

AWARD NUMBER: W81XWH-11-2-0100

TITLE: The Temporal Relationship Between Intrafamilial Violence, Deployment, and Serious Mental Illness in US Army Service Members

PRINCIPAL INVESTIGATOR: David Rubin, MD, MSCE

CONTRACTING ORGANIZATION: Children's Hospital of Philadelphia
Philadelphia, PA 19104

REPORT DATE: January 2017

TYPE OF REPORT: Final

PREPARED FOR: U.S. Army Medical Research and Materiel Command
Fort Detrick, Maryland 21702-5012

DISTRIBUTION STATEMENT: Approved for Public Release; Distribution Unlimited

The views, opinions and/or findings contained in this report are those of the author(s) and should not be construed as an official Department of the Army position, policy or decision unless so designated by other documentation.

REPORT DOCUMENTATION PAGE				Form Approved OMB No. 0704-0188	
Public reporting burden for this collection of information is estimated to average 1 hour per response, including the time for reviewing instructions, searching existing data sources, gathering and maintaining the data needed, and completing and reviewing this collection of information. Send comments regarding this burden estimate or any other aspect of this collection of information, including suggestions for reducing this burden to Department of Defense, Washington Headquarters Services, Directorate for Information Operations and Reports (0704-0188), 1215 Jefferson Davis Highway, Suite 1204, Arlington, VA 22202-4302. Respondents should be aware that notwithstanding any other provision of law, no person shall be subject to any penalty for failing to comply with a collection of information if it does not display a currently valid OMB control number. PLEASE DO NOT RETURN YOUR FORM TO THE ABOVE ADDRESS.					
1. REPORT DATE January 2017		2. REPORT TYPE Final		3. DATES COVERED 18 FEB 2011 - 29 Oct 2016	
4. TITLE AND SUBTITLE The Temporal Relationship Between Intrafamilial Violence, Deployment, and Serious Mental Illness in US Army Service Members				5a. CONTRACT NUMBER	
				5b. GRANT NUMBER W81XWH-11-2-0100	
				5c. PROGRAM ELEMENT NUMBER	
6. AUTHOR(S) David Rubin, MD, MSCE rubin@email.chop.edu				5d. PROJECT NUMBER	
				5e. TASK NUMBER	
				5f. WORK UNIT NUMBER	
7. PERFORMING ORGANIZATION NAME(S) AND ADDRESS(ES) Children's Hospital of Philadelphia Philadelphia, PA 19104				8. PERFORMING ORGANIZATION REPORT NUMBER	
9. SPONSORING / MONITORING AGENCY NAME(S) AND ADDRESS(ES) U.S. Army Medical Research and Materiel Command Fort Detrick, Maryland 21702-5012				10. SPONSOR/MONITOR'S ACRONYM(S)	
				11. SPONSOR/MONITOR'S REPORT NUMBER(S)	
12. DISTRIBUTION / AVAILABILITY STATEMENT Approved for Public Release; Distribution Unlimited					
13. SUPPLEMENTARY NOTES					
14. ABSTRACT The high deployment tempo of the last decade has created unique stressors on military families. While military families themselves are not at increased risk for intrafamilial violence during peacetime, there is evidence that cycles of deployment may increase this risk. Prior data has demonstrated a cross-sectional association between deployment and intrafamilial violence, but there remains a great need to understand the temporal relationship between these factors, the specific personnel at greatest risk, and how such information can lead to better targeting of preventative resources.					
15. SUBJECT TERMS-					
16. SECURITY CLASSIFICATION OF:			17. LIMITATION OF ABSTRACT UU	18. NUMBER OF PAGES 116	19a. NAME OF RESPONSIBLE PERSON USAMRMC
a. REPORT U	b. ABSTRACT U	c. THIS PAGE U			19b. TELEPHONE NUMBER (include area code)

Table of Contents

	<u>Page</u>
1. Introduction	4
2. Keywords	4
3. Overall Project Summary	4
4. Key Research Accomplishments	19
5. Conclusion	21
6. Publications, Abstracts, and Presentations	22
7. Reportable Outcomes	24
8. Other Achievements	24
9. References	25
10. Appendices	27

1. INTRODUCTION:

Since 2001, multiple international conflicts have required the deployment of U.S. Army soldiers. There have been an increase in not only the number of soldiers deployed, but the number deployed multiple times (1). The effect of deployments on soldier health and reintegration has been documented in a growing body of literature. Recent evidence suggests that cycles of deployment are associated with increased risk for depression, alcohol and substance abuse, anxiety, and PTSD among soldiers. This risk may additionally differ according to rank and sex of soldiers (2-4).

As nearly half of U.S. Army soldiers are parents, these deployments have created unique stressors for military families (5). Risks for spouses of soldiers include marital problems, domestic violence, and mental health challenges (6-10). Among children of soldiers, studies have examined the effect of deployment on child behavior, educational well-being, mental health, as well as the relationship between children and their soldier-parent upon return from deployment (11-19).

The unique stressors experienced by military families related to deployments and relocations have raised questions about the risk for intrafamilial violence, particularly during a time period in which soldiers experienced frequent and prolonged combat-related deployments. Evidence has suggested that deployments may place children at increased risk of maltreatment (20-22). Services offered to soldiers and their families have begun to reflect the body of evidence that the stress of prolonged deployments impacts not only soldiers, but their families and relationships as well (8, 23, 24). If these deployment-related services are to be provided at an appropriate scale and with the specificity required to ensure their success, further information is needed about the specific temporal nature of the relationship between deployment and maltreatment.

The findings of this project provide evidence that can inform strategies to support U.S. Army soldiers and their families, providing an opportunity to precisely target resources that reduce the risk for intrafamilial violence that may be associated with deployment. The goals of this project were as follows: 1) to understand the temporal relationship between deployment and intra-familial violence; 2) analyze the effect of deployment on mental health states over time; 3) identify soldier and family characteristics that modify the temporal association between deployment and intra-familial violence.

With this project, we identified specific subgroups of families, time periods, and situations that constitute a unique and previously unexplored context in which family members of U.S. Army soldiers are at greatest risk for maltreatment. This information can improve policies within the Department of Defense to support family wellbeing and can improve soldier readiness.

2. KEYWORDS: child maltreatment, Family Advocacy Program, child protective services, prevention, child abuse, child neglect, mental health

3. OVERALL PROJECT SUMMARY: *Data supporting research conclusions, in the form of figures and/or tables, shall be embedded in the text, appended, or referenced to appended manuscripts. Actual or anticipated problems or delays and actions or plans to resolve them shall be included. Additionally, any changes in approach and reasons for these changes shall be reported.*

A revised SOW was submitted in August 2014 and approved in June 2015:

Stage 1 tasks and outcomes/products/deliverables with respective target dates.

Task	Outcome/product/deliverable
1. IRB approval (M1Y1Q1)	CHOP approval (M1Y1Q1)
2. HRPO approval (M3Y1Q1)	HRPO approval (M3Y1Q1)
3. Acquire data from DMDC, ACR, ACSAP, and TMA (M3Y1Q1).	Data use agreements; data acquired (M3Y1Q1-M2Y1Q2)
4. Prepare data (Y1Q1-4): Merge files, impute missing data, create variables	Working dataset (Y1Q4)
5. Primary analysis (Y1Q2-Y3Q2). a. Using proportional hazards models with time-varying covariates, we will analyze the effect of deployment on the development of mental health states over time. b. We will estimate levels of risk across soldiers by examining sub-groups of interest, including the soldier's unit, MOS, other family and individual characteristics, and deployment tempo characteristics. i. We will identify which MOS and units are at highest risk for intrafamilial violence after adjusting for other risk factors via regression models. ii. We will estimate the extent to which the effect of deployment on the risk of violence varies by unit and MOS. iii. We will model the difference in risk across sub-groups by modeling their relationship to family violence as effect modifiers using the mixed effects regression model.	Results that directly address Phase I aims and that inform data collection methods for Phase II (Y3Q2)
6. Prepare summary report of quantitative findings (Y3Q3-4). The report will provide: a. results on the temporal relationships and mediating and moderating factors that impact risk for intrafamilial violence; b. measures of relative effect of exposures and risk factors on the chances of intra-familial violence; c. the ratio of relative effects of risk for deployment and intrafamilial violence in the presence of effect modification (modifiers); d. predicted risk of violence across risk groups characterized by service person, family, unit, and installation; e. standardized estimates that will answer questions such as how many episodes of violence, and the number of injuries, that might be avoided by program changes or interventions applied to all service persons (or all families) or to certain high-risk subgroups.	Written report of quantitative findings (Y3Q4)
7. Prepare written progress reports as required by funder	Written progress reports (quarterly)

Progress and Accomplishments with Discussion

Stage 1 Task 1 was completed on February 15, 2011 when IRB at Children's Hospital of Philadelphia approved the study protocol for the IRB 09-007247.

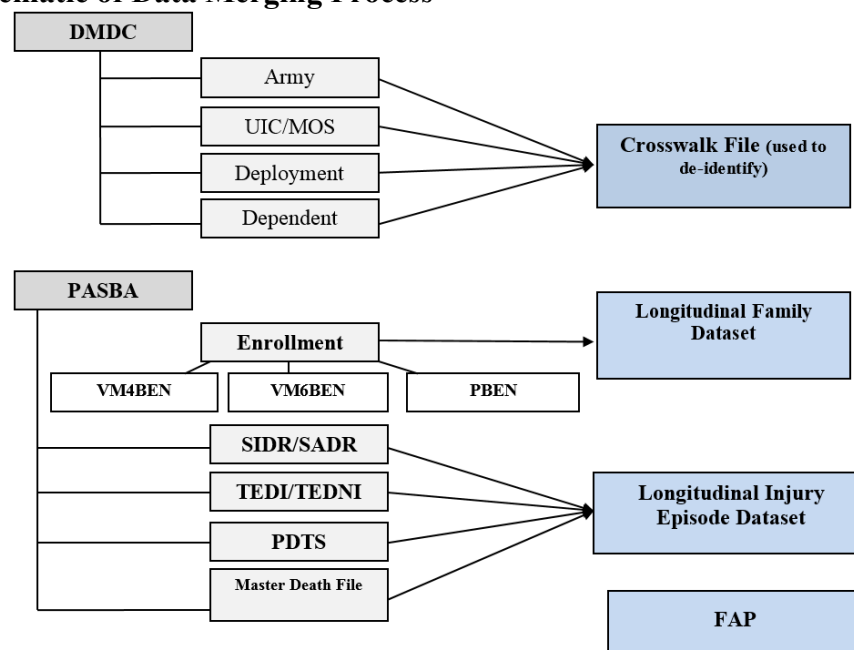
Stage 1 Task 2 was completed on May 11, 2011 when the U.S. Army Medical Research and Materiel Command's (USAMRMC), Office of Research Protections (ORP), Human Research Protection Office (HRPO) approved the study protocol that had previously been approved by the IRB at Children's Hospital of Philadelphia.

Stage 1 Task 3 of this project entailed the acquisition of datasets from three sources: 1) the Defense Manpower Data Center (DMDC) provided records of soldier enlistment and demographic characteristics; 2) Patient Administration Systems and Biostatistics Activity (PASBA) provided medical claims; and 3) Family Advocacy Program (FAP) data from the Army Central Registry (ACR) provided reports of substantiated child maltreatment. The project initially experienced an 11 month delay in acquisition of the PASBA medical claims data. This resulted in significant delays in data preparation, cleaning, linking datasets. Additionally, FAP data from the ACR was delayed due to Data Transfer Agreements. In 2012, the team requested the first no cost extension to accommodate the change in project timeline caused by these delays.

Stage 1 Task 4 (data cleaning and preparation) began in 2011 as the data requests were delayed. Throughout 2011 and 2012, we developed key algorithms including our PTSD definitions (Appendix A), a high risk injury for child abuse and neglect algorithm (Appendix B), and identified groups of medications to be used in identifying treatment for mental health conditions (Appendix C). In 2013, we completed our data acquisition request with PASBA, meaning we were able to proceed with the development of analysis datasets from the three administrative data sources we had received.

Early data preparation and cleaning entailed identifying and defining family units among enlisted U.S. Army soldiers and their children. Family units were identified using dependent and sponsor social security number (SSN) and then linked across datasets using SSNs and Unique DOD identifiers called EDI_PINS. To accomplish our analytical goals, we created four datasets: 1) a crosswalk file used to identify family units and link their data between datasets; 2) a longitudinal family dataset used to identify a family's association with the U.S. Army over time; 3) a longitudinal dataset used to identify episodes of child maltreatment and soldier mental illness over time; and 4) FAP records of substantiated child maltreatment reports. The process of creating and linking these four datasets is illustrated in **Figure 1** below.

Figure 1. Schematic of Data Merging Process



In the process of cleaning the component datasets and producing a usable analytic file, several unexpected issues were identified and discussed in both quarterly and annual reports. These included linking datasets; variable missingness; inconsistent variable definitions across datasets; establishing a longitudinal cohort of discrete family units; and identifying crude rates of child maltreatment across our cohort.

The cohort we ultimately identified from our work in Stage 1 Task 4 consisted of 418,011 active duty service members (ADSM) and their nearly 1.2 million dependents across 580,000 unique families. Enlisted service members (E1-E4) accounted for 80% of our service member cohort. At the study start time (09/2001), 41% of ADSM were less than 24 years of age, 17% were 24-28 years of age, and 42% were greater than 28 years of age. Of the 1.2 million dependents, 61% were dependent children at some point during the study period and 36% were dependent spouses. Thirty-six percent of children were born during the study period. Of all ADSM in the study cohort, 71% of the cohort was deployed at some point during the study period. Of those deployed, 97% experienced 1-3 deployments from 09/2001-09/2007. Due to the sheer size of the data sets, we created separate longitudinal files that would be later used to complete separate analyses.

Two approaches were used to estimate the occurrence of child maltreatment in U.S. Army families. The first approach used Family Advocacy Program substantiated reports of child maltreatment in the Army families included in the study. Data included details for each report such as type of maltreatment (physical abuse, sexual abuse, emotional abuse, and neglect), severity of abuse, drug and alcohol involvement, perpetrator characteristics, and death due to maltreatment. The second approach for identifying child maltreatment used diagnostic codes found in medical claims records to identify child injuries, and specific abuse/assault codes to identify cases of serious physical abuse (such as children hospitalized with head injuries, burns, or fractures due to abuse) and children at high risk for injury due to abuse (25).

While working with each of these methods of identifying child maltreatment, it became apparent that medical diagnoses of maltreatment and reports to the Family Advocacy Program did not overlap as expected. Because medical providers are mandated reporters of suspected child maltreatment, we expected that all medical diagnoses of maltreatment would have a corresponding report to the Family Advocacy Program. After finding that this did not hold true in our data, our team decided to more fully explore the implications of this finding as it could represent an important gap in reporting to the Family Advocacy Program that could have serious implications for children. Though of the scope of the original analysis, our Army partners felt that this was a priority. The findings of this analysis are detailed in Stage 1 Task 6.

Stage 1 Task 5a used proportional hazards models to analyze the effect of deployment on the development of mental health states among soldiers over time. Our team of mental health experts developed an algorithm for identifying mental health conditions from the TRICARE medical claims. This is a critical issue for the study because Army regulation and clinical practice changed significantly over the study period. Therefore, this algorithm takes into account the ICD-9 codes for mental illness diagnoses, but also relies on other comorbid conditions. This algorithm acted as a guide as we explore the data to identify cases of PTSD and other deployment-related conditions. Our mental illness identification and classification algorithm has been validated by Gerlinde Harb, PhD, Dr. Richard Ross, MD, PhD, as well as behavioral specialists within the U.S. Army. We categorized mental health diagnoses into the following groups: PTSD, mood disorders, anxiety disorders, psychotic disorders, attention deficit disorders,

violence-related disorders, personality disorders, sleep disorders, and substance abuse disorders (Appendix D).

We first conducted an analysis examining when mental health conditions were first identified relative to soldier's deployment. A manuscript of these analyses is currently being prepared for peer review. Our study population consisted of 159,451 active-duty US Army soldiers with at least three consecutive years of active service and a single deployment between October 2001 and September 2007. All soldiers in our population had either a spouse or child dependent during the study period. To study a homogeneous group of soldiers, we restricted our population to soldiers who experienced one deployment during the study period.

This descriptive analysis identified that 42% of soldiers with a single deployment received a mental health diagnosis at some point during their enlistment (**Table 1**) (26). During the pre-deployment period, 21% perceived their first diagnosis, while 18.7% received their first mental health diagnosis in the post-deployment period. Receipt of more specific diagnoses appeared to increase in the post-deployment period, relative to the pre-deployment period. First-time diagnoses of adjustment and acute stress disorder increased from 5.5% of soldiers in pre-deployment to 8.1% in post-deployment. Anxiety disorder was diagnosed in 3.1% of soldiers in pre-deployment and 5.2% in post-deployment. Similarly, 0.3% of soldiers were diagnosed with PTSD in the pre-deployment, compared to 4.5% in the post-deployment period.

Table 1. First identification of mental health diagnoses among soldiers deployed once, by deployment time period. (26)

Mental Health Diagnoses	Overall Rate of Identification (% of 159,452 soldiers^a)	First Identification in Pre-Deployment Period, %	First Identification in Post-Deployment Period, %
Any mental health diagnosis	42.0	21.0	18.7
Adjustment and acute stress disorders	14.4	5.5	8.1
Mood disorder	8.6	3.1	5.2
Alcohol/substance use disorders	7.4	3.7	3.5
Anxiety disorder	6.5	1.8	4.1
Post-traumatic stress disorder	5.0	0.3	4.5
Personality disorder	1.5	0.5	0.9
Sleep disorder	0.5	0.1	0.4

^a 159,452 soldiers includes only soldiers who enlisted during the study period (2001-2007) and were deployed at total of one time during their observation period.

We conducted an additional analysis using proportional hazards models with time-varying covariates to analyze the risk factors associated with the development of PTSD in the post-deployment period. For this analysis, our study population consisted of 139,156 soldiers with a single deployment between 2001 and 2007, and who had not received a diagnosis of PTSD prior to the end of their deployment. Cox proportional hazard models were used to estimate the hazard of PTSD diagnosis by month. Right censoring occurred when the soldier was no longer enlisted, or the study period ended (September, 2007).

Among this study population, 5.2% (n = 7,264) received a PTSD diagnosis after returning from deployment. In proportional hazards models adjusting for only demographic characteristics,

male soldiers (HR = 1.26, $p < 0.001$) were more likely than female soldiers to be diagnosed with PTSD, while officers or warrant officers were less likely (HR = 0.41, $p < 0.001$) than soldiers with an enlisted rank to receive a PTSD diagnosis (Appendix E). Additionally, compared to their white counterparts, black (HR = 0.62, $p < 0.001$) and Asian/Pacific Islander (HR = 0.64, $p < 0.001$) soldiers were less likely to receive a PTSD diagnosis.

We additionally created models adjusting for characteristics related to deployment and service characteristics, as well as mental health states prior to deployment. In these models, soldiers with an infantry MOS code were more likely to receive a PTSD diagnosis (HR = 1.5, $p < 0.001$). Soldiers with a severe or mild traumatic brain injury were also significantly more likely to be diagnosed with PTSD (HR = 2.61, $p < 0.001$; HR = 2.14, $p < 0.001$). Compared to those whose deployment lasted 1-6 months, those deployed 7-12 months (HR = 1.41, $p < 0.001$) and those deployed for longer than 12 months (HR = 1.61, $p < 0.001$) were at increased risk of PTSD. Those soldiers associated with child (HR = 1.25, $p < 0.001$) or spousal abuse (HR = 1.65, $p < 0.001$), as well as those with a mental illness diagnosed in the pre-deployment period (HR = 1.80, $p < 0.001$), were more likely to have PTSD.

Stage 1 Task 5.b.i-ii estimated levels of risk for child maltreatment across soldiers by examining sub-groups of interest related to their specific service characteristics, including deployment tempo, rank, and timing of maltreatment relative to deployment. To accomplish this, we conducted two retrospective cohort studies to examine the risk of child maltreatment among a cohort of children less than two years with an active-duty service member having either one or two deployments from 2001-2007.

In **the first study** (Appendix F), we descriptively examined changes in rates of abuse at several points in time relative to a soldier's deployment. We examined two distinct outcomes occurred among children ages 0-24 months: 1) substantiated child maltreatment reports from FAP; and 2) medical diagnoses of child maltreatment (based on International Classification of Diseases, Ninth Revision, Clinical Modification (ICD-9-CM) codes) from TRICARE medical records.

Exposures of interest were predefined time periods relative to a soldier's deployment. For soldiers who experienced a total of 1 deployment during the study period (1-deployed), the observation window was divided into the following 5 periods:

1. 7 or more months pre-deployment (time before a deployment begins),
2. 0 to 6 months pre-deployment,
3. during deployment,
4. 0 to 6 months post-deployment (time after a deployment ends), and
5. 7 or more months post-deployment.

For soldiers who experienced a total of 2 deployments during the study period (2-deployed), the observation window was divided into the following 7 periods:

1. 7 or more months pre-deployment,
2. 0 to 6 months pre---first deployment,
3. during first deployment,
4. between deployments (inter-deployment),
5. during second deployment,
6. 0 to 6 months post---second deployment, and
7. 7 or more months post-deployments.

For each deployment period, maltreatment rates were calculated as the observed number of maltreatment episodes divided by the number of child-months. P-values comparing rates in different exposure periods were obtained assuming a Poisson distribution.

Among 1-deployed soldiers, 444 children (0.46%) had a substantiated maltreatment episode, and 461 children (0.48%) had a medical diagnosis of maltreatment, resulting in rates of 4.58 substantiated maltreatment episodes per 1000 children and 4.75 medical diagnoses of maltreatment per 1000 children across the study period. For 2-deployed soldiers, 334 children (0.50%) had a substantiated maltreatment episode, and 270 children (0.40%) had a medical diagnosis of maltreatment, corresponding to 5.00 substantiated maltreatment episodes per 1000 children and 4.04 medical diagnoses of maltreatment per 1000 children.

Child Maltreatment Rates among Dependent Children of 1-Deployed Soldiers: For children of 1-deployed soldiers, substantiated FAP reports occurred at a rate of 2.90 episodes (95% CI 2.67, 3.17) per 10,000 child-months. Substantiated FAP reports were higher for the 6-month period after deployment compared to the 6-month period before deployment (4.43 episodes vs. 2.69 episodes per 10,000 child-months, $p=0.007$). The rate during deployment was also higher compared to the 6-month period before deployment (3.72 episodes per 10,000 child-months vs. 2.69 episodes per 10,000 child-months, $p=0.05$) (**Figure 1**).

Child Maltreatment Rates among Dependent Children of 2-Deployed Soldiers: In aggregate, the rate of child maltreatment for dependents of 2-deployed soldiers was 3.01 episodes (95% CI 2.71, 3.33) per 10,000 child-months. The rate of maltreatment during a soldier's first deployment was 2.78 episodes (95% CI 2.02, 3.75) per 10,000 child-months. During a soldier's second deployment, the rate of child maltreatment increased significantly to 4.83 episodes per 10,000 child-months (95% CI 3.89, 5.94, $p=0.003$) (**Figure 2**).

Child Maltreatment Rates among Dependent Children of 1-Deployed Soldiers: In aggregate, medical diagnoses of child maltreatment occurred at a rate of 3.22 episodes (95% CI 2.96, 3.49) per 10,000 child-months. Medical diagnoses of child maltreatment occurred at a rate of 3.34 episodes per 10,000 child-months during deployment, which was lower than the post-6 month deployment period rate of 4.63 events (95% CI 3.61, 5.85) per 10,000 child-months (95% CI 3.90, 6.22, $p=0.008$) (**Figure 1**). See Supplement eTable2 for a description of maltreatment type by deployment period.

Child Maltreatment Rates among Dependent Children of 2-Deployed Soldiers: In aggregate, the rate of child maltreatment for dependents of soldiers who were deployed twice was 2.71 episodes (95% CI 2.44, 3.02) per 10,000 child-months. The rate of maltreatment during a soldier's first deployment was 2.98 episodes per 10,000 child-months (95% CI 2.18, 3.97). During a soldier's second deployment, the rate of child maltreatment was slightly lower with 2.69 episodes per 10,000 child-months (95% CI 1.99, 3.54) (**Figure 2**).

Figure 1: Rate of Child Maltreatment by Deployment Periods among Children of Soldiers Deployed Once

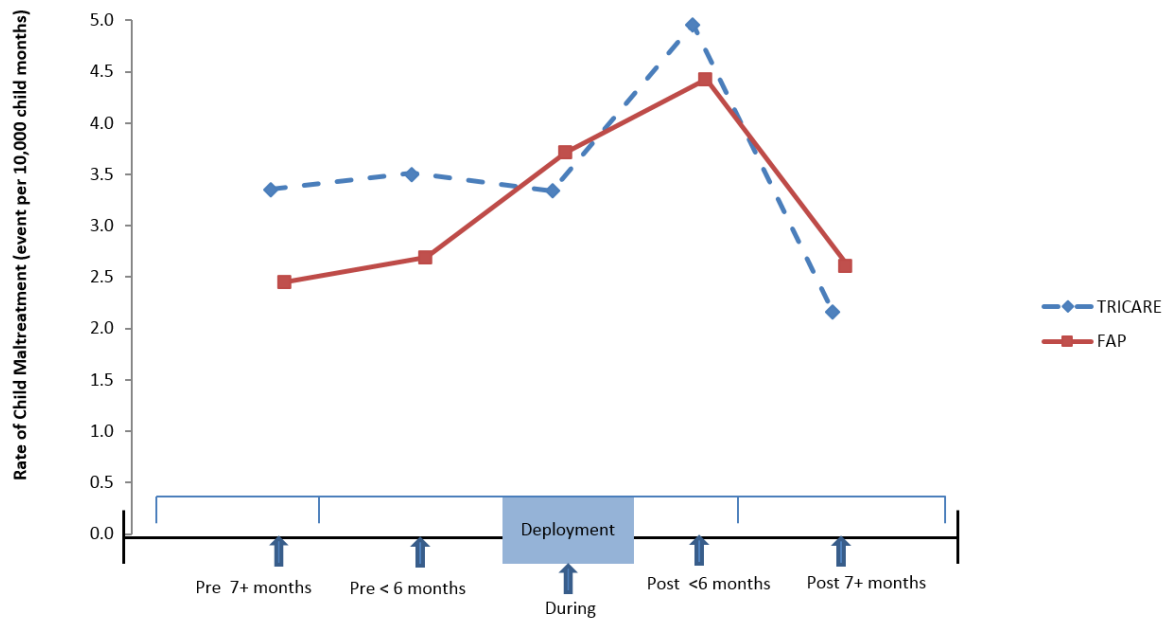
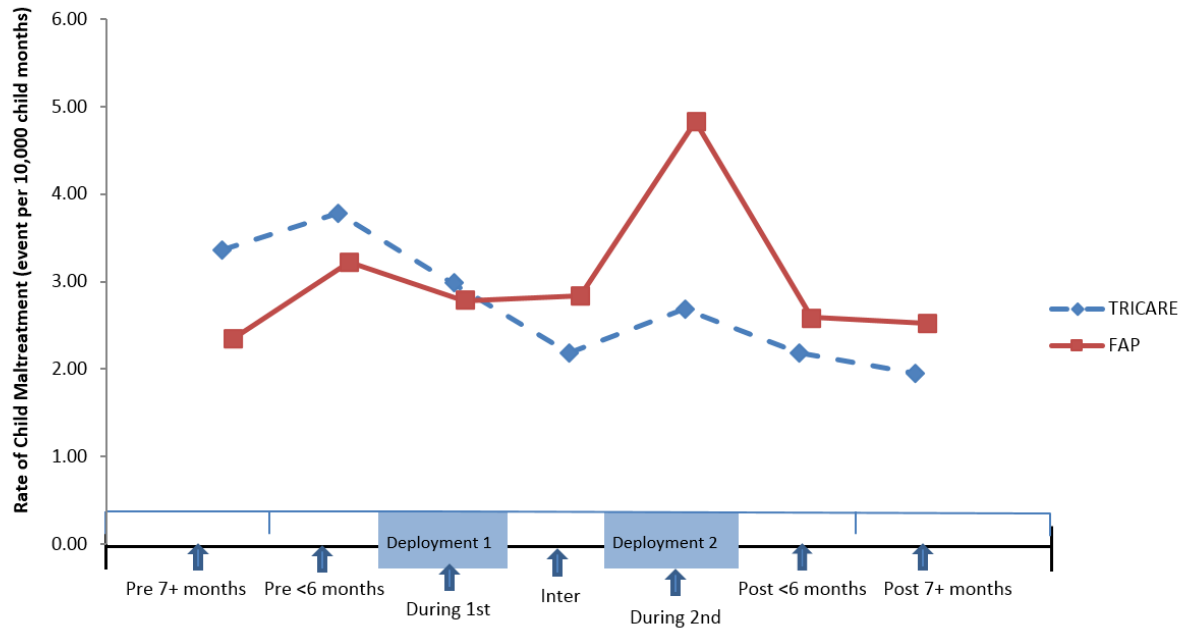


Figure 2: Rate of Child Maltreatment by Deployment Periods among Children of Soldiers Deployed Twice



In the **second study** (Appendix G), we built on our initial findings by using proportional hazards model to simultaneously examine the time periods at which children were at risk, as well as endogenous child- and parent level characteristics associated with maltreatment. Among other goals, this allowed us to examine the association between maltreatment and soldier rank, as well

as the risk of maltreatment at particular points in time periods surrounding a soldier's deployment.

We used a study population similar to the prior study of unadjusted rates of abuse, however for this analysis we selected only children of soldiers with one deployment during the study period in order to reduce heterogeneity in our study population. Cox proportional hazard models were used to estimate the hazard of child maltreatment. Right censoring occurred when the child aged to 25 months or when the study period ended (September, 2007). As before, our outcome was a medical diagnosis of child maltreatment or a substantiated report to the Family Advocacy Program. Children's exposure to deployment time period was modeled as a time-varying covariate where each child-month was assigned one of the five time periods relative to the soldier's deployment. The additional primary exposures included soldier-level characteristics of gender, as well as any diagnoses of mental health condition or prescription drug use related to a mental health condition before the birth of the child. The primary child characteristic was a history of premature birth or early special needs.

While controlling for the previously mentioned soldier characteristics, we identified that compared to the pre-deployment period, children were at highest risk of maltreatment in the 6 months following a soldier's deployment (HR=1.68; $p<0.001$). (See Table 2 in Appendix G)

Additionally, after controlling for important demographic, family-, and soldier-level characteristics, children of soldiers of with officer or warrant officer rank were significantly less likely than those of enlisted rank to experience maltreatment (HR=0.47, $p=0.004$). Children whose sponsor had a mental illness diagnosed prior to their birth were at an overall increased risk compared to children of sponsors with no diagnosis (HR=1.69; $p<0.001$). Children of soldiers with higher educational attainment were less likely to experience maltreatment (HR=0.39; $p<0.001$). We identified no overall difference in risk for children of male soldiers compared to female soldiers (HR = 0.87; $p=0.33$).

Children born prematurely or with special healthcare needs were at substantially increased risk of maltreatment (HR=2.01; $p<0.001$), as well as, children with multiple siblings (HR=1.47; $p<0.001$). There was no difference in risk of maltreatment among male children compared to female (HR=1.07; $p=0.43$).

Stage 1, Task 5.b.iii: Finally, after identifying that the time period following a soldier's deployment was significantly associated with child maltreatment, we sought to build on these findings by examining how the risk related to deployment time periods is modified by other important child and soldier characteristics.

Use the same proportional hazards models with time-varying covariates, we specifically sought to understand how the temporal relationship between family violence and deployment may be different depending on soldier gender, as well as soldier mental health characteristics. To examine the modifying effect of mental health states, we categorized soldiers as 1) receiving a mental health diagnosis, 2) receiving a mental health prescription but never a diagnosis, and 3) having received neither a diagnosis nor a prescription. In models testing for these interactions, model fit was significantly improved when accounting for differences in maltreatment risk across deployment time periods for soldier gender ($p=0.02$), and a trend towards improved model fit for

difference across time periods for soldier mental health history ($p=0.07$). (See Table 3 in Appendix G)

The effect modification across deployment time periods is best characterized by within-group hazard ratios comparing each time period to the baseline time period of more than six months prior to deployment (Table 3). For example, among children with a male soldier-parent, risk for maltreatment was elevated during deployment ($HR=1.30$, $p=0.04$), and in the 6 months following deployment ($HR=1.72$, $p<0.001$), relative to the baseline time period. Among children of female soldier-parent, the hazard of maltreatment was highest in the 6 months prior to deployment ($HR=1.82$, $p=0.05$). Similarly, the contrast within time periods, but across soldier gender is also revealing. Within the 6 months prior to deployment, the risk of maltreatment was significantly higher among children of female soldiers relative to male soldiers ($HR = 2.20$, $p=0.006$), greater than among any other period of deployment. (See Table 3 in Appendix G)

The effect modification of soldier mental health history across time periods also resulted in contrasts relative to the baseline time period of more than six months before deployment. The children of soldiers who had received a psychotropic prescription without a formal mental health diagnosis had an elevated hazard for maltreatment in the 6 months following deployment ($HR = 2.66$, $p=0.002$) and during deployment ($HR = 1.88$, $p = 0.04$). At the same time, the children of those who had received a mental health diagnosis ($HR = 1.64$, $p<0.05$) and of those who had no prior mental health services ($HR = 1.49$, $p=0.02$) had elevated risk in the post-deployment period relative to each's respective baseline time period. Within the 6 months prior to deployment, however, those soldiers who had a formal mental health diagnosis had significantly increased risk of maltreatment compared to those with no prior mental health diagnoses or prescriptions ($HR = 2.78$, $p<0.001$). The increased risk for soldiers with a mental illness diagnosis was also present in the period of more than 6 months prior to deployment ($HR = 1.47$, $p=0.04$), and the 6 months following deployment ($HR = 1.63$, $p<0.05$).

Stage 1 Task 6 was completed over a 3-year period from 2014-2017. The team drafted three manuscripts for academic journals reporting Stage 1 quantitative findings. These manuscripts represent the progression of our findings and the context in which we believe them to be most useful. The abstracts for these manuscripts are included below, as well as the published manuscripts in the appendices. Following the abstracts, this report will provide further detail as to how these manuscripts address the aims outlined for Stage 1 Task 6 in the Statement of Work.

Differential Child Maltreatment Risk Across Deployment Periods of US Army Soldiers (Appendix G) (5)

Objectives: The objective of this study was to describe the risk for maltreatment among toddlers of US Army soldiers over deployment cycles. Our goal was to determine if there were child maltreatment risk periods that have not been previously described.

Methods: A person-time analysis of substantiated maltreatment reports and medical diagnoses among children of 112,325 deployed US Army soldiers between 2001 and 2007.

Results: Elevated risk of maltreatment was found directly after deployment for children of soldiers deployed once during the study period, but not for children of soldiers deployed twice. During the 6 months after deployment, children of 1-deployed soldiers had 4.43 substantiated maltreatment reports and 4.96 medical diagnoses per 10,000 child-months. The highest rate of maltreatment among children of 2-deployed soldiers occurred during the second deployment for substantiated maltreatment episodes (4.83 episodes per 10,000 child-months) and before the first deployment for medical diagnoses of maltreatment (3.78 episodes per 10,000 child-months).

Conclusions: This study highlights differential child maltreatment risk across deployment periods and suggests possible points for interventions to facilitate successful reintegration and family stability across the deployment cycle.

Under-Ascertainment from Healthcare Settings of Child Abuse Events among Children of Soldiers by the U.S. Army Family Advocacy Program (Appendix H) (27)

In cases of maltreatment involving children of U.S. Army service members, the U.S. Army Family Advocacy Program (FAP) is responsible for providing services to families and ensuring child safety. The percentage of cases of maltreatment that are known to FAP, however, is uncertain. Thus, the objective of this retrospective study was to estimate the percentage of U.S. Army dependent children with child maltreatment as diagnosed by a military or civilian medical provider who had a substantiated report with FAP from 2004-2007. Medical claims data were used to identify 0-17 year old child dependents of soldiers who received a medical diagnosis of child maltreatment. Linkage rates of maltreatment medical diagnoses with corresponding substantiated FAP reports were calculated. Bivariate and multivariable analyses examined the association of child, maltreatment episode, and soldier characteristics with linkage to substantiated FAP reports. Across 5,945 medically diagnosed maltreatment episodes, 20.3% had a substantiated FAP report. Adjusting for covariates, the predicted probability of linkage to a substantiated FAP report was higher for physical abuse than for sexual abuse, 25.8%, 95% CI (23.4, 28.3) versus 14.5%, 95% CI (11.2, 17.9). Episodes in which early care was provided at civilian treatment facilities were less likely to have a FAP report than those treated at military facilities, 9.8%, 95% CI (7.3, 12.2) versus 23.6%, 95% CI (20.8, 26.4). The observed low rates of linkage of medically diagnosed child maltreatment to substantiated FAP reports may signal the need for further regulation of FAP reporting requirements, particularly for children treated at civilian facilities.

Family Characteristics Associated with Maltreatment across the Deployment Cycle of U.S. Army Soldiers (Appendix G) (26,28)

Introduction: Soldier deployment can create a stressful environment for US Army families with young children. Prior research has identified elevated rates of child maltreatment in the six months immediately following a soldier's return home from deployment. In this study, we longitudinally examine how other child- and family-level characteristics influence the relationship of deployment to risk for maltreatment of dependent children of US Army soldiers.

Materials and Methods: We conducted a person-time analysis of substantiated reports and medical diagnoses of maltreatment among the 73,404 children of 56,087 US Army soldiers with a single deployment between 2001 and 2007. Cox proportional hazard models estimated hazard rates of maltreatment across deployment periods while simultaneously considering main effects for other child- and family-level characteristics across periods.

Results: In adjusted models, maltreatment hazard was highest in the 6 months following deployment (HR = 1.63, $p < 0.001$). Children born prematurely or with early special needs independently had an increased risk for maltreatment across all periods (HR = 2.02, $p < 0.001$), as well as those children whose soldier-parent had been previously diagnosed with a mental illness (HR = 1.68, $p < 0.001$). In models testing for effect modification, during the 6 months prior to deployment, children of female soldiers (HR = 2.22, $p = 0.006$), as well as children of soldiers with a mental health diagnosis (HR = 2.78, $p = 0.001$) were more likely to experience maltreatment, exceeding the risk at all other time periods.

Conclusions: Infants and children are at increased risk for maltreatment in the six months following a parent's deployment, even after accounting for other known family- and child-level risk factors. However, the risk does not appear to be the same for all soldiers and their families in relationship to deployment, particularly for female soldiers and those who had previously diagnosed mental health issues, for whom the risk appears most elevated prior to deployment. Accounting for the unique needs of high-risk families at different stages of a soldier's deployment cycle may allow the US Army to better direct resources that prevent and address child maltreatment.

Stage 1 Task 6a provided results on the temporal relationships and mediating and moderating factors that impact risk for intrafamilial violence. *Taylor et al, 2015* provided descriptive evidence that families experiencing different number of deployments had different periods in which the risk for child maltreatment was highest. For those soldiers deployed a single time, the highest risk period was in the 6 months immediately following a deployment. Among those soldiers deployed twice, rates of maltreatment were highest during the second deployment, suggesting that the stress of deployment impacted not just the soldier, but the entire family unit.

Strane et al, 2017 provided further evidence of a temporal relationship between deployment and risk for abuse. In this analysis, we examined this relationship in the context of a longitudinal event history analysis, while simultaneously considering main effects of child-,

soldier, and family-level characteristics. Using proportional hazards models, we identified the 6 months following deployment to be significantly associated with increased risk of maltreatment (HR = 1.68, $p < 0.001$).

Stage 1 Task 6b was to provide measures of relative effect of exposures and risk factors on the chances of intra-familial violence. This was accomplished in *Strane et al, 2017* in which proportional hazards models were used to identify time periods and child-, soldier, and family-level characteristics associated with maltreatment in infants and young children. Apart from the previously described increase in risk during the immediate post-deployment period, we identified a particularly high risk among children born prematurely or with early special needs. Additionally, children of sponsors with diagnosed mental illnesses were at an overall increased risk of maltreatment. Sponsors' higher educational attainment and higher rank also appeared to have a protective effect and their children were at lower risk of maltreatment.

Stage 1 Task 6c investigated the ratio of relative effects of risk for deployment and intrafamilial violence in the presence of effect modification (modifiers). Based on a priori hypotheses, we investigated how the temporal association between deployment and maltreatment would be modified by three characteristics in particular: children with a history of prematurity or early special needs, soldier gender, and soldier mental health status.

In models testing for effect modification, there were significant differences in maltreatment risk across deployment period for soldier gender ($p = 0.02$), and a trend towards difference across periods for soldier mental health history ($p = 0.07$) (Table 3). The risk for maltreatment among children with prematurity or early special needs remained similarly elevated across all periods, and so, no effect modification was detected, indicating an increased risk at all times, regardless of temporal proximity to a parent's deployment.

Among children of male soldiers, the risk for maltreatment was highest in the 6 months following deployment, whereas for children of female soldiers, the highest risk period was the 6 months immediately preceding the deployment. During pre-deployment period, the risk for maltreatment was significantly higher among children of female soldiers compared to male soldiers.

Among children whose soldier-parent received a mental health diagnosis prior to their birth, the risk of maltreatment was elevated in both the pre-deployment period, as well as the 6 months following deployment. In the 6 months immediately following deployment, the risk of maltreatment was significantly increased for all children, but the risk increased the most among children of soldiers with a diagnosis of mental illness.

Stage 1 Task 6d was to examine the predicted risk of violence across risk groups characterized by service person, family, unit, and installation. This was examined in *Taylor et al, 2015* and *Strane et al, 2017*. We identified that soldiers and their families experiencing different deployment tempos experience the greatest risk of child maltreatment at different points in time. Additionally, in *Strane et al, 2017*, we found that children of soldiers of higher rank have a lower risk of child maltreatment. Additionally, children with special healthcare needs, families with more children, and children of soldiers with lower educational attainment were at significantly increased risk of maltreatment. There was no difference in risk associated with sponsor gender.

Stage 1 Task 6e was distinct from other aims in the scope of this project. While working with each of these methods of identifying child maltreatment, it became apparent that medical diagnoses of maltreatment and reports to the Family Advocacy Program did not overlap as expected. Because medical providers are mandated reporters of suspected child maltreatment, we expected that all medical diagnoses of maltreatment would have a corresponding report to the Family Advocacy Program. After finding that this assumption did not hold true in our data, our team decided to more fully explore the implications of this finding as it could represent an important gap in reporting to the Family Advocacy Program that could have serious implications for children. The analysis in support of this research aim is presented in *Wood et al, 2016*, in which we examine the proportion of medically identified child abuse episodes with a corresponding substantiated report to the Family Advocacy Program.

Among the 150,690 soldiers with 211,183 dependent children, 4,136 soldiers were parents for 5,109 children who received at least one medical diagnosis of child maltreatment. This equated to 2.7% of soldiers with dependents for whom a child maltreatment diagnosis was identified. Among the 5,109 child victims, there were 5,945 medically diagnosed child maltreatment episodes.

Overall, 20.3% of the 5,945 medically diagnosed maltreatment episodes diagnosed by a medical professional were linked to a corresponding substantiated FAP report. Linkage from medically diagnosed maltreatment to FAP reports was poor across all characteristics and ranged from 9.8% for episodes of children observed at a civilian treatment facility to 24.2% for episodes at military treatment facilities. At a child-level (as opposed to an episode-level), among the 5,109 children with at least one medically diagnosed child maltreatment episode, 20.8% had a substantiated FAP report at any time during the study period.

Adjusting for child, soldier, and episode characteristics using logistic regression models, the likelihood of substantiation continued to be associated with installation type, maltreatment type, soldier education level, and race/ethnicity. The predicted (and standardized) probability of linkage between a maltreatment episode and a FAP report remained lower if treatment in the first 2 days occurred in a civilian treatment facility (9.8% in civilian facilities versus 23.6% in military facilities, $p < 0.01$). Linkage to a FAP report was more likely in episodes involving children with a black soldier parent, and in episodes where the soldier had less than college education, although with smaller marginal differences than those for installation type and maltreatment type. The adjusted effects for soldier rank and gender were not significant (See Table 2, Appendix H).

We additionally examined differences in linkage based on the size of the installation at which the child's soldier was assigned (**Table 2**, below). Though linkage between medical diagnoses and substantiated FAP reports was low across each type of installation, linkage rates were lowest when the soldier was stationed in a non-military catchment area (11.8%) or at a large U.S. installation with a large medical facility (14.5%). Linkage was highest when the soldier was stationed at an installation outside the U.S. (28.9%)(29).

Table 2. The percentage of medically diagnosed child maltreatment episodes linked to a substantiated Family Advocacy Program (FAP) report, by the category of installation at which the child received care.

Installation type	Medically-Diagnosed Maltreatment Episodes, (n=5,006) n	Medically-Diagnosed Maltreatment Episodes with a Corresponding FAP Report, (n=1,003) n (%)
Large U.S. Installations with Large Medical Facilities	581	84 (14.5)
Large U.S. Installations with Moderate Size Medical Facilities	958	192 (20.0)
Large U.S. Installations with Small Medical Facilities	857	158 (18.4)
Small U.S. Installations with Small Medical Facilities	1,276	256 (20.0)
Installations Outside U.S.	911	263 (28.9)
Non-Military Catchment Areas	423	50 (11.8)

Stage 1 Task 7 was completed with submissions of quarterly and annual reports from 2011-2016.

Stage 2

Stage 2 tasks and outcomes/products/deliverables with respective target dates.

Task	Outcome/product/deliverable
1. IRB submission, Amendment (Y2Q4) a. Local IRB amendment submission explicitly outlining details surrounding a stakeholder driven data-sharing dissemination process that will occur in lieu of a formal Stage 2 qualitative study. Driven by the expectation of a second study, the additional details instead highlight the already approved protocol and aims by more thoroughly outlining what the informal qualitative process will provide and how there will be no further data collection, but rather derived from stakeholder meetings that will inform already approved analytical methods.	IRB amendment approval (Y3Q1)
2. Key Stakeholder Feedback (Y3Q1-4) a. We will present the data trends to key stakeholders and members of the Army community with interest and experience in family advocacy and solicit their feedback.	The key stakeholders to whom we present data trends and statistics will provide targeted feedback that will guide the already IRB/HRPO approved methods from a statistical and cultural standpoint. Summaries of stakeholder interpretations of

	these findings will be provided to help with the development of future interventions and policy decisions.
3. Summary report preparation (Y4Q3-4). This report will include the interpretation of Stage 1 data by key military stakeholders and their recommendations regarding appropriate implementation of interventions that surface from Stage 1 findings.	Final written report of findings with recommendations for future policy decisions and interventions.
4. Prepare written progress reports as required by funder (quarterly)	Written progress reports (quarterly)

Stage 2 Task 1 was completed on August 15, 2014 with the approval of an amendment to IRB 09-007247 from the IRB at Children’s Hospital of Philadelphia of the revised Stage 2 aims.

Stage 2 Tasks 2 and 3 was carried out in 2014 to 2016 in an ongoing process. Publications and presentations are described in greater detail in Section 6. In addition to publications, Stage 2 tasks focused on collaborating with key stakeholders so as to present data trends and statistics and receive targeted feedback. These ongoing stakeholder partnerships were critical throughout the study period. Our stakeholders provided important insight into the child maltreatment-reporting system and were able to help guide ongoing analysis and identify appropriate stakeholders at the federal level.

During Stage 2, the team requested and was granted a second no cost extension. Also during this time, the study team was invited to present at the DoD Family Advocacy Program Quarterly Managers Meeting in January, 2016. The team presented findings from Wood et al, 2016. In 2015, study team member Christine Taylor presented a Platform Presentation at the Pediatric Academic society annual meeting. Miss Taylor presented the preliminary child abuse reporting trends findings that lead to the Wood et al, 2016 publication. These findings were also presented that year by Miss Taylor at the One Child, Many Hands conference in Philadelphia, PA. Also during this time, Miss Taylor presented a poster presentation at the Military Health System Research Symposium in August 2015.

Stakeholders in the U.S. Army felt that the findings related to under-reporting of child maltreatment from medical treatment facilities to the Family Advocacy Program was particularly important to the mission of the program. In light of this, our Army partners communicated that more recent data from 2014 and 2015 could provide compelling evidence to decision-makers about how to make policy changes that would improve practices of reporting child maltreatment when it is identified among children of U.S. Army soldiers. Additionally, with the support of our U.S. Army partners, our research group submitted an application for a Broad Agency Announcement to support a mixed methods research project investigating the factors associated with failed reporting of child maltreatment to the Family Advocacy Program.

Stage 2 Task 4 was completed with submissions of quarterly and annual reports from 2011-2016.

- 4. KEY RESEARCH ACCOMPLISHMENTS:** Bulleted list of key research accomplishments emanating from this research. Project milestones, such as simply

completing proposed experiments, are not acceptable as key research accomplishments. Key research accomplishments are those that have contributed to the major goals and objectives and that have potential impact on the research field.

A. 2011

- i. Data acquisition from the Defense Manpower Data Center

B. 2012

- i. Data acquisition from PASBA and ACR
- ii. Data cleaning and preparation initiated

C. 2014

- i. Identified and described our population
- ii. Identified crude rates of child maltreatment across study cohort
- iii. Enhanced security standards and data storage shifted to secure non-networked visual desktop interface
- iv. Revised statement of work submitted
- v. Platform presentation at Pediatric Academic Societies annual meeting, title *“The Temporal Relationship Between Deployment and Abuse Among Dependent Children of US Army Service Members”*

D. 2015

- i. No Cost Extension requested and approved
- ii. Revised Statement of Work Approved
- iii. Published findings in *American Journal of Public Health* in November 2015
- iv. Platform presentation at Pediatric Academic Societies annual meeting, titled *“Underreporting of Physical Abuse Among Children of Army Soldiers to the U.S. Army Family Advocacy Program”*
- v. Poster presentation at Military Health System Research Symposium, titled *“Mental Health Diagnostic Patterns Among Active Duty U.S. Army Soldiers with Post-Traumatic Stress Disorder”*
- vi. Presentation at One Child, Many Hands conference in Philadelphia, PA, titled *“Protecting Our Nation’s Military Children: Reporting of Child Abuse and The Direction of Future Policy”*

E. 2016

- i. Presentation to DOD Family Advocacy Program Quarterly Mangers Meeting, titled *“Protecting Our Nation’s Military Children: Reporting of Child Abuse and The Direction of Future Policy”*
- ii. No Cost Extension requested and approved
- iii. Publication Findings in *Child Abuse and Neglect* journal in December 2016
- iv. Deployment Hazards Analysis and Submission for Peer-Review to Military Medicine
- v. Department of Defense contract obtained to update findings related to underreporting of child maltreatment
- vi. Submitted application for Department of Defense Broad Agency Announcement to conduct mixed methods research project examining

the factors associated with failure to report to FAP instances of child maltreatment identified in medical settings.

F. 2017

- i. Platform presentation at Pediatric Academic Societies Annual Meeting (scheduled), titled “*Family Characteristics Associated with Maltreatment Across the Deployment Cycle of U.S. Army Soldiers*”

5. **CONCLUSION:** Summarize the importance and/or implications with respect to medical and /or military significance of the completed research including distinctive contributions, innovations, or changes in practice or behavior that has come about as a result of the project. A brief description of future plans to accomplish the goals and objectives shall also be included.

Our research characterized the association between soldier deployments, mental illness, and child maltreatment among U.S. Army soldiers. In particular, a more thorough understanding of the temporal qualities of this relationship would be valuable to DoD’s Family Advocacy Program. Child abuse is preventable and the U.S. Army already has in place numerous mechanisms to support families during a stressful period. The ultimate value of this research is its ability to provide the U.S. Army with information that can allow existing family and soldier support systems within the Army to better serve families during a stressful period. Doing so will keep children safe, improve family dynamics, and enhance soldier readiness.

This project was the first to reveal an increased risk when soldiers with young children return home from deployment. Additionally, we found that children of soldiers deployed twice were most likely to be abused during their sponsor’s second deployment. These findings demonstrate that elevated stress surrounding a soldier’s deployment can affect the entire family, and is not simply a consequence of the soldier’s experience and stress following deployment.

While the risk of maltreatment related to deployment presents a problem, it is important to acknowledge that it occurs within families who may have other risk factors for maltreatment. In light of this, the results of our proportional hazards analysis provided deeper insight into the context in which maltreatment occurs. Even after accounting for family characteristics known to be associated with maltreatment, the increased risk following deployment remained. Furthermore, our work highlighted that families of U.S. Army soldiers may require intervention at different points in time relative to deployment in order to provide needed support that can prevent child abuse. Particularly soldiers with a diagnosed mental illness may require additional support during the stressful period leading up to a deployment, as well as upon their return home.

Perhaps the most unexpected finding of this project was the inconsistent reporting of medically-diagnosed child maltreatment to the Family Advocacy Program. This was particularly surprising as medical providers are mandated reporters of suspected child abuse. Our study examined only instances in which the provider felt strongly enough in their suspicion of child abuse that they documented it in the child’s medical record. What this study tells us is that we have an incomplete picture of what is happening to a large population of children in this country who might need our help.

Children in military families have a particular set of needs that civilian Child Protective Services may not be equipped to handle appropriately. Military families may move between states frequently, their parents may be at higher risk of mental illness, and families may experience substantial stress during and surrounding a soldier's deployment.

The Department of Defense created an extra layer of support for children in military families – recognizing their unique needs related to the stress of deployment and frequent moves around the country – by establishing its own child and family services program in 1981, the Family Advocacy Program (FAP). However, FAP can only provide these supports if both military and civilian health care providers either report cases directly to them or if Child Protective Services reports all cases they receive involving a military child back to FAP. Further research is needed to fully understand how systematic under-reporting and under-recognition of child maltreatment occurs within the Army and to shed light on why under-reporting may be occurring. Finally, by knowing the true magnitude of this stress to the U.S. Army family, we can better identify the resources FAP needs to meet its obligations in serving military families. Our hope is that by bringing this problem to light, we can work together with our civilian partners and the U.S. Army to build a better approach to tracking child abuse cases in the military to ensure no child in danger nor at-risk family is neglected.

In summary, this body of work represents a more nuanced understanding of how deployment can impact the wellbeing of children of U.S. Army soldiers. Using the findings of these studies, we believe that the U.S. Army and the Family Advocacy Program are better equipped to keep children safe by providing families with the resources they need at the times when their need is greatest. Furthermore, the Family Advocacy Program may use these findings to better understand the resources they need to carry out their mission. Child maltreatment can be prevented and in doing so, the U.S. Army has the ability to improve soldier readiness.

6. PUBLICATIONS, ABSTRACTS, AND PRESENTATIONS:

- a. List all manuscripts submitted for publication during the period covered by this report resulting from this project. Include those in the categories of lay press, peer-reviewed scientific journals, invited articles, and abstracts. Each entry shall include the author(s), article title, journal name, book title, editors(s), publisher, volume number, page number(s), date, DOI, PMID, and/or ISBN.

Peer-Reviewed Scientific Journals:

Taylor C.M., Ross M.E., Wood J.N., Griffis H.M., Harb G.C., Mi L., Song L., Strane D., Lynch K.G., Rubin D.M. Differential Child Maltreatment Risk across Deployment Periods of US Army Soldiers. *Am J Public Health* 2016; 106:153.

Wood, J. N., Griffis, H. M., Taylor, C. M., Strane, D., Harb, G. C., Mi, L., Song L., Lynch K.G. & Rubin, D. M.. Under-ascertainment from healthcare settings of child abuse events

among children of soldiers by the US Army Family Advocacy Program. *Child Abuse & Neglect* 2017, 63, 202-210. doi: 10.1016/j.chiabu.2016.11.007. doi: 10.2105/AJPH.2015.302874.

Under Peer Review

Strane D., Lynch K.G., Griffis H.M., Taylor C.M., Mi L., Song L., French B., Rubin D.M. Family Characteristics Associated with Child Maltreatment across the Deployment Cycle Of U.S. Army Soldiers. *Manuscript accepted for publication in Military Medicine*.

Harb G., Strane D., et al. Identification of Mental Health Problems in Active Duty Soldiers: Psychiatric Diagnoses and Prescriptions Relative to Deployment. *Manuscript currently in preparation for peer review*.

Abstracts and Presentations:

May 2017 (scheduled)

Family Characteristics Associated with Child Maltreatment across the Deployment Cycle Of U.S. Army Soldiers. Strane D, Lynch KG, Griffis HM, Taylor CM, Mi L, Song L, French B, Rubin DM. *Presented at: Pediatric Academic Society 2017, San Francisco, CA.*

January 2016

Protecting Our Nation's Military Children: Research Findings from PolicyLab. Taylor CM, Rubin DM. *Presented at: FAP Quarterly Managers Meeting, Alexandria, VA*

August 2015

Psychiatric Diagnoses in U.S. Soldiers: The Identification of Mental Health Problems Relative to Soldier Deployments. Harb GC, Taylor CM, Griffis HM, Ross R, Lynch KG, Rubin DM. *Presented at: Military Health Research Symposium*

June 2015

Protecting Our Nation's Military Children: Reporting of Child Abuse and The Direction of Future Policy. Taylor CM, Wilson L. *Presented at: One Child, Many Hands: A Multi-disciplinary Conference on Child Welfare at The Field Center for Children's Policy, Practice, and Research; Philadelphia, PA.*

April 2015

Underreporting of Physical Abuse Among Children of Army Soldiers to the U.S. Army Family Advocacy Program. Taylor CM, Wood JN, Griffis HM, Frioux SM, Lynch KG, Rubin DM. *Presented at: Pediatric Academic Society 2015, San Diego, CA.*

April 2014

The Temporal Relationship between Deployment and Abuse among Dependent Children of US Army Service Members. Frioux SM, Griffis HM, Taylor CM, Luan X, Localio RA, Lynch KG, Ross ME, Harb G, Rubin DM. *Presented at: Pediatric Academic Society 2014, Vancouver, British Columbia.*

Lay Press:

- Stars and Stripes — <http://www.stripes.com/news/report-child-abuse-in-army-families-under-reported-in-broken-system-1.444287>
- Military.com — <http://www.military.com/daily-news/2016/12/13/child-abuse-army-families-likely-under-reported-study.html>

- Forbes — <http://www.forbes.com/sites/tarahaelle/2016/12/14/up-to-1-in-5-army-child-abuse-cases-may-never-be-investigated/#392b3f067231>
- HealthDay News — <http://www.physiciansbriefing.com/Article.asp?AID=717804>
- Philly Voice — <http://www.phillyvoice.com/chop-study-child-abuse-army-families-could-be-going-under-reported/>
- US News and World Report — <http://health.usnews.com/health-care/articles/2016-12-14/child-abuse-cases-in-army-families-may-be-under-reported>
- Healio — <http://www.healio.com/psychiatry/pediatrics/news/online/%7B4754a9ac-f69b-4ac2-9171-312bdebb219d%7D/child-abuse-in-us-army-may-be-severely-underreported>
- U.S. Medicine — <http://www.usmedicine.com/agencies/departments-of-defense-dod/army-child-abuse-neglect-cases-under-reported>
- USA Today: <http://www.usatoday.com/story/news/nation/2015/11/12/study-shows-more-child-abuse-homes-returning-vets/75637992/>
- Military Times: <http://www.militarytimes.com/story/military/2015/11/12/study-finds-more-child-abuse-in-homes-of-returning-vets/75675584/>
- Children's Hospital of Philadelphia: <http://www.chop.edu/news/child-abuse-rises-connection-soldiers-deployments#.V78oJdIrKUK>
- United Press International: http://www.upi.com/Health_News/2015/11/13/Risk-for-child-abuse-increases-after-return-from-Army-deployment/5001447438243/

7. REPORTABLE OUTCOMES:

No commercialized products were generated a result of this award. The work conducted under this award has resulted in meaningful contribution toward the understanding, prevention, and identification of child maltreatment among military families.

8. OTHER ACHIEVEMENTS:

This list may include degrees obtained that are supported by this award, development of cell lines, tissue or serum repositories, funding applied for based on work supported by this award, and employment or research opportunities applied for and/or received based on experience/training supported by this award.

A. Funding Applied for Based on Funding by This Award:

- i. Application was submitted in 2015 for DoD USAMRMC FY15 Broad Agency Announcement for Extramural Medical Research (Opportunity Number: W81XWH-BAA-15-1). This application was not accepted for funding. The aim of the proposed project was to identify the factors associated with systematic under-reporting of medically-diagnosed child maltreatment to the U.S. Army Family Advocacy Program.
- ii. Application was submitted in 2016 for DoD USAMRMC FY15 Broad Agency Announcement for Extramural Medical Research (Opportunity Number: W81XWH-BAA-16-1). This application scored highly and recommended for funding in November, 2016, however funding was not available at that time to support the proposed research. The aim of the proposed project was to identify the factors associated with systematic under-reporting of medically-diagnosed child maltreatment to the U.S. Army Family Advocacy Program using both a mix-methods approach. This

project would identify child-, soldier-, and abuse episode-level factors associated with failed reporting of maltreatment. It would also seek to qualitatively identify the practices of reporting child maltreatment in two selected large military installation medical facilities. We are currently waiting to hear whether an appropriate funding mechanism will be identified to support the proposed research.

- iii. Sole Source Contract with Army Family Advocacy Program was awarded on September 30, 2016 (W81K04-16-P-0016). This 9-month contract was awarded to our research group with the aim of using data from 2014-2015 to provide updated estimates of under-reporting of medically-diagnosed child maltreatment to the U.S. Army Family Advocacy Program. This contract will expire on June 30, 2017.

9. REFERENCES: List all references pertinent to the report using a standard journal format (i.e., format used in *Science*, *Military Medicine*, etc.).

1. RAND Corporation. *Measuring Army Deployments to Iraq and Afghanistan*; 2013. Available at: http://www.rand.org/content/dam/rand/pubs/research_reports/RR100/R-R145/RAND_RR145.pdf. Accessed 28 February, 2017.
2. Hoge CW, Castro CA, Messer SC, McGurk D, Cotting DI, Koffman RL. Combat duty in Iraq and Afghanistan, mental health problems, and barriers to care. *New England Journal of Medicine* 2004;351(1):13-22.
3. Milliken CS, Auchterlonie JL, Hoge CW. Longitudinal assessment of mental health problems among active and reserve component soldiers returning from the Iraq war. *JAMA* 2007;298(18):2141-2148.
4. Taft CT, Kaloupek DG, Schumm JA, Marshall AD, Panuzio J, King DW, et al. Posttraumatic stress disorder symptoms, physiological reactivity, alcohol problems, and aggression among military veterans. *Journal of abnormal psychology* 2007;116(3):498.
5. Taylor CM, Ross ME, Wood JN, Griffis HM, Harb GC, Mi L, et al. Differential Child Maltreatment Risk Across Deployment Periods of US Army Soldiers. *Am J Public Health* 2016;106(1):153-8.
6. Goff BSN, Crow JR, Reisbig AM, Hamilton S. The impact of individual trauma symptoms of deployed soldiers on relationship satisfaction. *Journal of Family Psychology* 2007;21(3):344.
7. Schumm WR, Bell DB, Gade PA. Effects of a military overseas peacekeeping deployment on marital quality, satisfaction, and stability. *Psychological Reports* 2000;87(3):815-821.
8. Eaton KM, Hoge CW, Messer SC, Whitt AA, Cabrera OA, McGurk D, et al. Prevalence of mental health problems, treatment need, and barriers to care among primary care-seeking spouses of military service members involved in Iraq and Afghanistan deployments. *Military medicine* 2008.
9. Mansfield AJ, Kaufman JS, Marshall SW, Gaynes BN, Morrissey JP, Engel CC. Deployment and the use of mental health services among US Army wives. *New England Journal of Medicine* 2010;362(2):101-109.
10. Taft CT, Walling SM, Howard JM, Monson C. Trauma, PTSD, and Partner Violence in Military Families. In: *Risk and Resilience in US Military Families*: Springer; 2011. p. 195-212.

11. Paris R, DeVoe ER, Ross AM, Acker ML. When a parent goes to war: effects of parental deployment on very young children and implications for intervention. *American journal of Orthopsychiatry* 2010;80(4):610.
12. Barker LH, Berry KD. Developmental issues impacting military families with young children during single and multiple deployments. *Military medicine* 2009;174(10):1033-1040.
13. Card NA, Bosch L, Casper DM, Wiggs CB, Hawkins SA, Schlomer GL, et al. A meta-analytic review of internalizing, externalizing, and academic adjustment among children of deployed military service members. *Journal of Family Psychology* 2011;25(4):508.
14. Flake EM, Davis BE, Johnson PL, Middleton LS. The psychosocial effects of deployment on military children. *Journal of Developmental & Behavioral Pediatrics* 2009;30(4):271-278.
15. Eide M, Gorman G, Hisle-Gorman E. Effects of parental military deployment on pediatric outpatient and well-child visit rates. *Pediatrics* 2010;126(1):22-27.
16. Lester P, Peterson K, Reeves J, Knauss L, Glover D, Mogil C, et al. The long war and parental combat deployment: Effects on military children and at-home spouses. *Journal of the American Academy of Child & Adolescent Psychiatry* 2010;49(4):310-320.
17. Barnes VA, Davis H, Treiber FA. Perceived stress, heart rate, and blood pressure among adolescents with family members deployed in Operation Iraqi Freedom. *Military medicine* 2007;172(1):40.
18. Chartrand MM, Frank DA, White LF, Shope TR. Effect of parents' wartime deployment on the behavior of young children in military families. *Archives of pediatrics & adolescent medicine* 2008;162(11):1009-1014.
19. Chandra A, Lara-Cinisomo S, Jaycox LH, Tanielian T, Burns RM, Ruder T, et al. Children on the homefront: The experience of children from military families. *Pediatrics* 2010;125(1):16-25.
20. Gibbs DA, Martin SL, Kupper LL, Johnson RE. Child maltreatment in enlisted soldiers' families during combat-related deployments. *JAMA* 2007;298(5):528-535.
21. Gibbs DA, Martin SL, Johnson RE, Rentz ED, Clinton-Sherrod M, Hardison J. Child maltreatment and substance abuse among US Army soldiers. *Child maltreatment* 2008.
22. Rentz ED, Marshall SW, Loomis D, Casteel C, Martin SL, Gibbs DA. Effect of deployment on the occurrence of child maltreatment in military and nonmilitary families. *American Journal of Epidemiology* 2007;165(10):1199-1206.
23. Lincoln A, Swift E, Shorteno-Fraser M. Psychological adjustment and treatment of children and families with parents deployed in military combat. *Journal of clinical psychology* 2008;64(8):984-992.
24. Palmer C. A theory of risk and resilience factors in military families. *Military Psychology* 2008;20(3):205-217.
25. Leventhal JM, Martin KD, Gaither JR. Using US data to estimate the incidence of serious physical abuse in children. *Pediatrics* 2012;129(3):458-464.
26. Rubin DM, et al. 2016 Annual Report for "The Temporal Relationship between Intrafamilial Violence, Deployment, and Serious Mental Illness in US Army Service Members." Submitted
27. Wood JN, Griffis HM, Taylor CM, Strane D, Harb GC, Mi L, et al. Under-ascertainment from healthcare settings of child abuse events among children of soldiers by the U.S. Army Family Advocacy Program. *Child abuse & neglect* 2017;63:202-210.

28. Strane D, Lynch KG, Griffis HM, Taylor CM, Song L, Mi L, et al. Family characteristics associated with child maltreatment across the deployment cycle of U.S. Army soldiers. *Military Medicine* 2017. (Publication pending.)
29. Rubin DM, et al. Quarterly Report #15 (Q2Y4) for “The Temporal Relationship between Intrafamilial Violence, Deployment, and Serious Mental Illness in US Army Service Members.” Submitted September 1, 2015.

10. APPENDICES: Attach all appendices that contain information that supplements, clarifies or supports the text. Examples include original copies of journal articles, reprints of manuscripts and abstracts, a curriculum vitae, patent applications, study questionnaires, and surveys, etc.

- A.** PTSD algorithms
- B.** High Risk Injury (HRI) algorithm
- C.** Mental illness prescription categorization
- D.** Mental illness diagnosis categorization
- E.** Results table from proportional hazards analysis of PTSD
- F.** *Differential Child Maltreatment Risk across Deployment Periods of US Army Soldiers*, *American Journal of Public Health*, November 2015.
- G.** *Family Characteristics Associated with Child Maltreatment across the Deployment Cycle of U.S. Army Soldiers*, accepted for publication at *Military Medicine*, December 2016.
- H.** *Under-ascertainment from healthcare settings of child abuse events among children of soldiers by the U.S. Army Family Advocacy Program*, *Child Abuse and Neglect*, December 2016.

Appendix A

CHOP-DOD project (Harb/Ross)

PTSD categorization:

- a. Definite PTSD diagnosis (309.81): (from Armed Forces Health Surveillance Center (AFHSC) PTSD Definitions as stated in their July 2012 release)
either 1. or 2.:
 - 1. *One inpatient medical encounter* with the defining diagnosis of PTSD in *any* diagnostic position
 - 2. *Two outpatient medical encounters*, occurring on separate days, with the defining diagnosis of PTSD in *any* diagnostic position (There is *no date restriction*, i.e., a restriction on the length of the time interval between the two outpatient medical encounters)
- b. Very Likely PTSD: must have 1+ prior deployment and one of the following:
 - i. Prescribed Prazosin
 - ii. Nightmare disorder diagnosis (307.47 nightmare disorder)
 - iii. *One outpatient medical encounter* with the defining diagnosis of PTSD in *any* diagnostic position
- c. Likely posttraumatic symptomatology: must have 1+ prior deployment and one of the following:
 - i. Acute stress reaction diagnosis (308.0, 308.1, 308.2, 308.3, 308.4, 308.9) PLUS another visit within 6 months with antidepressant and/or antipsychotic med prescription (This may also capture soldiers with posttraumatic depression)
 - ii. Adjustment disorder diagnosis (309.0, 309.1, 309.24, 309.28, 309.3, 309.4, 309.82, 309.83, 309.89, 309.9) on two separate medical encounters, occurring on separate days within 6 months and a V code of V15.4 (History of psychological trauma).
 - iii. Prescriptions of antidepressant and/or antipsychotic med with a V code of V15.4 (History of psychological trauma) or an E code, E990-E999 (Injury Resulting From Operations Of War) (This may also capture soldiers with posttraumatic depression)
 - iv. Personality disorder diagnosis with V code of V15.4 (History of psychological trauma) or an E code, E990-E999 (Injury Resulting From Operations Of War) (This may also capture soldiers with personality disorders and childhood trauma)

Appendix B

Expanded HRI Definition May22nd 2014

In children 0-12 months of age (less than and not equal to 12 months) HRI=1 if ANY DX1-20 in ANY Claim, of ANY Episode during the first year of life is equal to one of the following...

Femur Injury	820.00,820.01,820.02,820.03,820.09,820.10,820.11,820.12,820.13,820.19, 820.20, 820.21,820.22,820.30,820.31,820.32, 820.3x, 820.8x,820.9x,821.00,821.01,821.10, 821.11, 821.20,821.21,821.22,821.23,821.29,821.30, 821.31,821.32,821.33,821.39
Rib Fracture	807.0-807.19
Radius/Ulna Fracture	813.0-813.93
Tibia/Fibula Fracture	823.0-823.92
Humerus Fracture	812.0-812.59
TBI	800.1x,800.2x,800.3x,800.4x,800.6x,800.7x,800.8x,800.9x,801.1x,801.2x, 801.3x, 801.4x, 801.6x, 801.7x,801.8x,801.9x, 803.1x,803.2x,803.3x,803.4x,803.6x,803.7x, 803.8x,803.9x,804.1x,804.2x,804.3x,804.4x,804.6x,804.7x,804.8x,804.9x,851.xx, 852.0x,852.1x,852.2x,852.3x,852.4x,852.5x,853.0x,853.1x

Appendix C

ICD-9 Coding**Head Trauma**

Series Code	Description
800	Fractures of vault of skull
801	Fractures of base of skull
802	Fractures of face bones
803	Other and unqualified skull fractures
804	Multiple fractures involving skull or face
850	Concussion
851	Cerebral laceration and contusion
852	Subarachnoid, subdural and extradural hemorrhage following injury
853	Other or unspecified intracranial hemorrhage following injury
854	Intracranial injury of other and unspecified nature

PTSD

309.81	PTSD
--------	------

Adjustment Disorders

309.0, 309.1	Brief depressive reaction, prolonged depressive reaction
309.24	Adjustment reaction with anxious mood
309.28	Adjustment reaction with mixed emotional features
309.3	Adjustment reaction with disturbance of conduct
309.4	Adjustment reaction, mixed conduct and emotions
309.82	Adjustment reaction with physical symptoms
309.83	Adjustment reaction with withdrawal
309.89, 309.9	Other/unspecified adjustment reaction
308.0, 308.1, 308.2, 308.3, 308.4, 308.9	Acute Reaction to stress

Anxiety Disorders

300.00	Anxiety State- unspecified
300.01	Anxiety Disorder: Panic Disorder
300.02	Generalized Anxiety Disorder
300.09	Other Anxiety States
300.2	Phobic Disorder
300.20	Phobia, unspecified
300.21	Agoraphobia with panic attacks
300.22	Agoraphobia without mention of panic attacks
300.23	Social Phobia
300.29	Other simple phobias
300.3	OCD
Somatoform disorders	

300.5	Neurasthenia
300.7	Hypochondriasis
300.8	Somatoform Disorders
300.81	Somatization Disorder
300.82	Undifferentiated Somatoform Disorders
300.89	Other Somatoform Disorders
300.11	Conversion Disorder
306	Physiological malfunction arising from mental factors
Dissociative disorders	
300.6	Depersonalization Disorder
300.10	Hysteria
300.12	Dissociative (psychogenic) Amnesia
300.13	Dissociative (psychogenic) Fugue
300.14	Dissociative Identity Disorder (multiple personality)
300.15	Dissociative Disorder or reaction, unspecified
Factitious disorders	
300.16	Factitious Disorder with predominantly psychological signs and symptoms
300.19	Other or unspecified factitious illness
General codes:	
300.9	Unspecified Non-psychotic Mental Disorder
290-319	Mental Health Outcome: EXCLUDES 305.10(tobacco)

Mood and Depressive Disorders

311	Mood Disorder/ Depressive Disorder
296.9	Episodic Mood Disorder, unspecified
311	Depressive Disorder, NOS
296.2-296.26, 296.3-296.36	Major Depressive disorder
300.4	Neurotic depression/Dysthymic Disorder
296.00-296.05, 296.10- 296.15, 296.40-296.45, 296.50-296.55, 296.60-296.65, 296.7, 296.80-296.89, 301.13	Bipolar Disorders

Substance and Alcohol Disorders

Alcohol	
291.0, 291.3, 291.4, 291.81	Alcohol withdrawal, withdrawal hallucinations, withdrawal psychosis, intoxication
291.1	Alcohol Amnestic syndrome
291.2	Alcoholic dementia
291.3	Alcoholic jealousy, paranoia
291.89, 291.9	Alcoholic psychoses

303.00-303.03, 303.90-303.93	Alcohol Dependence Syndrome
305.0-305.02	Alcohol abuse
Substances	
292	Substance withdrawal/intoxication/psychoses/delirium
dependence:	
304.00-.02	Opioid Type Dependence
304.10-.12	Sedative, Hypnotic, Anxiolytic Dependence
304.20-.22	Cocaine Dependence
304.30-.32	Cannabis Dependence
304.40-.42	Amphetamine, Psychostimulant Dependence
304.50-.52	Hallucinogen Dependence
304.60-.62	Other Specified Drug Dependence
304.70-.72	Combination of opioid with any other - dependence
304.80-.82	Combinations of drug dependence excluding opioids
304.90-.92	Unspecified drug dependence
substance abuse:	
305.20-.22	Cannabis abuse (Non-Dep)
305.30-.32	Hallucinogen abuse (Non-Dep)
305.40-.42	Sedative, hypnotic, anxiolytic abuse (Non-Dep)
305.50-.52	Opioid abuse (non-dep)
305.60-.62	Cocaine abuse (Non-Dep)
305.70-.72	Amphetamine or related acting sympathomimetic abuse (Non-dep)
305.80-.82	Antidepressant type abuse (non-dep)
305.90-.92	Other, mixed, or unspecified drug abuse (non-dep)

Psychotic Disorders

295.0-295.9	Schizophrenic Disorders
298	Other nonorganic psychoses

Violence-Related Diagnoses

312	Conduct Disorder
312.34	Intermittent Explosive Disorder
312.35	Isolated Explosive Disorder

Personality Disorder

301.0	Paranoid Personality Disorder
301.1, 301.11, 301.12	Affective Personality Disorders
301.2	Schizoid/schizotypal Personality Disorders
301.3	Explosive Personality Disorder
301.4	Obsessive Compulsive Disorder
301.5	Histrionic Personality Disorder

301.6	Dependent personality disorder
301.7	Antisocial personality disorder
301.81	Narcissistic personality disorder
301.82	Avoidant personality disorder
301.83	Borderline personality disorder
301.84	Passive-Aggressive personality
301.9	Unspecified personality disorder

Sleep Disorders

307.4	Sleep disorders of non-organic origin
307.41, 307.42	Insomnia
327-.00-327.08	Organic Insomnias (includes sleep apnea)
307.47	Nightmare Disorder
780.5	Organic Sleep Disturbance, NOS (includes sleep apnea)

Spinal Cord Injury (SCI)/Vertebral Column Injury (VCI)

806.0-806.9, 952.0-952.2, 952.3-.4, 952.8-952.9	Spinal Cord Injury, SCI
805.0-805.09, 839.0-839.59, 847.0-847.4	Vertebral Column Injury VCI

Other Series Codes for Symptoms of possible co morbid Conditions

314	ADD
389.9	Hearing Loss, unspecified
388.3	Tinnitus
780.4	Dizziness, lightheadedness
784.0	Headache
780.93	Memory loss, NOS
438.85	Vertigo
368.8	Blurred vision, NOS
780.7	Malaise and fatigue
787.02	Nausea
368.13	Photophobia

Deployment Status Codes

V70.5 5	During Deployment Encounter
V70.5 6	Post-Deployment Encounter
V62.21	Current Military Deployment status

TBI Screening Code

V80.01	Special screening for TBI
310.0	Frontal lobe syndrome

310.1	Organic personality syndrome
310.2	Post-concussion syndrome
310.8, 310.9	Other, unspecified mental disorder following brain damage

TBI Severity Scoring (Wojick et al.)

Most Severe-Type 1	800, 801, 803, and 804 (plus fourth and fifth digits: 0.03–0.05, 0.1–0.4, 0.53–0.55, 0.6–0.9); 850 (0.2–0.4); 851–854; 950 (0.1–0.3)
Type 2	800, 801, 803, and 804 (plus 0.00, 0.02, 0.06, 0.09, 0.50, 0.52, 0.56, 0.59); 850 (0.0, 0.1, 0.5, 0.9)
Least Severe-Type 3	800, 801, 803, and 804 (plus 0.01, 0.51)

History of Psych. Trauma

V15.4	History of Psychological Trauma
-------	---------------------------------

E- Codes

E950.0 - E950.9	Suicide and self-inflicted poisoning by solid or liquid substances
E951.0-1, E951.8	Suicide and self-inflicted poisoning by gases in domestic use
E952.0-1, E952.8-9	Suicide and self-inflicted poisoning by other gases and vapors
E953.0-1, E953.8-9	Suicide and self-inflicted injury by hanging, strangulation, and suffocation
E954	Suicide and self-inflicted injury by submersion [drowning]
E955.0-7, E955.9	Suicide and self-inflicted injury by firearms, air guns and explosives
E956	Suicide and self-inflicted injury by cutting and piercing instrument
E957.0-2, E957.9	Suicide and self-inflicted injuries by jumping from high place
E958.0-9	Suicide and self-inflicted injury by other and unspecified means
E959	Late effects of self-inflicted injury
E990	Injury due to war operations by fires and conflagrations
E991	Injury due to war operations by bullets and fragments
E992	Injury due to war operations by explosion of marine weapons
E993	Injury due to war operations by other explosion
E994	Injury due to war operations by destruction of aircraft
E995	Injury due to war operations by other and unspecified forms of conventional warfare
E996	Injury due to war operations by nuclear weapons
E997	Injury due to war operations by other forms of unconventional warfare
E998	Injury due to war operations but occurring after

Updated: 11/1/12

	cessation of hostilities
E999	Late effect of injury due to war operations and terrorism

References:

- Department of Defense ICD-9 Coding Guidance for Traumatic Brain Injury. Updated September, 2010.
- Shen, Arkes, Williams. Effects of Iraq/Afghanistan on Major Depression and Substance Use Disorder: Analysis of Active Duty Personnel in the US Military. American Journal of Public Health, 2012. Vol 102. No S1
- PTSD ICD-9 is from the DSM-IV-TR
- MacGregor, et al. Psychological Correlates of Battle and Nonbattle Injury Among Operation Iraqi Freedom Veterans. Military Medicine, March 2009, Vol 174.
- www.cms.gov
- Wojick et al., 2010

NOTE:

- Presence of an ICD-9 code between 290 and 319 (excluding 305.10) at any time (whilst in the military) since January 1, 2000 and prior to the date of injury was considered a previous mental health diagnosis. (MacGregor, 2009).

Appendix D

MEDICATIONS LIST

Updated 12/4/12

1. Any psychoactive medication
 - a. Lifetime - ever prescribed
 - b. Current - current prescription
2. Psychiatric Treatment Medications
 - a. Antidepressants

COMBO. ANTI-DEPRESSANTS

- AMITRIPTYLINE HCL/CHLORDIAZEPOXIDE (LIMBITROL)
- AMITRIPTYLINE HCL/PERPHENAZINE (TRIAVIL, ETRAFON)

TCA ANTIDEPRESSANTS

- AMITRIPTYLINE HCL (AMITRIL, ELAVIL, TRYPTANOL, ENDEP)
- AMOXAPINE (ASENDIN)
- CLOMIPRAMINE HCL (ANAFRANIL)
- DESIPRAMINE HCL (PERTOFRANE, NORPRAMIN)
- DOXEPIN (SINEQUAN, ADAPIN)
- IMIPRAMINE (SK-PRAMINE, PRESAMINE, JANIMINE, TOFRANIL)
- MAPROTILINE HCL (LUDIOMIL)
- NORTRIPTYLINE (AVENTYL, PAMELOR)
- PROTRIPTYLINE HCL (VIVACTIL)
- TRIMIPRAMINE MALEATE (SURMONTIL)

SSRI ANTIDEPRESSANTS

- FLUOXETINE HCL (PROZAC)
- FLUVOXAMINE (LUVOX)
- PAROXETINE (PAXIL)
- SERTRALINE (ZOLOFT)
- CITALOPRAM (CELEXA)
- ESCITALOPRAM (LEXAPRO)

MAOI ANTIDEPRESSANTS

- PHENELZINE SULFATE (NARDIL)
- TRANYLCPROMINE SULFATE (PARNATE)
- ISOCARBOXAZID (MARPLAN)

SNRI ANTIDEPRESSANTS

- VENLAFAXINE (EFFEXOR)
- DESVENLAFAXINE (PRISTIQ)
- DULOXETINE (CYMBALTA)

OTHER ANTIDEPRESSANTS

- TRAZODONE (DESYREL)
- NEFAZODONE (SERZONE)
- BUPROPION (WELLBUTRIN)
- MIRTAZAPINE (REMERON)

MEDICATIONS LIST

b. Mood stabilizers

MOOD STABILIZING ANTICONVULSANTS

- CARBAMAZEPINE (EPITOL, TEGRETOL, CARBATROL)
- VALPROIC ACID/VALPROATE (DEPAKENE, DEPAKOTE)
- LAMOTRIGINE (LAMICTAL)
- GABAPENTIN (NEURONTIN)
- OXCARBAZEPINE (TRILEPTAL)

ANTIMANIC AGENTS

- LITHIUM CARBONATE/LITHIUM CITRATE (CIALITH-S, ESKALITH, LITHONATE, LITHANE, LITHOBID, LITHOTABS)

c. Antipsychotics

ANTIPSYCHOTICS

- CHLORPROMAZINE (THORAZINE)
- CHLORPROTHIXENE (TARACTAN)
- CLOZAPINE (CLOZARIL)
- FLUPHENAZINE/FLUPHENZINE DECANOATE/FLUPHENZINE ENANTHATE (PERMITIL, PROLIXIN)
- HALOPERIDOL/HALOPERIDOL DECANOATE/HALOPERIDOL LACTATE (HALDOL)
- LOXAPINE HCL/ LOXAPINE SUCCINATE (LOXITANE)
- MESORIDAZINE (SERENTIL)
- MOLINDONE (MOBAN)
- OLANZAPINE (ZYPREXA)
- QUETIAPINE (SEROQUEL)
- PERPHENAZINE (TRILAFON)
- PIMOZIDE (ORAP)
- RISPERIDONE (RISPERDAL)
- THIORIDAZINE (MELLARIL, SK-THIORIDAZINE)
- THIOTHIXENE (NAVANE)
- TRIFLUOPERAZINE (STELAZINE, VESPRIN)
- DROPERIDOL (INAPSINE)
- PROMAZINE (SPARINE)
- ACETOPHENAZINE (TINDAL)
- ARIPIPRAZOLE (ABILIFY)
- ASENAPINE (SAPHRIS)
- ILOPERIDONE (FANAPT)
- PALIPERIDONE (INVEGA)

d. Sedative/hypnotics

ANXIOLYTIC BENZODIAZEPINES

- ALPRAZOLAM (XANAX)
- CHLORIDIAZEPOXIDE (SK-LYGEN, A-POXIDE, LIBRIUM, LIBRITABS, LIBRAX)
- CLORAZEPATE (TRANXENE)
- DIAZEPAM (VALIUM, VALRELEASE, CIV VALIUM, DIASTAT)
- LORAZEPAM (ATIVAN)
- OXAZEPAM (SERAX)
- PRAZEPAM (CENTRAX)
- VERSED
- CLONAZEPAM (KLONOPIN)

OTHER ANXIOLYTICS

- BUSPIRONE (BUSPAR)

HYPNOTIC BENZODIAZEPINES

- FLURAZEPAM (DALMANE)
- TRIAZOLAM (HALCION)
- TEMAZEPAM (RESTORIL)
- QUAZEPAM (DORAL)
- ESTAZOLAM (PROSOM)

e. Psycho-stimulants

STIMULANTS

- AMPHETAMINE/DEXTROAMPHETAMINE (ADDERALL, DEXEDRINE, DEXTROSTAT, LISDEXAMFETAMINE, VYNASE)
 - o (all variations of amphetamine/d-amphetamine; it would be worth checking with a military physician to see how/if amphetamine is prescribed)
- METHYLPHENIDATE (RITALIN)
- ATOMOXETINE (STRATTERA)

f. Sleep medications/sleep aides

OTHER HYPNOTICS

- ZOLPIDEM (AMBIEN)
- ZALEPLON (SONATA)
- CHLORAL HYDRATE
- LUNESTA (ESZOPICLONE)

g. Prazosin

- PRAZOSIN HCL (MINIPRESS)

h. Other relevant Medications: Pain medications

OPIOIDS

- CODEINE
- FENTANYL (DURAGESIC)
- HYDROCODONE
- HYDROMORPHONE (Dilaudid)
- LEVORPHANOL (LEVO-DROMORAN)
- MEPERIDINE (DEMEROL)
- METHADONE (DOLOPHINE)
- MORPHINE (MS CONTIN, ORAMORPH SR)
- OXYCODONE (OXYCONTIN)
- OXYMORPHONE (NUMORPHAN)
- PROPOXYPHENE (DARVON)
- TRAMADOL (ULTRAM)

ANTI SEIZURE MEDICATION (USED FOR CHRONIC PAIN)

- PHENYTOIN (DILANTIN)

NSAIDS

- ASPIRIN
- IBUPROFEN (MOTRIN)
- NAPROXEN SODIUM (ALEVE)
- DICLOFENAC POTASSIUM (CATAFLAM)
- DICLOFENAC SODIUM (VOLTAREN)
- ETODOLAC (LODINE)
- FLURBIPROFEN (ANSAID)
- INDOMETHACIN (INDOCIN)
- KETOROLAC (TORADOL, ACULAR)
- NABUMETONE (RELAFEN)
- NAPROXEN (ANAPROX, NAPRELAN, NAPROSYN)
- OXAPROZIN (DAYPRO)
- PIROXICAM (FELDENE)
- SULINDAC (CLINORIL)

COX-2 INHIBITORS

- CELECOXIB (CELEBREX)
- ROFECOXIB (VIOXX)- marketed from 1999-2004; recalled in shame by drug company
- VALDECOXIB (Bextra)- only marketed from 2004-2005; recalled in shame by drug company

Antidepressants also often used for chronic pain:

- AMITRIPTYLINE HCL/CHLORDIAZEPOXIDE (LIMBITROL)
- AMITRIPTYLINE HCL/PERPHENAZINE (TRIAVIL, ETRAFON)
- DESIPRAMINE HCL (PERTOFRANE, NORPRAMIN)
- VENLAFAXINE (EFFEXOR)
- DULOXETINE (CYMBALTA)

3. Medications known to increase violent behavior

- VARENICLINE (CHANTIX)
- INTERFERON ALFA (used in treating hepatitis)
- SODIUM OXYBATE (used in treating narcolepsy)

4. Medications used to treat substance abuse

Alcoholism:

- NALTREXONE
- DISULFIRAM (ANTABUSE)
- ACAMPROSATE

Opiate addiction:

- METHADONE
- NALTREXONE
- BUPRENORPHINE/NALOXONE (SUBOXONE)

Appendix E

Appendix E. Cox proportional hazards regression model of time to PTSD diagnosis following deployment, among soldiers with one deployment

Covariates		Outcome: FAP/TRICARE		Outcome: FAP/TRICARE	
		HR	p-value	HR	p-value
Gender	Male	1.29	<.0001	1.25	<.0001
	Female	-	-	-	-
Rank	Officer/Warrant	0.41	<.0001	0.44	<.0001
	Enlisted	-	-	-	-
Race	Black	0.62	<.0001	0.67	<.0001
	Hispanic	0.96	0.26	0.99	0.84
	Asian/PI	0.62	<.0001	0.67	<.0001
	American Indian	0.92	0.48	0.88	0.16
	Other	0.63	<.0001	0.70	<.0001
	White	-	-	-	-
Education	More than HS	0.68	<.0001	0.75	<.0001
	HS degree of less	-	-	-	-
Infantry MOS during deployment	Yes			1.48	<.0001
	No			-	-
TBI	Severe			2.63	<.0001
	Mild			2.08	<.0001
	None			-	-
Total time deployed	More than 12 months			1.64	<.0001
	7-12 months			1.43	<.0001
	1-6 months			-	-
Spousal abuse (FAP)	Yes			2.25	<.0001
	No			-	-
Child maltreatment (FAP, TRICARE, or HRI)	Yes			1.41	<.0001
	No			-	-
Pre-deployment psychostimulant RX	Yes			1.11	0.02
	No			-	-
Pre-deployment sleep medication RX	Yes			1.46	<.0001
	No			-	-
Any mental health DX in predeployment	Yes			1.80	<.0001
	No			-	-

Appendix F

Differential Child Maltreatment Risk across Deployment Periods of US Army Soldiers

Taylor et al, 2015

ABSTRACT

Objectives: The objective of this study was to describe the risk for maltreatment among toddlers of US Army soldiers over deployment cycles. Our goal was to determine if there were child maltreatment risk periods that have not been previously described.

Methods: A person-time analysis of substantiated maltreatment reports and medical diagnoses among children of 112,325 deployed US Army soldiers between 2001 and 2007.

Results: Elevated risk of maltreatment was found directly after deployment for children of soldiers deployed once during the study period, but not for children of soldiers deployed twice. During the 6 months after deployment, children of 1-deployed soldiers had 4.43 substantiated maltreatment reports and 4.96 medical diagnoses per 10,000 child-months. The highest rate of maltreatment among children of 2-deployed soldiers occurred during the second deployment for substantiated maltreatment episodes (4.83 episodes per 10,000 child-months) and before the first deployment for medical diagnoses of maltreatment (3.78 episodes per 10,000 child-months).

Conclusions: This study highlights differential child maltreatment risk across deployment periods and suggests possible points for interventions to facilitate successful reintegration and family stability across the deployment cycle.

INTRODUCTION

Since October 2001, United States Army units have experienced frequent and prolonged combat-related deployments due to multiple international conflicts. As of 2010, over 2.1 million American men and women service members were deployed in support of multiple international conflicts. Nearly half of those deployed soldiers are parents¹. Considerable stress on families occurs during unit deployment, when caretakers are absent as well as upon reintegration when soldiers return to family life. Periods of elevated stress can increase the likelihood of negative outcomes for families, such as child maltreatment²⁻⁴.

An emerging body of literature characterizing the effect of deployment on family well-being identifies a number of challenges for soldiers, spouses, and children. Increased rates of mental health problems and substance abuse by soldiers following deployment have been well documented⁵⁻⁷. Risks for soldier spouses, including marital problems, domestic violence, and mental health challenges, have also been identified⁸⁻¹². For children, a focus has been on behavioral and educational well-being. Stress and anxiety, as well as behavioral, school and sleeping problems during deployment stages have been identified, with additional attachment issues and challenges arising when a soldier returns home¹³⁻²¹.

Intrafamilial violence among military families, including spousal abuse and child maltreatment, is an area of increasing concern. The Family Advocacy Program (FAP) was established in 1976 as a preventive effort for spouse and child maltreatment in all military families and communities, separate from civilian child protective services. The Army Central Registry (ACR) reports an overall decrease in the rate of substantiated child maltreatment from 1990-2004, largely due to a decrease in the rate of child physical abuse. However, the rate of child neglect increased during this time. In 2004, child neglect reached the highest level since

1991, increasing by 40% from 2000 to 2004⁴. One study reported an increased rate of maltreatment during combat-related deployment compared to non-deployed periods in a small sample of Army soldiers². Beyond annual rates, few studies have examined the risk for child maltreatment in relationship to deployment stages.

A better understanding of the risk of child maltreatment across a single deployment cycle, as well as the impact of the multiple deployments experienced by many soldiers, is needed to develop a systematic response within the Army to provide families appropriate supports. The purpose of this study was to characterize rates of child maltreatment episodes among children less than 2 years of age in US Army families across stages of soldier deployment cycles during a period of intense deployment tempo, characterized by increased (frequency and length of deployment) in the last decade.

METHODS

Study Design and Data Sources

Data were obtained from the Army Central Registry (ACR), Patient Administration Systems and Biostatistics Activity (PASBA), and the Defense Manpower Data Center (DMDC). Deployment dates for soldiers as well as soldier demographic information were obtained from DMDC; substantiated maltreatment reports from FAP were obtained from the ACR; and TRICARE medical diagnoses from PASBA.

Individuals included in the study were children of active-duty U.S. Army soldiers with at least three consecutive years of active service between 2001 and 2007. Children under the age of two are considered to be the population at highest risk for severe injury and fatality from child

maltreatment. In addition, restricting to this age group reduces heterogeneity in age-related child maltreatment episodes across the deployment cycle.

We selected children of soldiers with one or two total deployments during the study period since the deployment experience for those with three or more deployments differed across key characteristics (such as duration) and also accounted for only a small minority of soldier experiences (12% of all those deployed during the period). Further, we separately considered children of soldiers with one and two total deployments during the study period in order to accurately define time periods relative to deployment(s). Soldiers may have qualitatively different experiences before, during, and after deployment depending on whether they experience one or two deployments. Each month of observation for children was linked to their soldier's deployment. Months where children had two or more soldiers listed (1,375,464 child-months), where two soldiers were listed as the TRICARE sponsor for the same child, at the same time, were excluded from the analysis due to difficulty in assigning episodes to deployment cycles of a single soldier. Additionally, children with more than one soldier during the first 24 months of life were excluded due to difficulties in assigning maltreatment episodes in relation to deployment period. Children were followed until they reached 24 months of age.

Study Measures

The primary outcome of interest was a child maltreatment episode. We considered child maltreatment episodes arising from two separate sources: 1) substantiated child maltreatment reports from FAP; and 2) medical diagnoses of child maltreatment (based on International Classification of Diseases, Ninth Revision, Clinical Modification (ICD-9-CM) codes) from TRICARE medical records. Substantiated FAP reports capture four types of child maltreatment: physical, sexual, emotional, and neglect. Since child maltreatment episodes may not be reported

to child protective service agencies (or alternatively reported to civilian child welfare agencies without notification to FAP), relying solely on FAP reports will result in under ascertainment of cases²²⁻²⁴. Thus, we also utilized medical diagnoses of child maltreatment found in TRICARE medical diagnoses. Medical diagnoses of child maltreatment included any of the following ICD-9-CM diagnosis or external cause of injury codes from an outpatient or inpatient encounter: 995.50, 995.51, 995.52, 995.53, 995.54, 995.55, 995.59, E967²⁵⁻²⁸. We consider these two sources of child maltreatment episodes to be two distinct outcomes capturing varying types of maltreatment, providing different yet valuable information for each episode, and may not overlap in the data.

For each child, all medical encounters occurring within 1 day of each other were collapsed into a single encounter. Then, following previous studies²⁹⁻³¹, multiple medical encounters with the same diagnosis or related diagnosis occurring within a 180-day interval were grouped into episodes, to avoid counting a single abuse episode more than once. For each abuse episode, the date on which the episode began was linked by month to the corresponding soldier's deployment data.

Exposures of interest were pre-defined time periods relative to a soldier's deployment. For soldiers who experienced a total of one deployment during the study period (1-deployed), the observation window was divided into the following 5 periods: 7 or more months pre-deployment (time before a deployment begins), 0-6 months pre-deployment, during deployment, 0-6 months post-deployment (time after a deployment ends) and 7 or more months post-deployment. For soldiers who experienced a total of two deployments during the study period (2-deployed), the observation window was divided into the following periods: 7 or more months pre-deployment, 0-6 months pre-first deployment, during first deployment, between deployments ("inter

deployment”), during second deployment, 0-6 months post-second deployments, and 7 or more months post-deployments. These periods are depicted in Figures 1 and 2. It was hypothesized *a priori* that the 6 months immediately before and after deployment would be higher risk periods, which is why the pre- and post-deployment periods were split.

Data Analysis

For each deployment period, maltreatment rates were calculated as the observed number of maltreatment episodes divided by the number of child-months. P-values comparing rates in different exposure periods were obtained assuming a Poisson distribution. All analyses were performed using Stata 13.1 (Stata Corp, College Station, TX, 2012).

RESULTS

Study Population

From 2001 to 2007, 66,724 1-deployed soldiers had 97,013 child dependents 0-24 months old, and 44,585 2-deployed soldiers had 66,828 child dependents 0-24 months old. Generally, characteristics of 1- and 2-deployed soldiers were similar. However, a smaller percentage of women and officers were deployed twice during our observation period (Table 1). We excluded soldiers with 3 or more deployments during the study period (8.6% of all soldiers in the cohort) because we found they were different in regards to length of deployment and the nature of the deployment. Among 1-deployed soldiers, the mean length of deployment was 12 (SD 4.86) months. Among 2-deployed soldiers, the mean length of deployment was 9 (SD 4.69) months. The median time between the first and second deployment among 2-deployed soldiers was 12 months.

Among 1-deployed soldiers, 444 children (0.46%) had a substantiated maltreatment episode and 461 children (0.48%) had a medical diagnoses of maltreatment episode, resulting in

rates of 4.58 substantiated maltreatment episodes per 1,000 children and 4.75 medical diagnoses of maltreatment per 1,000 children across the study period. For children of 2-deployed soldiers, 334 children (0.50%) had a substantiated maltreatment episode and 270 children (0.40%) had a medical diagnoses of maltreatment, corresponding to 5.00 substantiated maltreatment episodes per 1,000 children and 4.04 medical diagnoses of maltreatment per 1,000 children.

Substantiated Child Maltreatment Reports from FAP

Child Maltreatment Rates among Dependent Children of 1-Deployed Soldiers

For children of 1-deployed soldiers, substantiated FAP reports occurred at a rate of 2.90 episodes (95% CI 2.67, 3.17) per 10,000 child-months. Substantiated FAP reports were higher for the 6-month period after deployment compared to the 6-month period before deployment (4.43 episodes vs. 2.69 episodes per 10,000 child-months, $p=0.007$). The rate during deployment was also higher compared to the 6-month period before deployment (3.72 episodes per 10,000 child-months vs. 2.69 episodes per 10,000 child-months, $p=0.05$) (Figure 1).

Among substantiated FAP reports filed during soldier deployment, the perpetrator was listed as the non-soldier caregiver in 88% of cases. In all other periods of non-deployment, the perpetrator was listed as the soldier in, on average, 55% of reports. See Supplement eTable1 for a description of perpetrator type by deployment period.

Child Maltreatment Rates Among Dependent Children of 2-Deployed Soldiers

In aggregate, the rate of child maltreatment for dependents of 2-deployed soldiers was 3.01 episodes (95% CI 2.71, 3.33) per 10,000 child-months. The rate of maltreatment during a soldier's first deployment was 2.78 episodes (95% CI 2.02, 3.75) per 10,000 child-months. During a soldier's second deployment, the rate of child maltreatment increased significantly to 4.83 episodes per 10,000 child-months (95% CI 3.89, 5.94, $p=0.003$) (Figure 2).

Medical Diagnoses of Child Maltreatment from TRICARE

Child Maltreatment Rates Among Dependent Children of 1-Deployed Soldiers

In aggregate, medical diagnoses of child maltreatment occurred at a rate of 3.22 episodes (95% CI 2.96, 3.49) per 10,000 child-months. Medical diagnoses of child maltreatment occurred at a rate of 3.34 episodes per 10,000 child-months during deployment, which was lower than the post-6 month deployment period rate of 4.63 events (95% CI 3.61, 5.85) per 10,000 child-months (95% CI 3.90, 6.22, $p=0.008$) (Figure 1). See Supplement eTable2 for a description of maltreatment type by deployment period.

Child Maltreatment Rates Among Dependent Children of 2-Deployed Soldiers

In aggregate, the rate of child maltreatment for dependents of soldiers who were deployed twice was 2.71 episodes (95% CI 2.44, 3.02) per 10,000 child-months. The rate of maltreatment during a soldier's first deployment was 2.98 episodes per 10,000 child-months (95% CI 2.18, 3.97). During a soldier's second deployment, the rate of child maltreatment was slightly lower with 2.69 episodes per 10,000 child-months (95% CI 1.99, 3.54) (Figure 2).

DISCUSSION

This study characterizes the risk for substantiated child maltreatment reports and medical diagnoses of maltreatment among the young children of active duty US Army soldiers who were deployed between 2001 and 2007. We found an elevated risk of maltreatment directly after deployment among children of 1-deployed soldiers. In contrast, among children of 2-deployed soldiers, we found an elevated risk for substantiated maltreatment reports (although not medical diagnoses of maltreatment) during the second deployment. The rate of substantiated maltreatment reports during the second deployment was nearly double that observed during the first deployment.

The finding of increased post-deployment risk for child maltreatment among children of a 1-deployed soldier suggests elevated stress within families when a soldier reintegrates after the first deployment. There are many factors within families that likely contribute to this increased risk. For example, young children may display behavior and mood changes including aggression, depression, and hyperactivity during parent deployment, related to the trauma of separation^{20,32,33}. Behavior changes may also increase in frequency relative to the length of deployment^{14,18}. At the same time, soldiers who are readjusting following deployment may have particular difficulty dealing with behavioral changes in their children. Currently, the Army offers programs to families of deployed soldiers designed to facilitate adjustment to all phases of the deployment cycle including parenting classes, child care services, and free classes specific to soldier reintegration into home life. However, such programs may not be offered at a scale to support need during the immediate post-deployment period. Data such as these might suggest a need for a more intentional strategy to prepare families, particularly those with young infants, for both a soldier departure and for a soldier returning home.

Although post-deployment elevation of risk was identified for children of 1-deployed soldiers during our observation period, we did not detect such an elevated risk among soldiers who were deployed twice. There are several possible explanations for this difference. First, our rates in each period were sensitive to sample size, with fewer child maltreatment episodes observed in each period among this smaller subgroup of 2-deployed soldiers. But more importantly, there may be selection differences among soldiers who deploy twice that are associated with risk of future child maltreatment episodes. For example, a child maltreatment episode or significant soldier mental health event following the first deployment may impact eligibility for a second deployment.

Our study is unique in that it focuses on children under the age of 2, a period of high stress for families, particular those who experience deployment and reintegration. Prior studies focused on the risk related to the period of deployment, a time in which children appeared to be at higher risk for maltreatment and, in particular, neglect². Our study confirmed an elevated risk for child maltreatment during deployment, particularly among later deployments in 2-deployed families. In addition, our findings revealed a previously unidentified high risk period for children during the six months following a soldier's return home after a single deployment.

There are limitations to our study. First, we did not adjust for covariates. For example, we were unable to identify direct combat exposure in the soldiers and therefore could not examine the relationship of combat exposure to risk of child maltreatment. In addition, we were unable explore family specific risk factors due to limitations of the available data, such as income, that may be influencing child maltreatment rates. However, we do not expect a lot variation among those factors within this relatively homogenous population during the 24 month follow-up period. Second, although we could identify parent-child relationships, we could not determine the geographic residence of the child, who may be cared for by a non-custodial, non-military parent or extended family member at various points in the deployment cycle. Care by non-parent caregivers may heighten risk for neglect during deployment periods, but also may act as a buffer toward direct physical abuse by a soldier returning from conflict. Third, ascertaining child maltreatment episodes is fraught with difficulty, given both under-reporting and the heterogeneity of types of maltreatment across the deployment cycle. There is no single reliable measure of child abuse. For that reason, we studied two different measures (substantiated maltreatment reports and medical maltreatment diagnosis) so as to triangulate common trends across different measures. Finally, because reporting practices and trends may vary across posts,

our results could have been confounded by base, particularly if bases with higher deployment tempo were not reporting child maltreatment episodes as rigorously as those with lower deployment tempos.

This study revealed an elevated risk for child maltreatment during the 6 months following a soldier's return home from deployment among soldiers who are only deployed once. A somewhat different pattern was observed among the children of soldiers deployed twice, in whom the risk was most elevated during the second deployment. These findings, which illustrate the experiences of deployed Army families with infants and toddlers, adds to the body of literature characterizing elevated stress within families of returning war veterans. Many of the perpetrators identified in our study cohort were not soldiers themselves, suggesting that a soldier-only response is not enough to reduce risk for families. These findings can inform efforts by the military to initiate and standardize support and preparation to families during periods of elevated risk.

REFERENCES

1. United States Department of Defense (2010). Report on the Impact of Deployment of Members of the Armed Forces on Their Dependent Children Report to the Senate and House Committees on Armed Services Pursuant to National Defense Authorization Act for Fiscal year 2010 Section 571.
2. Gibbs DA, Martin SL, Kupper LL, Johnson RE. Child maltreatment in enlisted soldiers' families during combat-related deployments. *JAMA*. 2007;298(5):528-535.
3. Rentz ED, Marshall SW, Loomis D, Casteel C, Martin SL, Gibbs DA. Effect of deployment on the occurrence of child maltreatment in military and nonmilitary families. *American Journal of Epidemiology*. 2007;165(10):1199-1206.
4. McCarroll JE, Fan Z, Newby JH, Ursano RJ. Trends in US Army Child Maltreatment Reports: 1990–2004. *Child Abuse Review*. 2008;17(2):108-118.
5. Hoge CW, Castro CA, Messer SC, McGurk D, Cotting DI, Koffman RL. Combat duty in Iraq and Afghanistan, mental health problems, and barriers to care. *New England Journal of Medicine*. 2004;351(1):13-22.
6. Milliken CS, Auchterlonie JL, Hoge CW. Longitudinal assessment of mental health problems among active and reserve component soldiers returning from the Iraq war. *JAMA*. 2007;298(18):2141-2148.
7. Taft CT, Kaloupek DG, Schumm JA, et al. Posttraumatic stress disorder symptoms, physiological reactivity, alcohol problems, and aggression among military veterans. *Journal of abnormal psychology*. 2007;116(3):498.
8. Goff BSN, Crow JR, Reisbig AM, Hamilton S. The impact of individual trauma symptoms of deployed soldiers on relationship satisfaction. *Journal of Family Psychology*. 2007;21(3):344.
9. Schumm WR, Bell DB, Gade PA. Effects of a military overseas peacekeeping deployment on marital quality, satisfaction, and stability. *Psychological Reports*. 2000;87(3):815-821.
10. Eaton KM, Hoge CW, Messer SC, et al. Prevalence of mental health problems, treatment need, and barriers to care among primary care-seeking spouses of military service members involved in Iraq and Afghanistan deployments. *Military medicine*. 2008.
11. Mansfield AJ, Kaufman JS, Marshall SW, Gaynes BN, Morrissey JP, Engel CC. Deployment and the use of mental health services among US Army wives. *New England Journal of Medicine*. 2010;362(2):101-109.
12. Taft CT, Walling SM, Howard JM, Monson C. Trauma, PTSD, and Partner Violence in Military Families. *Risk and Resilience in US Military Families*: Springer; 2011:195-212.
13. Paris R, DeVoe ER, Ross AM, Acker ML. When a parent goes to war: effects of parental deployment on very young children and implications for intervention. *American Journal of Orthopsychiatry*. 2010;80(4):610.
14. Barker LH, Berry KD. Developmental issues impacting military families with young children during single and multiple deployments. *Military Medicine*. 2009;174(10):1033-1040.
15. Card NA, Bosch L, Casper DM, et al. A meta-analytic review of internalizing, externalizing, and academic adjustment among children of deployed military service members. *Journal of Family Psychology*. 2011;25(4):508.

16. Flake EM, Davis BE, Johnson PL, Middleton LS. The psychosocial effects of deployment on military children. *Journal of Developmental & Behavioral Pediatrics*. 2009;30(4):271-278.
17. Eide M, Gorman G, Hisle-Gorman E. Effects of parental military deployment on pediatric outpatient and well-child visit rates. *Pediatrics*. 2010;126(1):22-27.
18. Lester P, Peterson K, Reeves J, et al. The long war and parental combat deployment: Effects on military children and at-home spouses. *Journal of the American Academy of Child & Adolescent Psychiatry*. 2010;49(4):310-320.
19. Barnes VA, Davis H, Treiber FA. Perceived stress, heart rate, and blood pressure among adolescents with family members deployed in Operation Iraqi Freedom. *Military Medicine*. 2007;172(1):40.
20. Chartrand MM, Frank DA, White LF, Shope TR. Effect of parents' wartime deployment on the behavior of young children in military families. *Archives of Pediatrics & Adolescent Medicine*. 2008;162(11):1009-1014.
21. Chandra A, Lara-Cinisomo S, Jaycox LH, et al. Children on the homefront: The experience of children from military families. *Pediatrics*. 2010;125(1):16-25.
22. Gilbert R, Kemp A, Thoburn J, et al. Recognising and responding to child maltreatment. *The Lancet*. 2009;373(9658):167-180.
23. Sedlak AJ, Mettenburg J, Basena M, Peta I, McPherson K, Greene A. Fourth national incidence study of child abuse and neglect (NIS-4). *Washington, DC: US Department of Health and Human Services*. Retrieved on July. 2010;9:2010.
24. Sedlak AJ, Broadhurst DD. The national incidence study of child abuse and neglect. *Washington DC. US Department of Health and Human Services*. 1996.
25. Wood JN, Medina SP, Feudtner C, et al. Local macroeconomic trends and hospital admissions for child abuse, 2000–2009. *Pediatrics*. 2012;130(2):e358-e364.
26. Leventhal JM, Martin KD, Asnes AG. Incidence of fractures attributable to abuse in young hospitalized children: results from analysis of a United States database. *Pediatrics*. 2008;122(3):599-604.
27. Leventhal JM, Martin KD, Asnes AG. Fractures and traumatic brain injuries: abuse versus accidents in a US database of hospitalized children. *Pediatrics*. 2010;126(1):e104-e115.
28. Wood JN, Hall M, Schilling S, Keren R, Mitra N, Rubin DM. Disparities in the evaluation and diagnosis of abuse among infants with traumatic brain injury. *Pediatrics*. 2010;126(3):408-414.
29. Matone M, O'Reilly AL, Luan X, Localio AR, Rubin DM. Emergency department visits and hospitalizations for injuries among infants and children following statewide implementation of a home visitation model. *Maternal and Child Health Journal*. 2012;16(9):1754-1761.
30. Lestina DC, Miller TR, Smith GS. Creating injury episodes using medical claims data. *Journal of Trauma and Acute Care Surgery*. 1998;45(3):565-569.
31. Spady DW, Saunders DL, Schopflocher DP, Svenson LW. Patterns of injury in children: a population-based approach. *Pediatrics*. 2004;113(3):522-529.
32. Kelley ML, Hock E, Smith KM, Jarvis MS, Bonney JF, Gaffney MA. Internalizing and externalizing behavior of children with enlisted Navy mothers experiencing military-induced separation. *Journal of the American Academy of Child & Adolescent Psychiatry*. 2001;40(4):464-471.

33. Pierce PF, Vinokur AD, Buck CL. Effects of War-Induced Maternal Separation on Children's Adjustment During the Gulf War and Two Years Later¹. *Journal of Applied Social Psychology*. 1998;28(14):1286-1311.

Table 1. Soldier Characteristics

	1 Total Deployment(s) (n=66,724)	2 Total Deployment(s) (n=44,585)
	N(%)	N(%)
Gender		
Female	6,102 (9.1)	2,218(5.0)
Male	60,622(90.9)	42,367(95.0)
Race/ethnicity		
White	38,558(57.8)	26,066(58.5)
Black	15,157(22.7)	9,854(22.1)
Hispanic	8,006(12.0)	5,528(12.4)
American Indian/Alaskan Native	1,168(1.8)	864(1.9)
Asian/Pacific Islander	1,691(2.6)	1,025(2.3)
Other	1,682(2.5)	968(2.2)
Unknown/Missing	373(0.6)	270 (0.6)
Education		
Less than High School	4,036(6.1)	3,157(7.1)
High School/GED/Diploma	44,315(66.4)	31,534(70.7)
Some college/associates	4,287(6.4)	2,194(4.9)
College	7,818(11.7)	4,593(10.3)
College+	3,268(4.9)	1,724(3.9)
Unknown	3,000(4.5)	1,383(3.1)
Rank		
Enlisted	57,446(86.1)	39,351(88.2)
Officer	8,387(12.6)	4,495(10.1)
Warrant Officer	891(1.3)	739(1.7)

FIGURE LEGENDS

Figure 1; Rate of Child Maltreatment by Deployment Periods Among Children of Soldiers Deployed Once: The vertical axis shows the rate of child maltreatment in episodes per 10,000 child-months of exposure. The horizontal axis is the deployment periods of the soldier.

Figure 2; Rate of Child Maltreatment by Deployment Periods Among Children of Soldiers Deployed Twice: The vertical axis shows the rate of child maltreatment in episodes per 10,000 child-months of exposure. The horizontal axis is the deployment periods of the soldier.

Figure 1: Rate of Child Maltreatment by Deployment Periods among Children of Soldiers Deployed Once

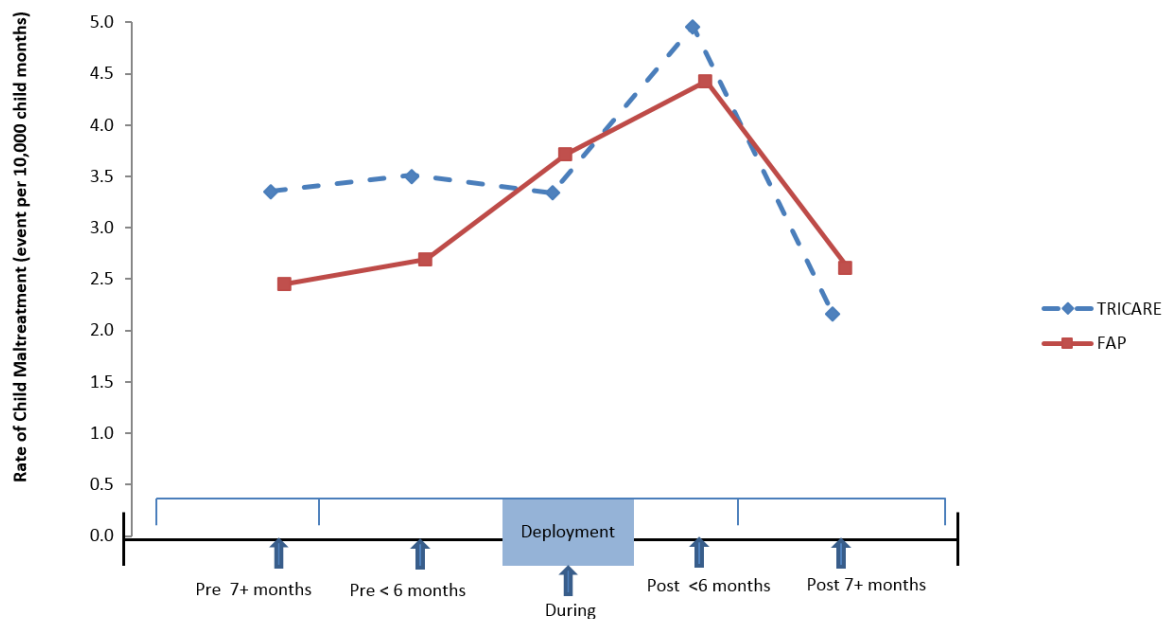
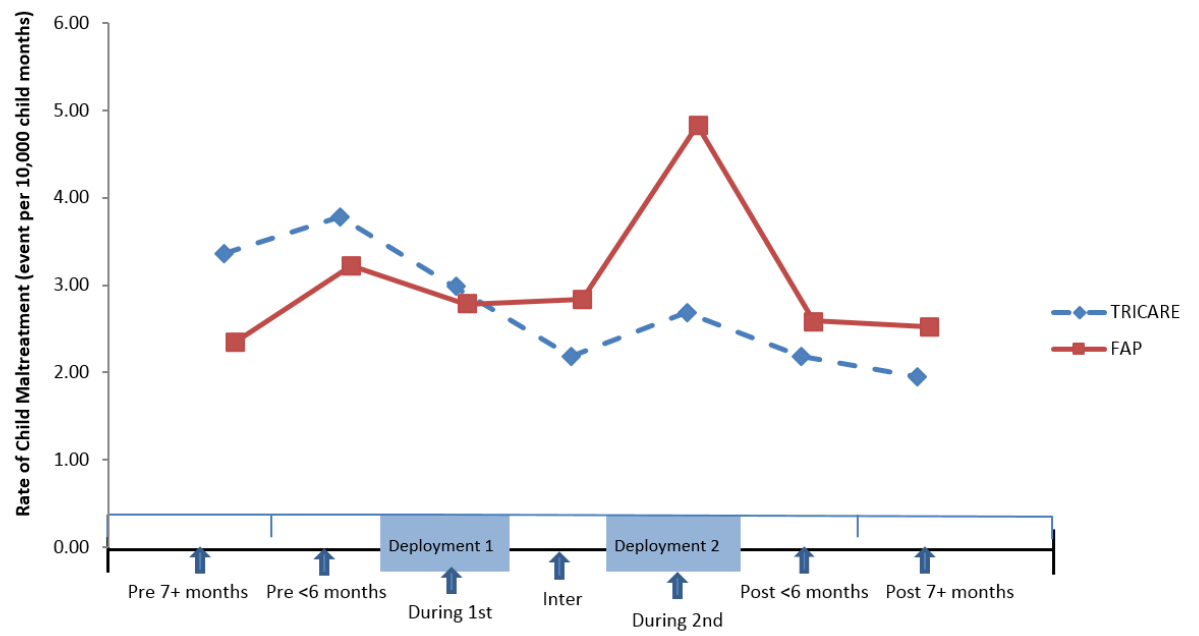


Figure 2: Rate of Child Maltreatment by Deployment Periods among Children of Soldiers Deployed Twice



Appendix G

Family characteristics associated with child maltreatment across the deployment cycle of U.S. Army soldiers

INTRODUCTION

Nearly 50% of all active duty service members are parents [1]. For soldiers in the US Army and their families, the departure and return of a soldier following deployment can create a uniquely stressful environment, particularly among families with young children. Few studies have investigated the risk of child maltreatment throughout a soldier's deployment cycle, and even less is known about how child and soldier characteristics can alter the risk for child maltreatment in this context.

A large body of evidence has identified that soldier deployments can be disruptive to soldiers and their families[2]. Deployments may lead to increased risk of spousal aggression [3, 4] child behavior symptoms [5, 6], and child maltreatment [7-9]. Furthermore, the impacts of deployment may be worsened by prolonged and repeat deployments [10, 11], as well as by a soldier's mental health history [12, 13]. Recent findings also reveal that young children might be at highest risk for maltreatment in the immediate period following a soldier's return from deployment [14].

Aside from the stress of deployment itself, it is likely that other soldier- and child-level factors might also elevate the risk for child maltreatment, or influence when in relation to deployment families experience the greatest stress. Children born prematurely and with neonatal comorbidities are known to be at higher risk for maltreatment [15-17]. Additionally, female soldier-parents may experience different stress than their male colleagues as they are more likely than male soldiers to be single parents [1], to not have support of family [18], or have unique stressors related to deployment [19]. Finally, parental psychiatric issues have been

strongly associated with increased risk of child abuse [20-23]. For military families, the combination of these stressors may occur in the months during or surrounding a deployment, creating a unique and previously unexplored context in which child maltreatment could occur.

A more thorough understanding and characterization of risk of child maltreatment among US Army families is needed in order to inform prevention policies and to target interventions more precisely based on family risk. For example, the Army's Family Advocacy Program, which provides services to active duty soldiers and their families, can position prevention resources or counseling to the appropriate soldiers at the right time in relationship to their deployments. Though prior studies have investigated trends in child maltreatment in military families, there is a need for research that addresses not only the risk of maltreatment at different time points across the deployment cycle, but how common family characteristics might influence the magnitude of this risk. The purpose of this study was to identify characteristics of soldiers and children that influence the relationship between deployment and maltreatment among children younger than 2 years in US Army families during a period of increased soldier deployment to international conflicts.

METHODS

Data

Data were obtained from the Army Central Registry, Patient Administration Systems and Biostatistics Activity, and Defense Manpower Data Center. Deployment dates for soldiers and soldier demographic information was obtained from Defense Manpower Data Center; substantiated maltreatment reports from the Family Advocacy Program (FAP) were obtained

from the Army Central Registry; and TRICARE medical diagnoses were obtained from Patient Administration Systems and Biostatistics Activity.

Study Population

Our study population consisted of children younger than two years of age of active-duty US Army soldiers with at least three consecutive years of active service between October 2001 and September 2007. All children in this cohort were born during the study period. Children of this age are considered the population at highest risk for severe injury and fatality from child maltreatment [24, 25]. In addition, restricting the participants to this age group reduces heterogeneity in age-related child maltreatment episodes across the deployment cycle.

We selected children of soldiers with one deployment during the study period. This population was selected due to the homogeneity of their deployment experience. Soldiers selected for multiple deployments differed across key characteristics and their families' experiences differed from those who experienced a single deployment. Months when children had two or more soldiers listed (two soldiers were listed as the TRICARE sponsor for the same child at the same time) were excluded from the analysis because of difficulty in assigning maltreatment episodes to deployment cycles of a single soldier.

Study Measures

The primary outcome of interest was a child's first maltreatment episode. We considered child maltreatment episodes arising from two separate sources: (1) substantiated child maltreatment reports from FAP and (2) medical diagnoses of child maltreatment (based on *International Classification of Diseases, Ninth Revision, Clinical Modification* codes) from TRICARE medical records[26]. Substantiated FAP reports capture four types of child

maltreatment from various reporting sources: physical, sexual, emotional, and neglect. Because child maltreatment episodes may not be reported to state or local civilian child protective service agencies, or alternatively reported to civilian child welfare agencies without subsequent notification to FAP, relying solely on FAP reports will result in under ascertainment of cases [27-29]. Thus, we also used medical diagnoses of child maltreatment found in TRICARE direct and purchased care medical claims and the medical diagnoses. Medical diagnoses of child maltreatment included any of the following *International Classification of Diseases, Ninth Revision, Clinical Modification*, diagnosis or external-cause-of-injury codes from an outpatient or inpatient encounter: 995.50, 995.51, 995.52, 995.53, 995.54, 995.55, 995.59, and E967 [30-33]. We believe that these two sources of child maltreatment reporting provide different yet valuable information for each maltreatment episode.

To create maltreatment episodes for each child, all medical encounters occurring within one day of each other were first collapsed into a single encounter. Then, following previous studies, [34-36] multiple medical encounters with the same diagnosis or related diagnosis occurring within a 180-day interval were grouped into episodes to avoid counting a single maltreatment episode more than once. For each child maltreatment episode, the date on which the episode began was linked by month to the corresponding soldier's deployment data.

Exposures of interest included pre-defined time periods relative to a soldier's deployment. Each month of observation for each child was linked to their soldier parents' deployment status. The observation window was divided into the following 5 periods: (1) 7 or more months pre-deployment (time before a deployment begins), (2) 0 to 6 months pre-

deployment, (3) during deployment, (4) 0 to 6 months post-deployment (time after a deployment ends), and (5) 7 or more months post-deployment.

The additional primary exposures included soldier-level characteristics of gender, as well as any diagnoses of mental health condition or prescription drug use related to a mental health condition before the birth of the child. The primary child characteristic was a history of premature birth or early special needs.

Our analyses also included relevant family covariates. Soldier-level variables included race/ethnicity (white, black, or other), rank (Enlisted or Officer/Warrant Officer), education (high school degree or less, more than high school, or unknown due to data missingness). Child covariates include year of birth (2001/2002-2007), gender, number of siblings at birth (0, 1, or 2 or more).

Statistical Analysis

For each deployment period, unadjusted maltreatment rates were calculated as the observed number of maltreatment episodes divided by the number of child-months, and stratified by soldier gender; soldier mental health status as of the child's birth; and child's prematurity or early special needs status. We obtained p-values comparing rates in different exposure periods assuming a Poisson distribution.

Cox proportional hazard models were used to estimate the hazard of child maltreatment. Right censoring occurred when the child aged to 25 months or when the study period ended (September, 2007). Children's exposure to deployment time period was modeled as a time-varying covariate where each child-month was assigned one of the five time periods relative to the soldier's deployment. We first present results from a base model that included

our main effects of interest (soldier gender, soldier mental health status, and child prematurity or early special needs status), while also adjusting for relevant child, family, and time period characteristics. Next, based on a priori hypotheses and prior literature, we present results from models that separately included an interaction term between time period and our three main effects of interest. All analyses were performed with SAS version 9.4 (SAS Institute Inc., Cary, NC).

RESULTS

Study Population

From 2001 to 2007, 73,404 children were born to 56,080 soldiers who were deployed one time during the observation period. The majority of these soldiers were male (91%), white (59%), had a high school degree or less (73%), and were of Enlisted rank (86 %). More than a quarter (26%) received a mental health condition diagnosis prior to the birth of their child, and additional 19% received a mental health-related prescription (and no diagnosis) prior to their child's birth.

During the study period, 647 (0.9%) children of age 0-24 months were identified with a maltreatment event from either FAP substantiated reports or medically-diagnosed maltreatment. Soldier-parent and child characteristics associated with having a maltreatment episode in univariate analysis appear in Table 1. Soldiers whose children had a maltreatment episode (vs. not) were more likely to have a mother as the soldier-parent (13% vs 9%) or to have their soldier-parent receive a mental health diagnosis prior to a child's birth (33% vs. 26%). Those whose children had a maltreatment event were, however, less likely to have received a

prescription for psychotropic medication in the absence of a formal mental health diagnosis (16% vs 19%). Among children with a maltreatment event, 4% were born prematurity or early special needs status, compared to 2% of children without maltreatment.

Compared to their peers, those soldiers whose children had a maltreatment episode were also more likely to be white (62% vs. 60%) or Black (26% vs. 21%), and less likely to be Hispanic (8% vs. 12%) or Other (5% vs 7%). Soldiers whose children had a maltreatment episode were also more likely to be of Enlisted rank (96% vs 86%) and more likely to have a high school degree or less (87% vs 73%).

Unadjusted rates of maltreatment

Among children of male sponsors, maltreatment events occurred at a rate of 4.2 events per 10,000 child-months, compared to 6.7 events per 10,000 child-months among female sponsors (Figure 1a). In the 6 months prior to a deployment, the rate of maltreatment was significantly higher among children of female soldiers, compared to children of male soldiers in the same time period (12.3 vs 3.8 events per 10,000 child-months; $p<0.001$). In the 6 months following a deployment, the rate of maltreatment was elevated among both female and male soldiers (8.1 vs 6.9 events per 10,000 child-months; $p=0.70$).

Among children of sponsors who had a mental health diagnosis prior to their birth, the rate of abuse was 6.3 events per 10,000 child months, compared to 3.9 among sponsors who received a psychotropic prescription in the absence of a mental health diagnosis, and 3.8 among those who received neither (Figure 1b). In the 6 months prior to deployment, the rate of maltreatment was significantly higher among those with a mental health diagnosis, compared to all others (9.3 vs 3.2 events per 10,000 child-months; $p<0.001$). In the 6 months following

deployment, sponsors with a diagnosis had increased rates of maltreatment compared to those with neither a diagnosis nor a psychotropic prescription (9.8 vs 5.6 events per 10,000 child-months; $p=0.02$) as well as in the ≥ 7 months after returning home from deployment (5.5 vs 2.6 events per 10,000 child-months; $p<0.001$).

Among children with a history of prematurity or early special needs, the rate of abuse was 9.0 events per 10,000 child-months, compared to 4.3 among those without prematurity or early special needs (Figure 1c). In the 6 months following a deployment, the rate of maltreatment was not significantly higher among children with a history of prematurity or early special needs (16.3 vs. 6.8 per 10,000 child-months). In the period of 7 or more months following the sponsor's deployment, the rate of maltreatment was significantly higher among children with a history of prematurity or early special needs (8.9 vs 3.3 per 10,000 child-months; $p<0.05$).

Event history analysis

Children contributed a total of 1,473,668 months of observation time. Time from birth to first maltreatment event was on average 12.3 months. Mirroring prior findings on time of child maltreatment relative to a deployment, children were at highest risk for maltreatment during the first 6 months of the post-deployment period ($HR=1.68$; $p<0.001$) compared to the pre-deployment period, even after adjusting for parent and child characteristics (Table 2).

Apart from deployment-associated risk, several family characteristics independently changed the risk for maltreatment across all time periods around deployment. This included children with a history of prematurity or early special needs ($HR=2.01$; $p<0.001$) and soldiers with a prior mental health diagnosis ($HR = 1.69$, $p<0.001$). Children with two or more siblings

(HR=1.47; $p<0.001$) also had increased risk of maltreatment. Some factors were also associated with a reduced risk of maltreatment; this included children of soldiers of Officer/Warrant Officer rank vs. Enlisted rank (HR=0.47; $p=0.004$), children of Hispanic or Asian/Pacific Islander soldiers compared to White soldiers (HR=0.55; $p<0.001$ and HR = 0.37; $p= 0.01$), and children of soldiers with more than a high school degree compared to those with less than a high school degree (HR=0.39; $p<0.001$).

In models testing for interaction, there were significant differences in maltreatment risk across deployment period for soldier gender (LR Chi-square = 12.8, $df=4$, $p=0.02$), and a trend towards difference across periods for soldier mental health history (LR Chi-square = 14.5, $df=8$, $p=0.07$) (Table 3). The risk for maltreatment among children with prematurity or early special needs remained similarly elevated across all periods, and so, no effect modification was detected (LR Chi-square = 1.4, $df=4$, $p=0.9$).

The effect modification across deployment time periods is best characterized by within-group hazard ratios comparing each time period to the baseline time period of more than six months prior to deployment (Table 3). For example, among children with a male soldier-parent, risk for maltreatment was elevated during deployment (HR=1.30, $p=0.04$), and in the 6 months following deployment (HR=1.72, $p<0.001$), relative to the baseline time period. Among children of female soldier-parent, the hazard of maltreatment was highest in the 6 months prior to deployment (HR=1.82, $p=0.05$). Similarly, the contrast within time periods, but across soldier gender is also revealing. Within the 6 months prior to deployment, the risk of maltreatment was significantly higher among children of female soldiers relative to male soldiers (HR = 2.20, $p=0.006$), greater than among any other period of deployment.

The effect modification of soldier mental health history across time periods also resulted in contrasts relative to the baseline time period of more than six months before deployment. The children of soldiers who had received a psychotropic prescription without a formal mental health diagnosis had an elevated hazard for maltreatment in the 6 months following deployment (HR = 2.66, $p=0.002$) and during deployment (HR = 1.88, $p = 0.04$). At the same time, the children of those who had received a mental health diagnosis (HR = 1.64, $p<0.05$) and of those who had no prior mental health services (HR = 1.49, $p=0.02$) had elevated risk in the post-deployment period relative to each's respective baseline time period. Within the 6 months prior to deployment, however, those soldiers who had a formal mental health diagnosis had significantly increased risk of maltreatment compared to those with no prior mental health diagnoses or prescriptions (HR = 2.78, $p<0.001$). The increased risk for soldiers with a mental illness diagnosis was also present in the period of more than 6 months prior to deployment (HR = 1.47, $p=0.04$), and the 6 months following deployment (HR = 1.63, $p<0.05$).

DISCUSSION

Although prior research has demonstrated that deployment-related stress elevates the risk for maltreatment within military families [14], it has been unclear whether that elevated risk is the same for all military families. The current study deepens our understanding of how subgroups of families might respond differently to deployment-related stress. This approach recognizes that child abuse prevention efforts by the Family Advocacy Program need to account for the heterogeneity of military families and the different times at which children in these families are at greatest risk of maltreatment. In doing so, the current study reveals unique temporal risk patterns for children of female soldiers and children of soldiers who had been

diagnosed with a mental illness prior to the child's birth.

Our study enriches the findings of prior work by revealing that the risk for child maltreatment was elevated for all families in the 6 months following a soldier's return from deployment, even while accounting for characteristics that differ across families [14]. This suggests that the challenges of a soldiers' return home following a deployment may be exacerbated in the presence of a young child, regardless of endogenous familial or parental risk factors such as age, rank, or educational attainment.

Perhaps this study's most revealing finding is to characterize the different stressors that may be occurring within the homes of female as compared to male soldier-parents. With the number of female members of the Armed Services climbing by 50% between 2005 and 2015, our findings reveal for the first time that interventions for female soldiers need to be uniquely tailored to their families' needs [1, 37]. In contrast to infants of male soldiers, whose risk period was particularly elevated in the 6 months following deployment, the infants of female soldier-parents were at highest risk in the 6 months prior to deployment.

The differences in maltreatment risk to infants of female soldiers may be reflective of unique stressors experienced by women in the military and therefore require unique attention by military leadership. Prior data on women in the military has suggested they may be at higher risk of developing mental health issues, though evidence is inconclusive whether this is related to deployment [19, 38, 39]. Evidence has also suggested that, compared to their male counterparts, female service members were more likely to be single parents, to report stress related to balancing home and career obligations, as well as in obtaining adequate childcare [1, 18]. It is important to note, however, that our study was unable to determine who perpetrated

the abuse. Regardless of perpetrator, however, this study's finding of an elevated risk period unique to families with female soldiers suggests that further Army research will need to interpret the root causes for elevated risk to infants in these families so that prevention strategies might be better adapted to support the families of female soldiers.

The children of female soldiers were not the only children who were revealed to be at unique risk relative to the overall population. Consistent with prior literature, infants with perinatal complications such as prematurity or early special healthcare needs were at elevated risk of maltreatment across all time periods relative to deployment, magnifying the deployment related risk we observed [15-17]. Premature children may have inconsistent sleep patterns and temperament, as well as more frequent crying [40, 41]. The stress of such difficulties could be exacerbated in families experiencing additional stress related to a soldier's deployment. The additive risk we observed suggests that families of children with special healthcare needs require special attention in relation to combat-related deployments.

In contrast to the special healthcare needs of the child, a soldier's mental health history did not consistently elevate a child's risk for maltreatment across every deployment-related period. Our findings suggest that, while children whose soldier-parent had a history of mental illness were at an overall increased risk of maltreatment, the magnitude of this increased risk may be elevated prior to deployment, and even more so in the six months following a deployment. Conversely, risk during deployment was not elevated. These findings are not surprising, as prior research has indicated that children of parents with a history of psychiatric disorder are substantially more likely to experience abuse [21, 22, 42].

We would caution that the finding of elevated risk when the soldier is home from deployment (either before or after) might falsely implicate the soldier as the perpetrator. Prior research has indicated that a service member's mental illness may perpetuate stress for all family members, particularly civilian spouses [43-45]. In recent years, the US Army and the Department of Defense have increased efforts to screen service members for mental health issues throughout the deployment cycle, and after reintegration into home life [46]. US Army soldiers who have young children and a mental health condition may require additional resources during the stressful months surrounding deployment in order to maintain a safe home environment; the nature of those interventions will require further study.

It was somewhat surprising to detect the magnitude of psychotropic prescriptions that soldiers received in the absence of a formal diagnosis (nearly 20% of all soldiers). Relative to the baseline time period, the largest increase in risk observed in the post-deployment period was among children of soldiers who received psychotropic prescriptions in the absence of formal counseling or diagnostic visits. That such an increased risk was identified among this group of families raises the concern that psychiatric prescriptions generated in the absence of diagnoses fail to fully impact the risk within these soldiers' families. Future study will be required to understand the reasons why psychiatric prescriptions were provided to some in the absence of diagnoses, as well as how treatment plans or more substantial counseling approaches could affect the safety of others in the soldier's home.

Limitations

Although a major strength of this study was the incorporation of longitudinal data analysis to better appraise risk of maltreatment across deployment, there were nevertheless

limitations in our approach. First, we were unable to precisely identify mental health risk among soldiers. Mental health risk was indicated in our study as the presence of ICD-9 diagnostic codes for mental illness diagnoses or mental illness-related prescriptions prior to the birth of a child; however, there is a high likelihood of under-ascertainment of soldiers' mental health status as our methods are reliant on interactions with the healthcare system and documentation of those interactions [12, 47]. This under-detection of mental illness may therefore have caused us to underestimate the true magnitude of the relationship between parental mental health issues and risk for maltreatment. Nevertheless, there remained an appreciable increase in risk among soldiers with diagnosed mental health issues, providing the Army with an identifiable group for child maltreatment prevention efforts. Additionally, the uniquely elevated risk for these families in the months surrounding a deployment are unlikely to have been affected by this misclassification.

There are several other limitations in our study. First is the concern of unobserved confounding. Due to limitations of the available data, we were unable to identify soldiers with direct combat exposure and therefore could not examine its relationship with child maltreatment. Relevant family-level risk factors, such as income, were also unavailable; however, the homogeneity of our study population suggests that we would not expect substantial between-family variation in such family-level risk factors during our study period. Second, children may have been cared for by a non-custodial, non-military parent, or by extended family members at various points in the deployment cycle; our data did not indicate the identity of the maltreatment perpetrator. Finally, ascertaining child maltreatment episodes is fraught with challenges, given both under-reporting and the heterogeneity of types of

maltreatment. For this reason, we studied two different measures (substantiated FAP maltreatment reports and medical maltreatment diagnosis) in order to identify common trends.

Conclusion

In summary, this study illustrates that each US Army family may experience the stress of deployment differently, and at varying points throughout the deployment cycle. Taking into account the risk for maltreatment across soldier and child characteristics, as well as at different points in time, can guide a more nuanced positioning of resources to support families in the US Army. The Army offers programs to families of deployed soldiers in order to support their reintegration into family life upon return. Subsets of families, such as those with female soldiers, soldiers with mental illnesses, and soldiers with a child born prematurely or with early special needs may require additional or correctly-timed support and services in order to ensure a safe and healthy home environment for young children during a stressful period.

References

1. **2015 Demographics: Profile of the Military Community. Washington, DC: Department of Defense, Office of the Deputy Assistant Secretary of Defense for Military Community and Family Policy; 2015. Available at <http://download.militaryonesource.mil/12038/MOS/Reports/2015-Demographics-Report.pdf>; accessed January 13, 2017.**
2. **Sheppard SC, Malatras JW, Israel AC: The impact of deployment on US military families. American Psychologist 2010. 65(6); p. 599.**

3. McCarroll JE, Newby JH, Thayer LE, Norwood AE, Fullerton CS, Ursano RJ: Reports of spouse abuse in the US Army Central Registry (1989–1997). *Mil Med* 1999. 164(2); p.77-84.
4. Newby JH, McCarroll JE, Thayer LE, Norwood AE, Fullerton, CS: Spouse abuse by black and white offenders in the US Army. *Journal of Family Violence*, 2000. 15(2): p. 199-208.
5. Paris R, DeVoe ER, Ross AM, Acker ML: When a parent goes to war: effects of parental deployment on very young children and implications for intervention. *American journal of Orthopsychiatry* 2010. 80(4); p. 610.
6. Chartrand MM, Frank DA, White LF, Shope TR: Effect of parents' wartime deployment on the behavior of young children in military families. *Archives of pediatrics & adolescent medicine* 2008. 162(11); p. 1009-1014.
7. Gibbs DA, Martin SL, Kupper LL, Johnson RE: Child maltreatment in enlisted soldiers' families during combat-related deployments. *JAMA* 2007. 298(5): p. 528-535.
8. Rentz ED, Marshall SW, Loomis D, Casteel C, Martin SL, Gibbs DA: Effect of deployment on the occurrence of child maltreatment in military and nonmilitary families. *American Journal of Epidemiology* 2007. 165(10); p. 1199-1206.
9. McCarroll JE, Newby JH, Thayer LE, Ursano RJ, Norwood AE, Fullerton CS: Trends in US army child maltreatment reports: 1990–2004. *Child Abuse Review* 2008. 17(2); p. 108-118.
10. Lincoln A, Swift E, Shorteno-Fraser M: Psychological adjustment and treatment of children and families with parents deployed in military combat. *Journal of Clinical Psychology* 2008. 64(8); p. 984-992.
11. Palmer C: A theory of risk and resilience factors in military families. *Military Psychology* 2008. 20(3); p. 205-217.

12. Milliken CS, Auchterlonie JL, Hoge CW: Longitudinal assessment of mental health problems among active and reserve component soldiers returning from the Iraq war. *JAMA* 2007. 298(18); p. 2141-2148.
13. Marshall AD, Panuzio J, Taft CT: Intimate partner violence among military veterans and active duty servicemen. *Clin Psychol Rev* 2005. 25; p. 862-76.
14. Taylor CM, Ross ME, Wood JN, Griffis HM, Harb GC, Mi L, Song L, Strane D, Lynch KG, Rubin DM: Differential Child Maltreatment Risk Across Deployment Periods of US Army Soldiers. *Am J Public Health* 2016. 106(1); p. 153-8.
15. Doud AN, Lawrence K, Goodpasture M, Zeller KA: Prematurity and neonatal comorbidities as risk factors for nonaccidental trauma. *J Pediatr Surg* 2015. 50(6); p. 1024-7.
16. Smith JA, Adler AG: Children hospitalized with child abuse and neglect: a case-control study. *Child Abuse Negl* 1991. 15(4); p. 437-45.
17. Lynch MA, Roberts J: Predicting child abuse: signs of bonding failure in the maternity hospital. *Br Med J*, 1977. 1(6061); p. 624-6.
18. 2008 Report. Washington, DC: Defense Department Advisory Committee on Women in the Services. Available at <http://dacowits.defense.gov/Portals/48/Documents/Reports/2008/Annual%20Report/dacowits2008report.pdf>; accessed January 12, 2017.
19. Seelig AD, Jacobson IG, Smith B, Hooper TI, Gackstetter GD, Ryan MA, Wells TS: Prospective evaluation of mental health and deployment experience among women in the US military. *Am J Epidemiol* 2012. 176(2); p. 135-45.
20. Kelleher K, Chaffin M, Hollenberg J, Fischer E: Alcohol and drug disorders among physically abusive and neglectful parents in a community-based sample. *Am J Public Health* 1994. 84(10); p. 1586-90.

21. Sidebotham P, Golding J: Child maltreatment in the "children of the nineties" a longitudinal study of parental risk factors. *Child Abuse Negl*, 2001. 25(9); p. 1177-200.
22. Walsh C, MacMillan H, Jamieson E: The relationship between parental psychiatric disorder and child physical and sexual abuse: findings from the Ontario Health Supplement. *Child Abuse Negl* 2002. 26(1); p. 11-22.
23. Wells K: Substance abuse and child maltreatment. *Pediatr Clin North Am* 2009. 56(2); p. 345-62.
24. U.S. Department of Health & Human Services, Administration for Children and Families, Administration on Children, Youth and Families, Children's Bureau. Child maltreatment 2014. Available at <http://www.acf.hhs.gov/programs/cb/research-data-technology/statistics-research/child-maltreatment>; accessed January 13, 2017.
25. Wildeman C, Emanuel N, Leventhal JM, Putnam-Hornstein E, Waldfogel J, Lee H: The prevalence of confirmed maltreatment among US children, 2004 to 2011. *JAMA Pediatr* 2014. 168(8); p. 706-13.
26. International Classification of Diseases, Ninth Revision, Clinical Modification, 1980: Hyattsville, MD.
27. Gilbert R, Kemp A, Thoburn J, Sidebotham P, Radford L, Glaser D, Macmillan HL: Recognising and responding to child maltreatment. *The Lancet* 2009. 373(9658); p. 167-180.
28. Seldak AJ, Broadhurst DD: The National Incidence Study of Child Abuse and Neglect., 1996, US Department of Health and Human Services: Washington, DC.
29. Seldak, A.J., et al., Fourth National Incidence Study of Child Abuse and Neglect (NIS- 4): Report to Congress, 2010, US Department of Health and Human Services, Administration for Children and Families: Washington, DC.

30. Wood JN, Hall M, Schilling S, Keren R, Mitra N, Rubin DM: Disparities in the evaluation and diagnosis of abuse among infants with traumatic brain injury. *Pediatrics* 2010. 126(3); p. 408-414.
31. Wood JN, Medina SP, Feudtner C, Luan X, Localio R, Fieldston ES, Rubin DM: Local macroeconomic trends and hospital admissions for child abuse, 2000–2009. *Pediatrics* 2012. 130(2); p. e358-e364.
32. Leventhal JM, Martin KD, Asnes AG: Incidence of fractures attributable to abuse in young hospitalized children: results from analysis of a United States database. *Pediatrics* 2008. 122(3); p. 599-604.
33. Leventhal JM, Martin KD, Asnes AG: Fractures and traumatic brain injuries: abuse versus accidents in a US database of hospitalized children. *Pediatrics* 2010. 126(1); p. e104-e115.
34. Matone M, O'Reilly AL, Luan X, Localio AR, Rubin DM: Emergency department visits and hospitalizations for injuries among infants and children following statewide implementation of a home visitation model. *Maternal and Child health journal*, 2012. 16(9): p. 1754-1761.
35. Lestina DC, Miller TR, Smith GS: Creating injury episodes using medical claims data. *Journal of Trauma and Acute Care Surgery*, 1998. 45(3): p. 565-569.
36. Spady DW, Saunders DL, Schopflocher DP, Svenson LW: Patterns of injury in children: a population-based approach. *Pediatrics* 2004. 113(3); p. 522-529.
37. Department of Defense, Office of the Deputy Assistant Secretary of Defense for Military Community and Family Policy. 2005 Demographics: Profile of the Military Community. Available at <http://download.militaryonesource.mil/12038/MOS/Reports/2005%20Demographics%20Report.pdf>; accessed January 13, 2017.

38. Wojcik BE, Akhtar FZ, Hassell LH: Hospital admissions related to mental disorders in U.S. Army soldiers in Iraq and Afghanistan. *Mil Med*, 2009. 174(10): p. 1010-8.
39. Adler AB, Huffman AH, Bliese PD, Castro CA: The impact of deployment length and experience on the well-being of male and female soldiers. *J Occup Health Psychol* 2005. 10(2); p. 121-37.
40. Chapieski ML, Evankovich KD, Behavioral effects of prematurity. *Semin Perinatol* 1997. 21(3); p. 221-39.
41. Barr RG: Preventing abusive head trauma resulting from a failure of normal interaction between infants and their caregivers. *Proc Natl Acad Sci USA* 2012. 109(2); p. 17294-301.
42. Brown J, Cohen P, Johnson JG, Salzinger S: A longitudinal analysis of risk factors for child maltreatment: findings of a 17-year prospective study of officially recorded and self-reported child abuse and neglect. *Child Abuse Negl* 1998. 22(11); p. 1065-78.
43. Sayers SL, Farrow VA, Ross J, Oslin DW: Family problems among recently returned military veterans referred for a mental health evaluation. *Journal of Clinical Psychiatry* 2009. 70(2); p. 163.
44. Allen ES, Rhoades GK, Stanley SM, Markman HJ: Hitting home: relationships between recent deployment, posttraumatic stress symptoms, and marital functioning for Army couples. *J Fam Psychol* 2010. 24(3); p. 280-8.
45. Blow AJ, Gorman L, Ganoczy D, Kees M, Kashy DA, Valenstein M, Marcus SM, Fitzgerald HE, Chermack S: Hazardous drinking and family functioning in National Guard veterans and spouses postdeployment. *J Fam Psychol* 2013. 27(2); p. 303-13.
46. Department of the Army. Post-Deployment Health Reassessment [Memorandum]. Available at:
[http://fhp.osd.mil/pdhrainfo/media/PDHRA%20Implementation%20Plan%20Approved%20\(3\).pdf](http://fhp.osd.mil/pdhrainfo/media/PDHRA%20Implementation%20Plan%20Approved%20(3).pdf); access January 13, 2017.

47. Hoge CW, Castro CA, Messer SC, McGurk D, Cotting DI, Koffman RL: Combat duty in Iraq and Afghanistan, mental health problems, and barriers to care. *New England Journal of Medicine* 2004. 351(1); p. 13-22.

Table 1: Characteristics of children ages 0-24 months among families of soldiers who were deployed between 2001 and 2007, stratified by child maltreatment status

Characteristics		Maltreatment*		No maltreatment		p†
		n	%	n	%	
Soldier-level characteristics^		(n = 605, 1.1%)		(n = 55482, 98.2%)		
Soldier Gender	Female	77	12.7%	5069	9.1%	0.002
	Male	528	87.3%	50413	90.9%	
Race	White	373	61.7%	32820	59.2%	0.0008
	Black	154	25.5%	11849	21.4%	
	Hispanic	49	8.1%	6712	12.1%	
	Other	29	4.7%	4101	7.4%	
Rank	Enlisted	583	96.4%	47764	86.1%	<.0001
	Officer/Warrant	22	3.6%	7718	13.9%	
Education	HS degree or less	526	86.9%	40594	73.2%	<.0001
	More than HS	48	7.9%	12619	22.7%	
	Unknown	31	5.1%	2269	4.1%	
Child-level characteristics^		(n = 647, 0.9%)		(n = 72757; 99.1%)		
Neonatal Complex Chronic Condition	Yes	25	3.9%	1365	1.9%	0.0002
	No	622	96.1%	71392	98.1%	
Soldier parent had mental health-related DX or RX prior to birth	Diagnosis	210	32.5%	18200	25.0%	<.0001
	Prescription only	108	16.7%	14406	19.8%	
	None	329	50.8%	40151	55.2%	
Child Gender	Female	305	47.1%	34785	47.8%	0.001
	Male	342	52.9%	36480	50.1%	
	Unknown	0	0%	1492	2.1%	
Birth siblings	0	226	34.9%	27770	38.2%	0.01
	1	185	28.6%	22650	31.1%	
	2 or more	236	36.5%	22337	30.7%	

† p-value from chi-square test

^ Though the study population consists of children, soldier-level and child-level characteristics are presented here with each group's respective denominator in order to distinguish whether characteristics were reflective of children or their parent

* Maltreatment is defined as a substantiated report to the Family Advocacy Program or the presence of a medical diagnosis of child abuse

Table 2: Child and family characteristics associated with risk for maltreatment across all deployment periods for a sample of families with children ages 0-24 months whose soldier-parents were deployed between 2001 and 2007†

Covariates*		Outcome: FAP/TRICARE	
		HR	p-value
Child prematurity or early special needs status	No	-	-
	Yes	2.01	0.0006
Sponsor Gender	Female	-	-
	Male	0.87	0.33
Soldier mental health condition prior to child's birth	No DX or RX pre-birth	-	-
	RX only pre-birth	1.11	0.3495
	DX pre-birth	1.69	<0.0001
Deployment status by month	Predeploy 7+	-	-
	Predeploy 6	1.06	0.69
	Deploy	1.23	0.09
	Post-deploy 6	1.68	0.0001
	Post-deploy 7+	0.91	0.48
Child gender	Male	-	-
	Female	1.07	0.43
Birth Siblings	0	-	-
	1	1.08	0.43
	2 or more	1.47	<0.0001
Sponsor Rank	Officer/Warrant	-	-
	Enlisted	0.47	0.006
Sponsor Race	White	-	-
	Hispanic	0.57	0.0001
	Other	0.57	0.0029
	Black	0.90	0.27
Sponsor Education	HS degree or less	-	-
	More than HS	0.39	<0.0001

† Obtained from Cox proportional hazard models

* Calculated for multi-level variables using Log likelihood ratio test

Table 3. Differential risks of maltreatment across deployment time periods by soldier gender and soldier mental health history among families with children ages 0-24 months whose soldier-parents were deployed between 2001 and 2007.

Soldier characteristic		Deployment Period	Males		Females				p-value*
			HR	p-value	HR	p-value			
Sponsor gender	Comparison of time periods, by gender	Predeploy 7+	-	-	-	-			<0.01
		Predeploy 6	0.92	0.62	1.82	0.05			
		Deploy	1.30	0.04	0.56	0.20			
		Post-deploy 6	1.72	0.0001	1.16	0.75			
		Post-deploy 7+	0.89	0.38	1.12	0.70			
	Comparison by gender, within time period ‡	Predeploy 7+	-	-	1.11	0.66			
		Predeploy 6	-	-	2.20	0.01			
		Deploy	-	-	0.48	0.08			
		Post-deploy 6	-	-	0.75	0.50			
		Post-deploy 7+	-	-	1.40	0.14			
Soldier characteristic		Deployment Period	No DX or RX prior to birth		RX only prior to birth		DX prior to birth		p-value*
			HR	p-value	HR	p-value	HR	p-value	
Sponsor mental health status prior to child's birth	Comparison of time periods, by mental health status	Predeploy 7+	-	-	-	-	-	-	0.07
		Predeploy 6	0.83	0.34	1.10	0.82	1.56	0.07	
		Deploy	1.24	0.16	1.88	0.04	0.95	0.84	
		Post-deploy 6	1.49	0.02	2.66	0.002	1.64	0.05	
		Post-deploy 7+	0.78	0.16	1.39	0.39	0.86	0.63	
	Comparison of mental health status groups, by time period †	Predeploy 7+	-	-	0.83	0.48	1.47	0.04	
		Predeploy 6	-	-	1.11	0.79	2.78	0.0001	
		Deploy	-	-	1.27	0.28	1.13	0.57	
		Post-deploy 6	-	-	1.49	0.12	1.63	0.05	
		Post-deploy 7+	-	-	1.49	0.12	1.63	0.05	

* Chi squared p-value from log-likelihood ratio test

‡ Children of male soldiers is the reference group

† Children of soldiers with no mental health history prior to child's birth is the reference group

Figure 1a: Unadjusted rate of child maltreatment events (per 10,000 child-months) across deployment time periods for families whose soldier-parents were deployed between 2001 and 2007, stratified by soldier-parent gender



Figure 1b: Unadjusted rate of child maltreatment events (per 10,000 child-months) across deployment time periods for families whose soldier-parents were deployed between 2001 and 2007, stratified by soldier-parent's mental health history prior to the child's birth.

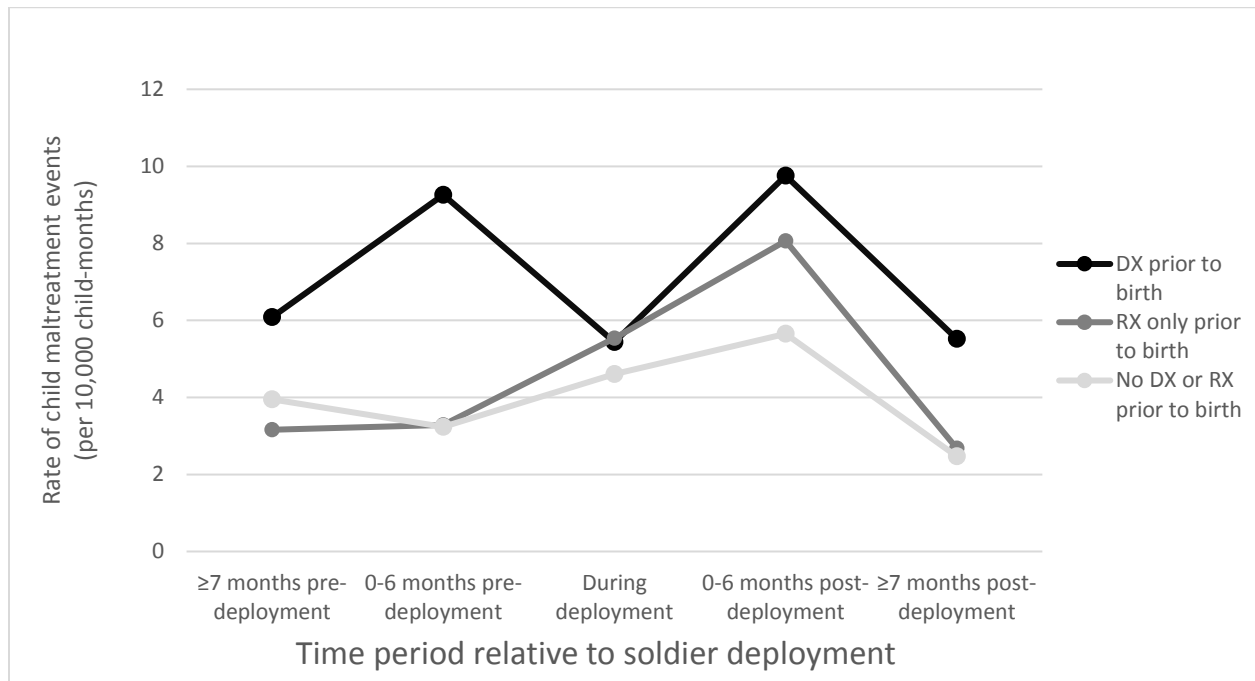
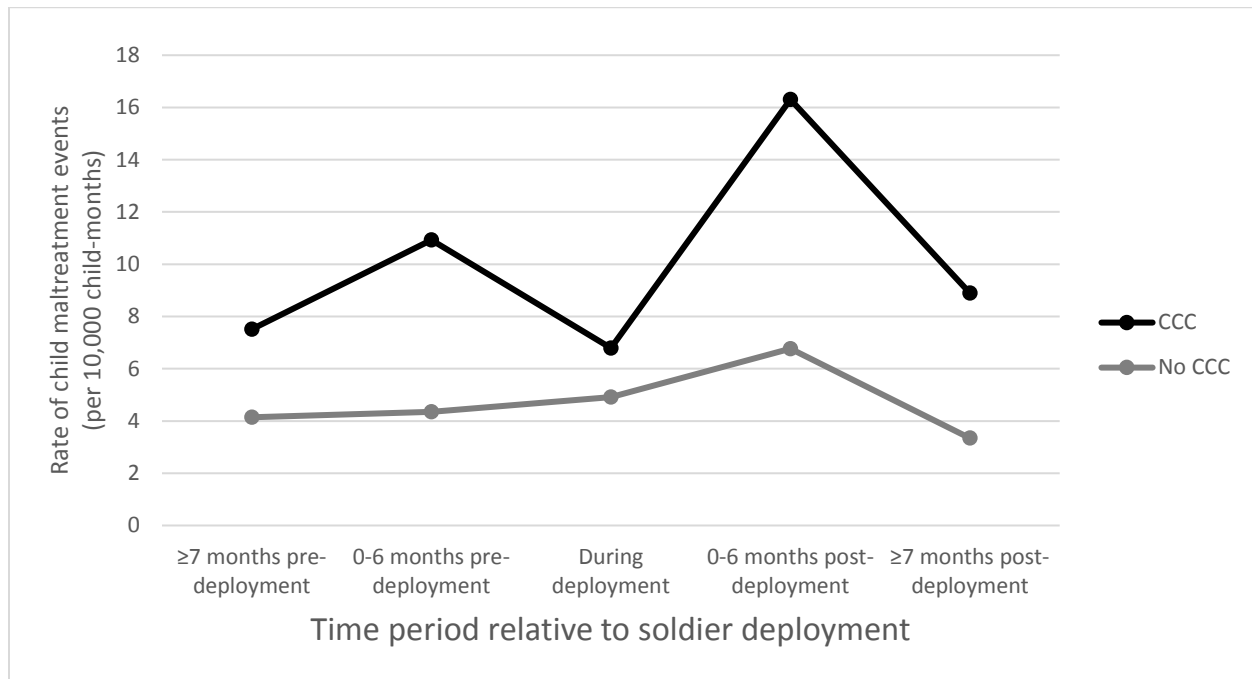


Figure 1c: Unadjusted rate of child maltreatment events (per 10,000 child-months) across deployment time periods for families whose soldier-parents were deployed between 2001 and 2007, stratified by child's premature birth or early special needs status



Appendix H

Under-Ascertainment from Healthcare Settings of Child Abuse Events among Children of Soldiers by the U.S. Army Family Advocacy Program

Abstract

In cases of maltreatment involving children of U.S. Army service members, the U.S. Army Family Advocacy Program (FAP) is responsible for providing services to families and ensuring child safety. The percentage of cases of maltreatment that are known to FAP, however, is uncertain. Thus, the objective of this retrospective study was to estimate the percentage of U.S. Army dependent children with child maltreatment as diagnosed by a military or civilian medical provider who had a substantiated report with FAP from 2004-2007. Medical claims data were used to identify 0-17 year old child dependents of soldiers who received a medical diagnosis of child maltreatment. Linkage rates of maltreatment medical diagnoses with corresponding substantiated FAP reports were calculated. Bivariate and multivariable analyses examined the association of child, maltreatment episode, and soldier characteristics with linkage to substantiated FAP reports. Across 5,945 medically diagnosed maltreatment episodes, 20.3% had a substantiated FAP report. Adjusting for covariates, the predicted probability of linkage to a substantiated FAP report was higher for physical abuse than for sexual abuse, 25.8%, 95% CI (23.4, 28.3) versus 14.5%, 95% CI (11.2, 17.9). Episodes in which early care was provided at civilian treatment facilities were less likely to have a FAP report than those treated at military facilities, 9.8%, 95% CI (7.3, 12.2) versus 23.6%, 95% CI (20.8, 26.4). The observed low rates of linkage of medically diagnosed child maltreatment to substantiated FAP reports may signal the need for further regulation of FAP reporting requirements, particularly for children treated at civilian facilities.

Keywords: child maltreatment, child abuse, Family Advocacy Program (FAP), military

Established in 1981, the Family Advocacy Program (FAP) is responsible for the prevention, identification, reporting, investigation and treatment of spouse and child abuse in military families ("The Army Family Advocacy Program, Rapid Action Revision," 2011; Rentz et al., 2006). Each year FAP investigates over 15,000 reports of alleged maltreatment involving children of military service members (U.S. Department of Defense, 2015). In the approximately 45% of reported cases in which FAP makes a determination that maltreatment has occurred and substantiates the report (U.S. Department of Defense, 2015), FAP is responsible for collaborating with local civilian child protection service (CPS) agencies in providing services to families and ensuring the safety of children ("The Army Family Advocacy Program, Rapid Action Revision," 2011).

The unique stressors experienced by military families related to deployments and relocations have raised concern that military families may be at increased risk for child maltreatment, particularly during times of frequent and prolonged combat-related deployments (Gibbs, Martin, Kupper, & Johnson, 2007; Rentz et al., 2007; Rentz et al., 2006; Taylor et al., 2016). Rates of substantiated FAP reports of child maltreatment, however, have suggested that, on average, substantiated rates of child maltreatment in the U.S. military are half the rate of that for civilian children (McCarroll, Ursano, Fan, & Newby, 2004; Rentz et al., 2006; U.S. Department of Defense, 2015), raising speculation that some attributes of military families may be protective against abuse (Gumbs et al., 2013; Rentz et al., 2006; U.S. Department of Defense, 2015). Other studies have produced mixed results regarding the relative rates of child maltreatment in civilian and military populations (Gumbs et al., 2013; Rentz et al., 2006).

The reported number of substantiated cases served by FAP, however, almost certainly underestimates the number of child dependents of U.S. military service members who are

victims of maltreatment. Numerous studies have demonstrated that many cases of child maltreatment in the U.S. are never reported to a CPS agency or are reported but not investigated or substantiated (Gilbert et al., 2009; Sedlak et al., 2010). Even severely maltreated children, requiring medical care due to abuse or neglect are not uniformly known to civilian CPS agencies. Among cases in which a diagnosis of child maltreatment is documented in the medical record and a diagnosis code for child maltreatment is assigned, the vast majority (90%) are reported to CPS (Schnitzer, Slusher, & Van Tuinen, 2004). In many cases, however, a diagnosis of child maltreatment is not documented and a report is not made because medical providers either failed to recognize the maltreatment or recognized the maltreatment but chose not to diagnose and report it (Flaherty et al., 2008; Jenny, Hymel, Ritzen, Reinert, & Hay, 1999; Oral, Blum, & Johnson, 2003; Ravichandiran et al., 2010; Taitz, Moran, & O'Meara, 2004; Thorpe, Zuckerbraun, Wolford, & Berger, 2014). Given the complexity of the reporting system for military families, there may be an even larger gap in reporting to FAP, as medical providers may not uniformly report to FAP even when they have made and documented a diagnosis of child maltreatment in a military family. Failures of reporting suspected child maltreatment to FAP could result in vulnerable children and families not receiving FAP services and contribute to undercounting of child maltreatment in the U.S. military.

The reporting system for suspected child maltreatment involving families in the U.S. Army, the largest branch of the military, is complex, with multiple possible routes for the communication of reports of suspected maltreatment to the U.S. Army FAP. These routes of communication may vary by medical care site. Children of Army service members with injuries from maltreatment may receive care at medical facilities associated with military installations or at non-military medical facilities. When medical providers at a military facility suspect a child is

a victim of maltreatment, they are required per Army Regulation 608-18 ("The Army Family Advocacy Program, Rapid Action Revision," 2011) to make an immediate report to the on-site Reporting Point of Contact (RPOC) designated by the installation commander. In most instances, the RPOC is the military treatment facility emergency room or Military Police desk ("The Army Family Advocacy Program, Rapid Action Revision," 2011). Medical providers caring for a military family at non-military facilities, may be unfamiliar with the military system and make reports to civilian CPS agencies via centralized hotlines and not make an additional report to FAP. In some cases, military medical providers may choose to bypass the FAP RPOC and make reports to civilian CPS agencies. Thus, civilian CPS agencies may receive reports for children treated at military facilities as well as for children treated at non-military facilities. At military installations where a memorandum of agreement (MOA) exists between FAP and local civilian CPS agencies, each agency agrees to shared case management and is expected to provide case information on all known and suspected instances of child maltreatment involving soldiers and their families. This allows FAP to coordinate the case management and provision of services with civilian CPS as well as provide military-specific services when appropriate (United States Department of Army, 1995). It is unclear how many installations have the necessary MOAs in place to support an integrated response between civilian and FAP agencies. Furthermore, the extent to which these communications occur when MOAs are in place is also uncertain. Thus, there are multiple opportunities for lapses in communication of child maltreatment concerns to FAP.

Given the concern for possible under-reporting of child maltreatment to the U.S. Army FAP, the aim of this study was to estimate the proportion of medically diagnosed cases of child maltreatment that resulted in a substantiated U.S. Army FAP report, and to investigate how child,

episode, and soldier characteristics influenced the linkage of a medically diagnosed child maltreatment episode to a substantiated FAP report. Although child maltreatment reports originating from medical providers represent a minority of all substantiated reports in both the civilian CPS and the FAP systems (Foster et al., 2010; Schnitzer et al., 2004; U.S. Department of Health and Human Services, 2015), we chose to focus on medically diagnosed cases of maltreatment for two reasons. First, the population of medically diagnosed cases of maltreatment includes the most severely injured and maltreated children, including those at highest risk for a fatality. Second, medical diagnosis codes can be used to identify cases of alleged child maltreatment including physical abuse with a high specificity (Berger, Parks, Fromkin, Rubin, & Pecora, 2013; A. M. Hooft et al., 2015; Schnitzer et al., 2004; Winn, Agran, & Anderson, 1995). The vast majority (90%) of cases in which concern for child maltreatment is documented in the medical record and a diagnosis code for child maltreatment is assigned are reported to civilian CPS (Schnitzer et al., 2004). Previous studies have utilized medical diagnosis codes to estimate the number of children in the United States receiving medical care for child maltreatment in the emergency department or inpatient settings (King, Farst, Jaeger, Onukwube, & Robbins, 2015; Leventhal, Martin, & Gaither, 2012). Unfortunately, there is no systematic approach to identifying the denominator of at-risk children originating from other settings beyond healthcare.

Methods

Data Sources

Records of substantiated reports of suspected child maltreatment made to U.S. Army FAP were obtained from the Army Central Registry. Medical claims data for both direct and purchased care received in the United States and abroad was obtained from the TRICARE

Management Activity's Patient Administration Systems and Biostatistics Activity system.

Direct care includes medical services provided in the approximately 60 inpatient acute care hospitals and 385 standalone medical clinics that are exclusively Military Treatment Facilities. Services provided in direct care facilities are free to service members and families. Purchased care includes medical services received at non-military related hospitals or clinics (Office of the Assistant Secretary of Defense for Health Affairs & Activity, 2012). The direct and purchased care claims used in this study included claims for care received in the inpatient, emergency department and ambulatory settings. Soldier characteristics were obtained from the Defense Manpower Data Center. Soldier family information was compiled using personnel and enrollment data.

The necessary permissions to obtain and link these datasets were obtained from the DMDC Data Request Service, TRICARE Management Activity, the Family Advocacy Research Subcommittee, and the U.S. Army Medical Research and Materiel Command, Office of Research Protections, Human Research Protection Office. Strict security requirements set by the U.S. Army and Department of Defense regarding the storage of these data were followed. Data from all sources were linked using unique identifiers common to all datasets, including patient and soldier Social Security number, date of birth, and a Department of Defense unique patient identifier supplied by the Defense Manpower Data Center, also known as an Electronic Data Interchange Person Number.

Population

The study population included U.S. Army dependent children aged 0-17 years old with a diagnosis of child maltreatment in inpatient, emergency department, or outpatient medical claims between 2004 and 2007. Only child dependents of active-duty soldiers with at least three

consecutive years of active service between 2001 and 2007 were included. Children with a diagnosis of child maltreatment were identified based on the presence of International Classification of Diseases, Ninth Revision, Clinical Modification (ICD-9-CM) diagnosis or external cause of injury codes from an inpatient or outpatient encounter for physical abuse (995.54, 995.55 and E967), sexual abuse (995.53), neglect (995.52), emotional abuse (995.51), and unspecified abuse (995.50, 995.59). Children less than 2 years of age with an external cause of injury code for assault (E962, E963, E964, E965, E966, E968.0- E968.3, E968.5-E968.9) were included in the physical abuse group. The assault codes were not used for older children due to concern that some cases may represent peer violence and not child abuse.

Measures

The primary outcome of interest was the percentage of medical encounters with a diagnosis of child maltreatment that had a corresponding substantiated FAP report. Recognizing that children may have multiple medical encounters for the treatment of a single maltreatment event, we created maltreatment episodes (Lestina, Miller, & Smith, 1998; Matone, O'Reilly, Luan, Localio, & Rubin, 2012; Spady, Saunders, Schopflocher, & Svenson, 2004). First, all claims for medical encounters for maltreatment or injury for the same child occurring within 1 day of each other were collapsed. Then all encounters with the same diagnosis or related diagnosis occurring within a 180-day interval were grouped into episodes. For example, a child with an emergency department visit for sexual abuse and multiple follow-up outpatient visits occurring in a 180-day window for management of sexual abuse would be categorized as having a single sexual abuse episode. Similarly, a child with a hospitalization for a fracture and diagnosis of physical abuse and multiple follow-up outpatient visits occurring in a 180-day window for management of that fracture would be categorized as having a single physical abuse

episode. If different diagnosis types occurred within that 180-day window, a new episode was created. All episodes that had at least one mutual diagnosis code and were separated by less than 180 days were collapsed into a single episode, retaining all diagnosis flags. This was done to ensure that maltreatment and injury events requiring multiple follow-up medical visits were counted as a single episode. We then linked each medical maltreatment episode to any substantiated FAP report received within the time period spanning from 1 month prior to the start date of the child maltreatment episode to 1 month after the end date of the child maltreatment episode.

Predictors of interest included child, episode, and soldier characteristics. The child's age at the start of the episode was categorized as 0-2 years, 3-5 years, and 6 years or older. Episode characteristics included the child-episode number (first maltreatment episode versus subsequent additional episodes); treatment facility type (episodes which only included civilian treatment facilities in the first 2 days compared to those that included a military treatment facility); and type of maltreatment. We included treatment facility type, because we hypothesized that the rate of linkage of a medically diagnosed child maltreatment episode to a substantiated FAP report would be lower among children cared for at non-military facilities compared to children cared for at military facilities, because civilian providers are likely less familiar with the FAP system. Type of maltreatment was defined as a hierarchical categorical variable, such that any episode with a sexual abuse ICD-9-CM code was categorized as sexual abuse, any episode with physical abuse ICD-9-CM code without sexual abuse was categorized as physical abuse, and all other episodes without a physical or sexual abuse ICD-9-CM were categorized as neglect/other. Prior research has demonstrated differences in rates of substantiation based on type of child maltreatment (Foster et al., 2010; Travis, Collins, McCarthy, Rabenhorst, & Milner, 2014).

Soldier-level characteristics included gender (male or female), race/ethnicity (white, black, Hispanic, other), education (high school or less, college or more), and rank (enlisted or officer/warrant) and were selected based on prior studies demonstrating racial and socioeconomic disparities in reporting of child abuse by medical providers (Flaherty et al., 2008; Hampton & Newberger, 1985; Lane & Dubowitz, 2007; Lane, Rubin, Monteith, & Christian, 2002).

Analysis

Descriptive analyses reported the distribution of maltreatment episodes by child, episode, and soldier characteristics for those child maltreatment episodes diagnosed in military or civilian medical facilities. Cross-tabulations were used to describe percentages of maltreatment episodes linked to a substantiated FAP report across child, episode, and soldier characteristics. Logistic regression models, clustering at the installation-level (i.e. allowing for correlation between episodes within installations using a robust variance estimator), were used to examine the associations of the predictors with the probability of linking to a FAP report. Simple logistic regression models were used to assess the unadjusted associations of each predictor with the FAP linkage outcome, followed by a multiple logistic regression model to assess their adjusted effects. Further analyses examined whether episode treatment location (military or civilian) modified the linkage results by rank (enlisted or officer/warrant) or maltreatment type (sexual, physical, or neglect/other). A final model explored whether age of the child modified the linkage results by type of maltreatment. Results were expressed as odds ratios and standardized marginal probabilities with confidence intervals.

Approximately 5% of the episodes contained missing data on soldier race/ethnicity and education. We conducted sensitivity analyses that included (with a default category for unknown

status on race or education) and excluded episodes with missing data. The odds ratios were similar in both instances. While we describe characteristics for the entire population, we include only episodes with complete data in the multivariable analyses.

All analyses were performed using Stata 13.1 (StataCorp, College Station, TX, 2012). For the logistic regression models, the cluster option was used to produce the Huber-White robust variance estimator (StataCorp, 2011). IRB approval for the study was granted by The Children's Hospital of Philadelphia Institutional Review Board and the U.S. Army Medical Research and Materiel Command, Office of Research Protections, Human Research Protection Office.

Results

Study Population Characteristics

Among the 150,690 soldiers with 211,183 dependent children, 4,136 soldiers were parents for 5,109 children who received at least one medical diagnosis of child maltreatment. This equated to 2.7% of soldiers with dependents for whom a child maltreatment diagnosis was identified. Among the 5,109 child victims, there were 5,945 medically diagnosed child maltreatment episodes. The majority of these episodes (58.7%) occurred when children were 6 years of age or older (Table 1). For approximately one-quarter of episodes (23.4%), treatment within the first 2 days was at a civilian treatment center. Sexual abuse occurred among slightly over one-quarter of episodes (27.8%). The majority of maltreatment episodes included children of soldiers who were male (84.8%), white (54.9%), of enlisted rank (93.4%), or with high school or less education (78.9%).

Linkage of Medically Diagnosed Child Maltreatment Episodes to Substantiated FAP Reports

Overall, 20.3% of the 5,945 maltreatment episodes diagnosed by a medical professional were linked to a corresponding substantiated FAP report. Linkage was poor across all characteristics and ranged from 9.8% for episodes of children observed at a civilian treatment facility to 24.2% for episodes at military treatment facilities (Table 2). At a child-level (as opposed to an episode-level), among the 5,109 children with at least one medically diagnosed child maltreatment episode, 20.8% had a substantiated FAP report at any time during the study period.

Unadjusted Associations of Child, Episode, and Soldier Characteristics with Linkage to a Substantiated Report

Approximately one-quarter (25.5%) of maltreatment episodes involving children of female soldiers were linked to a substantiated FAP report compared to 19.4% of episodes involving children of male soldiers. Similarly, 20.7% of episodes of children of lower-ranked (enlisted) soldiers were linked to a FAP report compared to 15.5% of episodes of children of soldiers of a higher rank (officer or warrant). Unadjusted analyses showed no significant associations for child age ($p=0.60$) and number of abuse episodes ($p=0.74$) with odds of linkage to a substantiated FAP report. There were significant associations for the other six covariates: treatment facility ($p<0.01$), maltreatment type ($p<0.01$), soldier gender ($p=0.02$), soldier race and ethnicity ($p<0.01$), soldier education ($p<0.01$), and soldier rank ($p<0.01$). The direction of the effects in unadjusted analyses was consistent with those shown in Table 2.

Adjusted Associations of Child, Episode, and Soldier Characteristics with Linkage to a Substantiated Report

Adjusting for child, soldier, and episode characteristics, the likelihood of substantiation continued to be associated with installation type, maltreatment type, soldier education level, and race/ethnicity (Table 2). The predicted (and standardized) probability of linkage between a maltreatment episode and a FAP report remained lower if treatment in the first 2 days occurred in a civilian treatment facility (9.8% in civilian facilities versus 23.6% in military facilities, $p < 0.01$). The predicted probability of linkage to a FAP report was also greater for physical abuse than for sexual abuse episodes, with a probability of 25.8% for physical abuse episodes versus 14.5% for sexual abuse episodes ($p < 0.01$). Linkage to a FAP report was more likely in episodes involving children with a black soldier parent, and in episodes where the soldier had less than college education, although with smaller marginal differences than those for installation type and maltreatment type. The adjusted effects for soldier rank and gender were not significant.

Additional analyses revealed a significant interaction between type of facility in which the initial maltreatment diagnosis occurred (military or civilian) and maltreatment type ($p < 0.001$) (Figure 1). While linkage of all types of maltreatment was higher in the military treatment facilities than in the civilian treatment facilities (OR = 2.92), the difference was greater for sexual abuse and for neglect/other maltreatment than for physical abuse (OR 3.21 for sexual abuse, OR 3.63 for neglect/other maltreatment and OR 2.51 for physical abuse). The point estimates and p-values for the other covariates remained unchanged with the addition of the interaction term to the regression model. In subsequent analyses, no clinically significant interactions were detected between treatment location and rank or between maltreatment type and age.

Discussion

Between 2004 and 2007 in a population of U.S. Army dependent children, only 20% of children with medical diagnoses of child maltreatment had a corresponding substantiated report to FAP, the U.S. Army agency responsible for investigation and treatment of child maltreatment. In contrast, a study linking maltreatment diagnoses to substantiated civilian CPS agency reports observed a 44% linkage rate, a rate more than double the rate we observed (Schnitzer et al., 2004). One possible explanation for our low linkage rate is that only 20% of medically diagnosed child maltreatment episodes reported to FAP were substantiated; however, the substantiation rate for child maltreatment reports to FAP from all sources during this time period, was, on average, 45% (U.S. Department of Defense, 2015). Thus, it is unlikely that the observed 20% linkage rate can be solely attributed to reports not being substantiated by FAP. This raises concern that medically diagnosed cases of maltreatment among child dependents of U.S. soldiers were not consistently reported to FAP. If one assumes, based on the overall FAP substantiation rate, that 45% of FAP reports for medically diagnosed child maltreatment episodes were substantiated, then our linkage rate of 20% suggests that only 44% of medically diagnosed child maltreatment episodes were reported to FAP. In comparison, a non-military study found that a report was made to CPS agencies in over 90% of cases of children assigned maltreatment diagnoses (Schnitzer et al., 2004).

Reporting of cases of child maltreatment to the FAP allows for initiation of military-specific services to the children and families in need, including counseling, case management, and other services as well as ongoing safety monitoring. Thus, the finding that the majority of Army children with medically diagnosed child maltreatment do not have an associated substantiated U.S. Army FAP report raises concern that children and families in need may not be

benefiting from FAP services. Furthermore, our findings raise concern that current estimates of child maltreatment among children of soldiers based on FAP data, may be under-estimating the true magnitude of this issue.

In addition we observed differences in rates of linkage based on source of care, soldier demographic characteristics, and type of child maltreatment. The finding of lower linkage rates among children treated at civilian medical facilities is not unexpected, as civilian medical providers may be unfamiliar with FAP and, thus, less likely than military medical providers to make a report directly to FAP. A study of over 30,000 reports of suspected child maltreatment to the U.S. Airforce FAP found that nearly 13% of reports were from military medical personnel while less than 1% were from civilian medical personnel (Foster et al., 2010). It is likely that reports of child maltreatment to the U.S. Army FAP from civilian medical personnel are similarly rare.

Race and soldier rank were also associated with linkage, such that maltreatment episodes involving child dependents of black soldiers and soldiers with less than college education had higher rates of linkage of maltreatment diagnoses to substantiated FAP reports. These differences in linkage by soldier characteristics may be reflective of the previously described racial and socioeconomic disparities in reporting of child maltreatment by medical providers (Hampton & Newberger, 1985; Lane & Dubowitz, 2007; Lane et al., 2002). These results should be interpreted with caution, however, as we were unable to determine whether they are due to differences in reporting or substantiation. Furthermore, we were unable to measure or adjust for maltreatment severity and other maltreatment characteristics that may have impacted reporting and substantiation decisions.

The reason behind our finding of lower linkage rates for sexual abuse and, in particular, sexual abuse treated at civilian facilities in our study is unclear. One possibility is that similar percentages of sexual abuse and physical abuse diagnoses were reported to FAP but differences in rates of subsequent substantiation led to the lower rates of linkage of sexual abuse diagnoses to substantiated FAP reports. Two studies in the U.S. Air Force, however, found that, overall, a higher percentage of reports made to FAP for concerns of sexual abuse were substantiated compared to reports made due to concerns of physical abuse (Foster et al., 2010; Travis et al., 2014). Therefore, these studies suggest that the lower linkage rate observed for sexual abuse in our study is unlikely to be due to lower sexual abuse substantiation rates. Another possible explanation is that unmeasured differences in care settings and medical provider characteristics led to differential rates of reporting to FAP by type of maltreatment.

There are several limitations to this analysis. First, the high specificity of abuse ICD-9-CM codes does not preclude a misclassification of an accidental injury as abuse (Berger et al., 2013; A. Hooft, Ronda, Schaeffer, Asnes, & Leventhal, 2013), but the extent of this misclassification is unlikely to substantially change our results. Second, although we identified a lapse in linkage of high-risk children to FAP, we are unable to identify the nature of the gap. As discussed, unsubstantiated reports to FAP were not available; thus we could not determine the proportion of episodes that were reported but not substantiated. Furthermore, it is possible that some of the unlinked cases were reported to civilian CPS but not to FAP. This would be consistent with the lower linkage rates observed from civilian treatment facilities. Further research incorporating unsubstantiated FAP reports and civilian CPS data is needed to elucidate the nature of the identified gap in linkage to FAP reports. Third, the dataset, although large, spans a period of time from 2004 to 2007, raising the question of generalizability to current time

periods. The time period of this study reflected an Army interest in understanding reporting trends across deployments during a period of significant operational tempo in international conflict for the U.S. Army, findings that have been reported previously (XXXX, XXXX). However, while there has been some standardization in substantiation protocols, there have been no systematic changes in FAP reporting requirements since the time period of this study. Fourth, our algorithm for collapsing multiple similar child maltreatment medical claims occurring within a 180-day timeframe into a single child maltreatment episode may be overly conservative. This may have resulted in an overestimation of the linkage rate. Fifth, as our study focused on child dependents of U.S. Army service members, the generalizability of our findings to other branches of the military is unknown. Finally, medical diagnoses of maltreatment represent a minority of child maltreatment victims, so our results may not be generalizable to all children who are maltreated within the U.S. Army. Nevertheless, the low rate of linkage to substantiated FAP reports in these most serious cases raises concern for the possibility of similar gaps in reporting and substantiation from other mandated reporters.

Despite these limitations, the low rates of linkage of medical diagnoses of child maltreatment to substantiated FAP reports revealed by this study indicate the need for evaluation of reporting practices across the U.S. Army in more recent years. The nature of under-reporting to FAP may be due to medical providers not consistently reporting these children to FAP, as well as civilian CPS agencies inconsistently sharing information with FAP on reports they receive involving military dependents. Further study will be needed to identify and understand the facilitators and barriers to successful reporting and communication across agencies in order to develop programs and policies that improve reporting of child maltreatment to FAP and better support children and families.

References

- The Army Family Advocacy Program, Rapid Action Revision, Army Regulation 608-18 C.F.R. (2011).
- Berger, R. P., Parks, S., Fromkin, J., Rubin, P., & Pecora, P. J. (2013). Assessing the accuracy of the International Classification of Diseases codes to identify abusive head trauma: a feasibility study. *Inj Prev*. doi: 10.1136/injuryprev-2013-040924
- Flaherty, E. G., Sege, R. D., Griffith, J., Price, L. L., Wasserman, R., Slora, E., . . . Binns, H. J. (2008). From suspicion of physical child abuse to reporting: primary care clinician decision-making. *Pediatrics*, 122(3), 611-619. doi: peds.2007-2311 [pii] 10.1542/peds.2007-2311
- Foster, R. E., Stone, F. P., Linkh, D. J., Besetsny, L. K., Collins, P. S., Saha, T., . . . Milner, J. S. (2010). Substantiation of Spouse and Child Maltreatment Reports as a Function of Referral Source and Maltreatment Type. *Military Medicine*, 175(8), 560-566.
- Gibbs, D. A., Martin, S. L., Kupper, L. L., & Johnson, R. E. (2007). Child maltreatment in enlisted soldiers' families during combat-related deployments. *JAMA*, 298(5), 528-535. doi: 10.1001/jama.298.5.528
- Gilbert, R., Kemp, A., Thoburn, J., Sidebotham, P., Radford, L., Glaser, D., & Macmillan, H. L. (2009). Recognising and responding to child maltreatment. *Lancet*, 373(9658), 167-180. doi: S0140-6736(08)61707-9 [pii] 10.1016/S0140-6736(08)61707-9
- Gumbs, G. R., Keenan, H. T., Seveck, C. J., Conlin, A. M., Lloyd, D. W., Runyan, D. K., . . . Smith, T. C. (2013). Infant abusive head trauma in a military cohort. *Pediatrics*, 132(4), 668-676. doi: 10.1542/peds.2013-0168
- Hampton, R. L., & Newberger, E. H. (1985). Child abuse incidence and reporting by hospitals: significance of severity, class, and race. *American Journal of Public Health*, 75(1), 56-60.
- Hooft, A., Ronda, J., Schaeffer, P., Asnes, A. G., & Leventhal, J. M. (2013). Identification of physical abuse cases in hospitalized children: accuracy of international classification of diseases codes. *The Journal of pediatrics*, 162(1), 80-85.
- Hooft, A. M., Asnes, A. G., Livingston, N., Deutsch, S., Cahill, L., Wood, J. N., & Leventhal, J. M. (2015). The Accuracy of ICD Codes: Identifying Physical Abuse in 4 Children's Hospitals. *Academic Pediatrics*, 15(4), 444-450. doi: 10.1016/j.acap.2015.01.008
- Jenny, C., Hymel, K. P., Ritzen, A., Reinert, S. E., & Hay, T. C. (1999). Analysis of missed cases of abusive head trauma. *JAMA*, 281(7), 621-626. doi: joc80101 [pii]
- King, A. J., Farst, K. J., Jaeger, M. W., Onukwube, J. I., & Robbins, J. M. (2015). Maltreatment-Related Emergency Department Visits Among Children 0 to 3 Years Old in the United States. *Child Maltreat*, 20(3), 151-161. doi: 10.1177/1077559514567176
- Lane, W. G., & Dubowitz, H. (2007). What factors affect the identification and reporting of child abuse-related fractures? *Clin Orthop Relat Res*, 461, 219-225. doi: 10.1097/BLO.0b013e31805c0849
- Lane, W. G., Rubin, D. M., Monteith, R., & Christian, C. W. (2002). Racial differences in the evaluation of pediatric fractures for physical abuse. *JAMA*, 288(13), 1603-1609.
- Lestina, D. C., Miller, T. R., & Smith, G. S. (1998). Creating injury episodes using medical claims data. *J Trauma*, 45(3), 565-569.
- Leventhal, J. M., Martin, K. D., & Gaither, J. R. (2012). Using US data to estimate the incidence of serious physical abuse in children. *Pediatrics*, 129(3), 458-464. doi: 10.1542/peds.2011-1277

- Matone, M., O'Reilly, A. L., Luan, X., Localio, A. R., & Rubin, D. M. (2012). Emergency department visits and hospitalizations for injuries among infants and children following statewide implementation of a home visitation model. *Matern Child Health J*, 16(9), 1754-1761. doi: 10.1007/s10995-011-0921-7
- McCarroll, J. E., Ursano, R. J., Fan, Z., & Newby, J. H. (2004). Comparison of U.S. Army and civilian substantiated reports of child maltreatment. *Child Maltreat*, 9(1), 103-110. doi: 10.1177/1077559503261262
- Office of the Assistant Secretary of Defense for Health Affairs, & Activity, T. M. (2012). Guide for DoD Researchers on Using MHS Data. Retrieved 6/10/2016, 2016, from <http://health.mil/Search-Results?query=guide%20for%20DoD%20researchers>
- Oral, R., Blum, K. L., & Johnson, C. (2003). Fractures in young children: are physicians in the emergency department and orthopedic clinics adequately screening for possible abuse? *Pediatr Emerg Care*, 19(3), 148-153. doi: 10.1097/01.pec.0000081234.20228.33
- Ravichandiran, N., Schuh, S., Bejuk, M., Al-Harthi, N., Shouldice, M., Au, H., & Boutis, K. (2010). Delayed identification of pediatric abuse-related fractures. *Pediatrics*, 125(1), 60-66. doi: peds.2008-3794 [pii] 10.1542/peds.2008-3794
- Rentz, E. D., Marshall, S. W., Loomis, D., Casteel, C., Martin, S. L., & Gibbs, D. A. (2007). Effect of deployment on the occurrence of child maltreatment in military and nonmilitary families. *Am J Epidemiol*, 165(10), 1199-1206. doi: 10.1093/aje/kwm008
- Rentz, E. D., Martin, S. L., Gibbs, D. A., Clinton-Sherrod, M., Hardison, J., & Marshall, S. W. (2006). Family Violence in the Military: A Review of the Literature. *Trauma, Violence, & Abuse*, 7(2), 93-108. doi: 10.1177/1524838005285916
- Schnitzer, P. G., Slusher, P., & Van Tuinen, M. (2004). Child maltreatment in Missouri: combining data for public health surveillance. *Am J Prev Med*, 27(5), 379-384. doi: S0749-3797(04)00203-X [pii] 10.1016/j.amepre.2004.08.007
- Sedlak, A., Mettenburg, J., Basena, M., Petta, I., McPherson, K., Greene, A., & Li, S. (2010). Fourth national incidence study of child abuse and neglect (NIS-4): report to congress. Washington, D.C.: U.S. Department of Health and Human Services.
- Spady, D. W., Saunders, D. L., Schopflocher, D. P., & Svenson, L. W. (2004). Patterns of injury in children: a population-based approach. *Pediatrics*, 113(3 Pt 1), 522-529.
- StataCorp. (2011). Robust variance estimates *Stata Programming Reference Manual, Release 12*. College Station, Texas: A Stata Press Publication.
- Taitz, J., Moran, K., & O'Meara, M. (2004). Long bone fractures in children under 3 years of age: Is abuse being missed in Emergency Department presentations? *Journal of Paediatrics and Child Health*, 40(4), 170-174. doi: 10.1111/j.1440-1754.2004.00332.x
- Taylor, C. M., Ross, M. E., Wood, J. N., Griffis, H. M., Harb, G. C., Mi, L., . . . Rubin, D. M. (2016). Differential Child Maltreatment Risk Across Deployment Periods of US Army Soldiers. *Am J Public Health*, 106(1), 153-158. doi: 10.2105/AJPH.2015.302874
- Thorpe, E. L., Zuckerbraun, N. S., Wolford, J. E., & Berger, R. P. (2014). Missed opportunities to diagnose child physical abuse. *Pediatr Emerg Care*, 30(11), 771-776. doi: 10.1097/PEC.0000000000000257
- Travis, W. J., Collins, P. S., McCarthy, R. J., Rabenhorst, M. M., & Milner, J. S. (2014). Characteristics associated with incidents of family maltreatment among United States Air Force families. *Mil Med*, 179(11), 1244-1249. doi: 10.7205/milmed-d-13-00544
- U.S. Department of Defense, Office of the Assistant Secretary of Defense for Health Affairs. (2015). *Department of Defense Family Advocacy Program Child Abuse/Neglect and*

- Domestic Abuse Data Trends from FY03 to FY14*. Washington, DC: Retrieved from http://download.militaryonesource.mil/12038/MOS/Reports/FAP_FY14_Report.pdf.
- U.S. Department of Health and Human Services, Administration for Children and Families, Administration on Children, Youth and Families, Children's Bureau. (2015). *Child Maltreatment 2013*. Washington, D.C.: Retrieved from <http://www.acf.hhs.gov/programs/cb/research-data-technology/statistics-research/child-maltreatment>.
- United States Department of Army. (1995). *The Army Family Advocacy Program* Washington, DC.
- Winn, D. G., Agran, P. F., & Anderson, C. L. (1995). Sensitivity of hospitals' E-coded data in identifying causes of children's violence-related injuries. *Public Health Rep*, 110(3), 277-281.

Table 1

Maltreatment episodes identified within military and civilian treatment facilities for dependents of U.S. Army soldiers between 2004 and 2007^a

Characteristics	All % (n=5945)	Military Facility (n=4554, 76.6%)	Civilian Facility (n=1391, 23.4%)
<i>Child</i>			
Age at start of episode			
0 to 2	18.3	18.2	18.7
3 to 5	23.0	22.8	23.6
6+	58.7	59.0	57.7
<i>Maltreatment Episode</i>			
Episode number			
1	85.9	86.1	85.3
2+	14.1	13.9	14.7
Treatment facility			
Military	73.3	--	--
Civilian only	26.7	--	--
Maltreatment type			
Sexual	27.8	21.0	50.0
Physical	32.5	34.0	27.8
Neglect/other ^c	39.7	45.0	22.2
<i>Soldier^b</i>			
Gender			
Female	15.2	16.6	10.5
Male	84.8	83.4	89.5
Race/ethnicity			
White	54.9	53.3	59.8
Black	28.4	30.0	23.4
Hispanic	9.3	9.6	8.5
Other	3.4	3.3	3.9
Unknown	4.0	3.8	4.4
Education			
High school or less	78.9	79.2	77.7
College plus	16.6	16.4	17.5
Unknown	4.5	4.4	4.7
Rank			
Enlisted	93.4	93.8	91.2
Officer/warrant	6.6	6.2	8.1

Note. ^a Episodes were coded as military facility if any military treatment facility was involved in first 2 days of a maltreatment episode; otherwise, episodes were coded as civilian facility. ^b The characteristics of the soldier parent of the child victim are presented and do not necessarily reflect the characteristics of the perpetrator as the perpetrator may not have been the soldier. ^c Child maltreatment episodes with a diagnosis code for neglect, emotional abuse or unspecified maltreatment were categorized as neglect/other.

Table 2

Unadjusted and adjusted association of child, episode, and soldier characteristics with child maltreatment episodes linked to substantiated U.S. Army Family Advocacy Program (FAP) reports^b

Characteristics	Bivariate % FAP Linked ^a	Adjusted % FAP Linked ^b (95% CI)	Adjusted OR ^b (95% CI)	P-value
<i>Child</i>				
Age at start of episode				
0 to 2	18.6	17.5 (14.2, 20.7)	--	
3 to 5	20.7	21.9 (18.7, 25.1)	1.34 (0.98, 1.82)	0.06
6+	20.7	21.3 (18.9, 24.0)	1.29 (0.97, 1.72)	0.08
<i>Maltreatment Episode</i>				
Episode number				
1	20.7	20.6 (18.8, 22.5)	--	
2+	20.9	21.1 (15.0, 27.2)	1.03 (0.74, 1.44)	0.86
Treatment facility				
Military	24.2	23.6 (20.8, 26.4)	--	
Civilian only	9.8	9.8 (7.3, 12.2)	0.34 (0.25, 0.48)	<0.01
Maltreatment type				
Sexual	12.6	14.5 (11.2, 17.9)	--	
Physical	26.4	25.8 (23.4, 28.3)	2.10 (1.56, 2.82)	<0.01
Neglect/other ^c	20.8	20.3 (16.7, 23.8)	1.51 (1.12, 2.04)	0.01
<i>Soldier^d</i>				
Gender				
Female	25.5	24.2 (19.2, 29.2)	--	
Male	19.4	20.0 (17.7, 22.4)	0.78 (0.58, 1.06)	0.11
Race/ethnicity				
White	18.7	19.6 (17.3, 21.9)	--	

	Black	25.1	23.5 (20.2, 26.8)	1.27 (1.07, 1.51)	0.01
	Hispanic	19.8	19.3 (15.2, 23.4)	0.98 (0.75, 1.28)	0.88
	Other	17.2	17.2 (10.2, 24.2)	0.84 (0.50, 1.43)	0.53
Education					
	High school or less	21.2	21.5 (19.2, 23.9)	--	
	College plus	16.1	16.7 (13.3, 20.0)	0.72 (0.56, 0.92)	0.01
Rank					
	Enlisted	20.7	20.7 (18.5, 23.0)	--	
	Officer/warrant	15.5	20.4 (14.9, 25.9)	0.98 (0.68, 1.41)	0.91

Note. ^a Results presented from unadjusted bivariate analysis. ^b Adjusted models employed

logistic regression, clustered by installation. ^c Child maltreatment episodes with a diagnosis code for emotional abuse, neglect or unspecified maltreatment were categorized as neglect/other.

^d The characteristics of the soldier parent of the child victim are presented and do not necessarily reflect the characteristics of the perpetrator as the perpetrator may not have been the soldier.