 2.Descriptive Statistics of Officer Personnel Characteristics

	Army	Marines	Navy	Air Force
Deployment Characteristics				
Location of Last OEF/OIF Deployment				
Not deployed under OEF/OIF	74.7%	71.0%	67.0%	62.5%
Afghanistan or Iraq	10.5%	9.0%	1.6%	4.6%
Other countries under OEF/OIF	14.8%	20.0%	31.4%	32.9%
Duration of Last OEF/OIF Deployment				
Short (1-120 days)	36.6%	32.5%	42.2%	72.2%
Medium (120-180 days)	13.6%	24.2%	20.8%	19.3%
Long (more than 180 days)	49.8%	43.4%	37.0%	8.5%
Deployment History				
Ever deployed under OEF/OIF	25.3%	29.0%	33.0%	37.5%
Ever deployed to Afghanistan or Iraq only	27.0%	18.4%	3.7%	8.4%
Ever deployed to other OEF/OIF countries except Afghanistan or Iraq	55.3%	68.0%	94.8%	86.3%
Ever deployed to Afghanistan or Iraq, and other OEF/OIF countries	17.7%	13.5%	1.5%	5.2%
Service Characteristics				
Military Occupational Specialty*				
Combat Arms	32.7%	29.3%	1.3%	0.4%
Combat Support	16.4%	6.7%	8.1%	0.2%
Combat Service Support	18.5%	27.9%	88.6%	1.2%
Aviation		31.7%	0.5%	
Medical	12.7%		0.1%	
Other MOS	19.4%	4.3%	2.1%	98.0%
Rank				
O1_O2	34.2%	36.5%	33.5%	30.4%
O3	31.9%	28.7%	31.3%	31.6%
O4	20.4%	19.7%	20.3%	22.4%
O5	9.9%	11.2%	11.2%	12.3%
O6_O10	3.6%	3.9%	3.7%	3.3%
Demographic Characteristics				
Gender				
Male	87.5%	94.6%	88.4%	86.1%
Female	12.5%	5.4%	11.6%	13.9%
Marital Status				
Single	34.3%	36.4%	39.8%	31.4%
Married	65.7%	63.6%	60.2%	68.6%
Race				
White	77.5%	83.6%	82.2%	85.1%
Black	11.3%	5.5%	7.3%	5.3%
Hispanic	2.9%	2.8%	4.3%	1.7%
Asian	4.0%	2.0%	3.8%	2.0%
Other races	4.4%	6.2%	2.4%	5.8%
Age	34.4	32.9	33.9	34.4
Sample Size	48952	8927	15438	22556

Table 3. Rate of PTSD Diagnoses By Deployment Location

	Army	Marines	Navy	Air Force
Enlisted Population				
Overall	1.40%	1.06%	0.77%	0.56%
Based on Location of Last OEF/OIF Deployment				
Not deployed under OEF/OIF	0.63	0.52	0.83	0.62
Afghanistan or Iraq	4.41	3.51	6.46	1.34
Other countries under OEF/OIF	3.77	2.28	0.49	0.31
Based on Duration of Last OEF/OIF Deployment				
Short (1-120 days)	2.90	2.31	0.50	0.31
Medium (120-180 days)	3.49	2.22	0.66	0.62
Long (more than 180 days)	4.83	3.19	0.77	0.99
Based on Deployment History				
Not deployed under OEF/OIF	0.63	0.52	0.83	0.62
Ever deployed under OEF/OIF	4.10	2.71	0.66	0.46
Ever deployed to Afghanistan or Iraq only	3.48	2.76	6.32	1.27
Ever deployed to other OEF/OIF countries except Afghanistan or Iraq	3.43	2.19	0.49	0.31
Ever deployed to Afghanistan or Iraq, and other OEF/OIF countries	6.20	5.14	6.06	1.36
Sample Size	332970	98695	134095	112467
Officer Population				
Overall	0.66%	0.36%	0.31%	0.29%
Based on Location of Last OEF/OIF Deployment				
Not deployed under OEF/OIF	0.39	0.22	0.34	0.32
Afghanistan or Iraq	1.64	1.03	1.43	0.94
Other countries under OEF/OIF	1.31	0.57	0.19	0.15
Based on Duration of Last OEF/OIF Deployment				
Short (1-120 days)	0.90	0.63	0.17	0.17
Medium (120-180 days)	1.32	0.79	0.32	0.46
Long (more than 180 days)	1.88	0.73	0.30	0.48
Based on Deployment History				
Not deployed under OEF/OIF	0.39	0.22	0.34	0.32
Ever deployed under OEF/OIF	1.45	0.71	0.25	0.25
Ever deployed to Afghanistan or Iraq only	1.26	0.69	1.33	1.05
Ever deployed to other OEF/OIF countries except Afghanistan or Iraq	1.24	0.52	0.19	0.15
Ever deployed to Afghanistan or Iraq, and other OEF/OIF countries	2.38	1.69	1.36	0.53
Sample Size	48952	8927	15438	22556

Table 4. Effect of Last Deployment's Location and Duration on the Rate of PTSD Diagnoses--Enlisted Population

	Army	Marines	Navy	Air Force
Model 1: Main Effect				
Location of Last Deployment (reference group is not deployed under OEF/OIF)				
Deployed to Afghanistan or Iraq	3.96**	4.57**	9.06**	1.25*
	(0.12)	(0.32)	(1.10)	(0.11)
Deployed to other countries under OEF/OIF	3.97**	3.51**	0.54**	0.36**
	(0.11)	(0.21)	(0.04)	(0.02)
Duration of Last Deployment (reference group is short, <120 days)				
Medium (120-180 days)	1.18**	0.95	1.19+	1.72**
	(0.04)	(0.06)	(0.12)	(0.14)
Long (longer than 180 days)	1.62**	1.11+	1.21*	2.84**
	(0.04)	(0.06)	(0.11)	(0.28)
Model 2: Interactive Effect				
Location of Last Deployment (reference group is not deployed under OEF/OIF)				
Deployed to Afghanistan or Iraq	3.70**	5.37**	4.53**	1.25+
	(0.17)	(0.51)	(1.38)	(0.14)
Deployed to other countries under OEF/OIF	4.07**	3.32**	0.59**	0.36**
	(0.12)	(0.22)	(0.04)	(0.02)
Duration of Last Deployment (reference group is short, <120 days)				
Medium (120-180 days)	1.21**	0.97	1.07	1.70**
	(0.06)	(0.07)	(0.11)	(0.17)
Long (longer than 180 days)	1.53**	1.28**	1.07	2.89**
	(0.05)	(0.09)	(0.10)	(0.34)
Interaction Between Deployment Duration and Iraq/Afghanistan Location				
Medium duration X Iraq or Afghanistan	0.97	0.99	2.50*	1.02
	(0.08)	(0.15)	(0.96)	(0.18)
Long duration X Iraq or Afghanistan	1.15*	0.71**	2.47**	0.96
	(0.07)	(0.08)	(0.82)	(0.20)
Sample size	332970	98695	134095	112467

Note: Full regression results for Model 1 is in the Appendix.
** p<0.01, * p<0.05,+ p<0.10

Table 5. Effect of Deployment History on the Rate of PTSD Diagnoses--Enlisted Population

	Army	Marines	Navy	Air Force
Model 3: Past Deployment Countries				
Deployment History (reference group is never deployed under OEF/OIF)				
Ever deployed to Afghanistan or Iraq only	4.61**	4.09**	10.34**	1.85**
	(0.12)	(0.23)	(1.20)	(0.15)
Ever deployed to other OEF/OIF countries except Afghanistan or Iraq	4.64**	3.48**	0.61**	0.47**
	(0.10)	(0.16)	(0.03)	(0.03)
Ever deployed to Afghanistan, Iraq, and other countries under OEF/OIF	8.34**	7.10**	9.65**	1.92**
	(0.20)	(0.42)	(1.74)	(0.19)
Model 4: Past Deployment Frequency				
Deployment History (reference group is never deployed under OEF/OIF)				
Deployed at least once to Afghanistan or Iraq only	4.62**	4.04**	10.15**	1.88**
	(0.12)	(0.23)	(1.21)	(0.16)
Deployed more than once to Afghanistan or Iraq only	0.99	1.91**	1.43	0.74
	(0.07)	(0.31)	(0.64)	(0.26)
Deployed at least once to other countries under OEF/OIF except AF or Iraq	4.54**	2.98**	0.61**	0.50**
	(0.10)	(0.15)	(0.03)	(0.03)
Deployed more than once to other countries under OEF/OIF except AF or Iraq	1.19**	2.29**	1.07	0.78*
	(0.05)	(0.17)	(0.10)	(0.08)
Deployed at least once to Afghanistan, Iraq, and other countries	8.15**	7.31**	9.66**	2.01**
	(0.20)	(0.44)	(1.76)	(0.20)
Deployed more than once to Afghanistan, Iraq, and more than once to other countries	2.20**	2.12*	1.08	0.33*
	(0.20)	(0.70)	(1.24)	(0.17)
Sample size	332970	98695	134095	112467

Full results are available upon request
** p<0.01, * p<0.05,+ p<0.10

Table 6. Effect of Last Deployment's Location and Duration on the Rate of PTSD Diagnoses--Officer Population

	Army	Marines	Navy	Air Force
Model 1: Main Effect				
Location of Last Deployment (reference group is not deployed under OEF/OIF)				
Deployed to Afghanistan or Iraq	1.81**	3.54**	2.05	2.15*
	(0.24)	(1.50)	(1.33)	(0.73)
Deployed to other countries under OEF/OIF	1.64**	2.13*	0.54	0.34**
	(0.18)	(0.68)	(0.23)	(0.07)
Duration of Last Deployment (reference group is short, <120 days)				
Medium (120-180 days)	1.54**	1.07	1.34	1.81+
	(0.24)	(0.42)	(0.96)	(0.60)
Long (longer than 180 days)	2.11**	0.73	2.64*	0.60
	(0.24)	(0.27)	(1.21)	(0.38)
Model 2: Interactive Effect				
Location of Last Deployment (reference group is not deployed under OEF/OIF)				
Deployed to Afghanistan or Iraq	2.11**	5.95**	0.34	3.75**
	(0.41)	(2.77)	(0.54)	(1.05)
Deployed to other countries under OEF/OIF	1.57**	1.62	0.69	0.26**
	(0.19)	(0.63)	(0.25)	(0.07)
Duration of Last Deployment (reference group is short, <120 days)				
Medium (120-180 days)	1.68**	1.85	1.27	3.41**
	(0.32)	(0.85)	(0.90)	(1.33)
Long (longer than 180 days)	2.25**	0.93	1.62	1.53
	(0.31)	(0.46)	(0.71)	(1.01)
Interaction Between Deployment Duration and Iraq/Afghanistan Location				
Medium duration X Iraq or Afghanistan	0.75	0.13*	3.07	0.25*
	(0.25)	(0.13)	(6.83)	(0.15)
Long duration X Iraq or Afghanistan	0.79	0.48	16.32	0.08*
	(0.19)	(0.34)	(28.08)	(0.10)
Model 3: Past Deployment Countries				
Deployment History (reference group is never deployed under OEF/OIF)				
Ever deployed to Afghanistan or Iraq only	2.54**	2.04+	3.66*	3.08**
	(0.28)	(0.85)	(2.24)	(1.11)
Ever deployed to other OEF/OIF countries except Afghanistan or Iraq	2.29**	1.83*	0.83	0.36**
	(0.19)	(0.52)	(0.22)	(0.07)
Ever deployed to Afghanistan, Iraq, and other countries under OEF/OIF	4.84**	5.16**	3.38	1.27
	(0.51)	(1.82)	(3.39)	(0.57)
Sample size	48952	8927	15438	22556

Note: Full regression results for Model 1 is in the Appendix.
** p<0.01, * p<0.05,+ p<0.10

Table 7. Comorbidity Distribution By Services--Enlisted PTSD Population

	Army		Marines		Navy		Air Force	
	Inpatient	**Outpatient**	**Inpatient**	**Outpatient**	**Inpatient**	**Outpatient**	**Inpatient**	**Outpatient**
Mental Health Illness Indicators (in percentage)								
Depression	35.3	12.6	30.0	16.4	34.2	17.3	46.5	20.1
Substance Abuse	30.2	10.7	39.0	15.2	25.7	12.3	23.1	8.1
Other Psychosis	10.9	3.4	7.8	2.8	7.1	3.7	11.4	3.3
Other Mental Illness	24.9	30.7	24.6	27.2	33.5	35.9	26.0	30.0
Unspecified mental and behavioral problems (V40)	0.00	0.08	0.00	0.09	0.00	0.04	0.00	0.03
Count of Mental Illness Comorbidity (in percentage)								
0	16.7	54.3	15.0	51.7	13.4	44.7	10.5	50.8
1	66.6	35.7	69.0	37.0	73.0	43.3	73.1	38.8
2	15.5	8.3	15.8	9.5	13.4	10.1	15.2	8.7
>2	1.22	1.66	0.26	1.83	0.22	1.90	1.17	1.71
Number of Individuals	**1,806**	**19,444**	**387**	**4,244**	**448**	**4,896**	**342**	**3,567**

Table 8. Comorbidity Distribution By Services--Officer PTSD Population

	Army		Marines		Navy		Air Force	
	Inpatient	**Outpatient**	**Inpatient**	**Outpatient**	**Inpatient**	**Outpatient**	**Inpatient**	**Outpatient**
Mental Health Illness Indicators (in percentage)								
Depression	59.7	16.6	71.4	23.0	26.7	17.3	47.8	21.1
Substance Abuse	17.9	4.2	42.9	6.4	13.3	6.1	21.7	3.8
Other Psychosis	11.9	2.7	14.3	4.8	6.7	4.4	8.7	1.9
Other Mental Illness	17.9	27.6	28.6	19.1	26.7	28.1	26.1	30.4
Unspecified mental and behavioral problems	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Count of Mental Illness Comorbidity (in percentage)								
0	11.9	58.0	0.0	60.3	33.3	56.6	17.4	54.7
1	68.7	33.7	57.1	28.6	60.0	32.9	69.6	35.2
2	19.4	7.7	28.6	8.7	6.7	8.8	8.7	8.4
>2	0.00	0.67	14.29	2.38	0.00	1.70	4.35	1.63
Number of Individuals	**67**	**1202**	**7**	**126**	**15**	**295**	**23**	**369**

Appendix A. Effect of Deployment Location and Duration on the Rate of PTSD Diagnoses--Enlisted Population

	Army	Marines	Navy	Air Force
Location of Last Deployment (reference group is not deployed under OEF/OIF)				
Deployed to Afghanistan or Iraq	3.96**	4.57**	9.06**	1.25*
	(0.12)	(0.32)	(1.10)	(0.11)
Deployed to other countries under OEF/OIF	3.97**	3.51**	0.54**	0.36**
	(0.11)	(0.21)	(0.04)	(0.02)
Duration of Last Deployment (reference group is short, <120 days)				
Medium (120-180 days)	1.18**	0.95	1.19+	1.72**
	(0.04)	(0.06)	(0.12)	(0.14)
Long (longer than 180 days)	1.62**	1.11+	1.21*	2.84**
	(0.04)	(0.06)	(0.11)	(0.28)
Military Occupational Specialty (reference group is Combat Arms)				
Combat Support	0.29**	0.35**	0.02**	
	(0.01)	(0.02)	(0.00)	
Combat Service Support	0.33**	0.37**	0.03**	0.09**
	(0.01)	(0.02)	(0.00)	(0.00)
Aviation	-	0.22**	0.02**	-
		(0.02)	(0.00)	
Medical	0.31**	-	0.16**	-
	(0.01)		(0.01)	
Other MOS	0.34**	0.47**	0.03**	0.11**
	(0.01)	(0.07)	(0.00)	(0.01)
Rank (reference group is E1-E3)				
E4	1.22**	0.93	0.72**	1.07
	(0.03)	(0.04)	(0.04)	(0.06)
E5	1.00	0.88*	0.41**	1.00
	(0.03)	(0.05)	(0.03)	(0.07)
E6	0.73**	0.46**	0.23**	0.68**
	(0.03)	(0.04)	(0.02)	(0.06)
E7-E9	0.57**	0.26**	0.16**	0.70**
	(0.02)	(0.03)	(0.02)	(0.08)
Demographics				
race (reference group is White)				
African-American	0.88**	0.95	0.73**	0.92
	(0.02)	(0.06)	(0.04)	(0.05)
Hispanic	0.81**	0.84**	1.06	1.16
	(0.03)	(0.05)	(0.07)	(0.11)
Asian	0.57**	0.75*	0.69**	0.64**
	(0.03)	(0.09)	(0.06)	(0.10)
Other races	0.98	0.97	1.18*	1.13
	(0.03)	(0.06)	(0.07)	(0.09)
Gender (reference group is male)				
Female	2.96**	6.34**	4.90**	5.20**
	(0.08)	(0.41)	(0.19)	(0.20)
Marital status (reference group is married)				
Single	0.64**	0.56**	0.75**	0.76**
	(0.01)	(0.02)	(0.03)	(0.03)
Age	1.04**	1.07**	1.06**	1.03**
	(0.00)	(0.01)	(0.00)	(0.00)
Sample size	332970	98695	134095	112467

Note: Year dummies are included. ** p<0.01, * p<0.05,+ p<0.10

Appendix B. Effect of Deployment Location and Duration on the Rate of PTSD Diagnoses--Officer Population

	Army	Marines	Navy	Air Force
Location of Last Deployment (reference group is not deployed under OEF/OIF)				
Deployed to Afghanistan or Iraq	1.81**	3.54**	2.05	2.15*
	(0.24)	(1.50)	(1.33)	(0.73)
Deployed to other countries under OEF/OIF	1.64**	2.13*	0.54	0.34**
	(0.18)	(0.68)	(0.23)	(0.07)
Duration of Last Deployment (reference group is short, <120 days)				
Medium (120-180 days)	1.54**	1.07	1.34	1.81+
	(0.24)	(0.42)	(0.96)	(0.60)
Long (longer than 180 days)	2.11**	0.73	2.64*	0.60
	(0.24)	(0.27)	(1.21)	(0.38)
Military Occupational Specialty (reference group is Combat Arms)				
Combat Support	0.36**	0.19**	0.00**	
	(0.04)	(0.12)	(0.00)	
Combat Service Support	0.26**	0.40**	0.00**	0.00**
	(0.03)	(0.12)	(0.00)	(0.00)
Aviation		0.37**		
		(0.10)		
Medical	0.29**			
	(0.04)			
Other MOS	0.25**	0.03**	0.00**	0.00**
	(0.03)	(0.03)	(0.00)	(0.00)
Rank (reference group is O1-O2)				
O3	1.09	1.09	3.93**	3.33**
	(0.11)	(0.35)	(1.50)	(0.90)
O4	0.63**	0.39*	1.20	2.69**
	(0.08)	(0.17)	(0.55)	(0.83)
O5	0.53**	0.23**	0.39+	4.62**
	(0.08)	(0.12)	(0.21)	(1.57)
O6_O10	0.34**	0.46	0.29*	4.38**
	(0.07)	(0.30)	(0.16)	(1.90)
Demographics				
race (reference group is White)				
African-American	1.22*	0.44	0.82	1.25
	(0.12)	(0.26)	(0.34)	(0.37)
Hispanic	1.28	0.62	1.76+	1.27
	(0.22)	(0.45)	(0.55)	(0.55)
Asian	0.75	0.43	1.49	1.38
	(0.15)	(0.44)	(0.55)	(0.56)
Other races	1.41*	0.68	2.00+	1.39
	(0.20)	(0.35)	(0.84)	(0.42)
Gender (reference group is male)				
Female	4.79**	4.78**	3.82**	2.42**
	(0.46)	(1.73)	(0.82)	(0.42)
Marital status (reference group is married)				
Single	0.95	0.89	0.73	1.29
	(0.07)	(0.23)	(0.15)	(0.22)
Age	1.10**	1.14**	1.18**	1.04**
Sample size	48952	8927	15438	22556

Note: Year dummies are included. ** p<0.01, * p<0.05,+ p<0.

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