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Abstract

Soldiers deployed to unstable areas suffer increased risk of developing mental disorders, and children of the deployed also face increased risk of behavioral problems. While many studies have documented associations between parental deployment and child mental health, none have identified the causal effect of individual's exposure to combat while deployed. For Denmark, which deployed 9,000 soldiers for peace-enforcing missions in Afghanistan and Iraq, we have research access to confidential mission reports detailing individual soldier combat exposure. Linking these soldiers with their teenage children (at the end of compulsory schooling) and exploiting that combat exposure among the deployed is as good as random, we estimate the effect of fathers' combat exposure on their children's test scores. To disentangle the effect of father's absences from other mechanisms, we explore the impact of combat exposure on the soldier's mental health and how father's combat exposure may affect other family members. The results—robust to several falsification tests—show that children of exposed fathers have lower test scores than children of deployed fathers not exposed to combat (an effect size of 0.13 standard deviation). Moreover, we find that combat exposure affects not only the father's mental health (substance abuse diagnosis), but also that of the mother and children (higher use of mental health services and antidepressants).

JEL Classification: I12, I19, I29, J13

Keywords: Military deployment, Children, Mental health, test scores.

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1 Introduction

The question as to whether children can be affected by the traumatization of their parents has long been debated. The evidence suggests that traumatization can cause parenting limitations that can disrupt a young child's development (van Ee et al., 2016). Moreover, children's mental health is an important factor in educational and labor market outcomes (Currie, 2009; Currie and Stabile, 2006; Lundborg et al., 2014), and parental psychopathology has consistently been associated with negative child outcomes (Manning and Gregoire, 2006). While the magnitude of correlations between parental health and child can easily be computed, identifying the causal impact of parental health, particularly the causal impact of mental health problems, is more challenging.

One area in which causality can be studied—given the right data—is military deployment to conflict areas. During the last three decades, millions of military personnel and soldiers were deployed on international missions to conflict areas throughout the world. Many with children were deployed multiple times as a result of the Global War on Terrorism (GWOT). Soldiers deployed to these unstable areas suffer increased risk of developing mental disorders. Since the Vietnam War, professionals have recognized that children of the deployed also face increased risk of behavioral problems (White et al., 2011). While many studies have documented associations between parental deployment and children's mental health, none have identified the causal effect of exposure to combat during deployment. These children might be affected by parental deployment not only when the parent is absent but also several years later in terms of family relationships or parental mental health (Lester and Flake, 2013).

While the literature on the impact of deployment on families has focused mainly on soldiers' subsequent health and earnings, much less is known about the impact on children's outcomes, and nothing is known about whether parental deployment per se, or combat exposure while deployed, affects children's outcomes. To understand the relationship between traumatized parents and their non-exposed children, we investigate the impact of fathers' combat exposure during deployment on their children's educational and mental health outcomes. Using special events recorded in Danish military communications, we can identify the causal effect of combat exposure on these families though the unique opportunity to follow fathers and their families in Denmark after one or several potentially traumatizing events occurring during deployment.

In Denmark—both a member of NATO and the country with the most casualties per capita in the

International Security Assistance Force in Afghanistan—about 14 percent of soldiers had one child when they began their first mission and on average two children at the end (Lyk-Jensen and Pedersen, 2019). For comparison, the U.S. Department of Defense (2010) shows that roughly 40 percent of active duty and reserve members have children (two on average). In 2003-2012 Denmark deployed 9,000 soldiers for 21 peace-enforcing missions in Afghanistan and Iraq. As we have research access to confidential mission reports detailing individual soldier combat exposure, ours is the first study to establish the causal impact of individual father's combat exposure on children's test scores and mental health.

Part of the GWOT, both the Iraq and Afghanistan missions are characterized as "diffuse wars," where the threats are diffuse and involve asymmetric warfare, with enemies of inferior strength using remotely detonated improvised explosive devices (IEDs) (Buffaloe, 2006; Wallace, 2009). Consequently, predicting the probability of the soldiers' being involved in an exchange of shots or rocket attacks, along with the intensity of this exposure, is extremely difficult. As our results confirm, all of these factors make the risk of exposure to intense combat (i.e., ambush, IED, or exchange of fire) as good as randomly distributed within and between units.

Thus we can credibly estimate the causal effect of a father's exposure to combat on his children's test scores and mental health behavior. To disentangle the parental absence effect due to deployment from other mechanisms, we explore the impact of combat exposure on the soldier's own mental health and how it may affect the mental health of the mothers, the children, or both. We exploit Danish registers linking family members and providing information about scores in national end-of-compulsory-schooling exams, the use of mental health services (e.g., hospitalizations, contact with psychologists or psychiatrists), mental health diagnoses, purchase of mental health medicine, suicide attempts, and early death. In Denmark, soldiers and their families are treated in the same hospitals as civilians and have access to the same general practitioners (GPs) and specialists. Moreover, as access to a GP is free and prescription drugs are heavily subsidized, Denmark constitutes a valuable case study.

Our results show that teenage children (at the end of compulsory schooling, age 15/16) of such fathers have lower test scores than children of deployed fathers not exposed to combat (an effect size of 0.13 standard deviations). Moreover, in a placebo analysis, we find that combat exposure only affects children's tests scores if exposure occurs before, not after, the test. In addition, we show no effect for classmates taking the same 9th grade test as the child of a deployed father.

Looking for response heterogeneity, we investigate a number of possible channels through which effects may operate, such as the sex of the child, and whether any effects depend on the level of combat exposure or vary with child age at first exposure or deployment. We find no difference by sex of the child, and the first event exposure matters more than many event exposure. Selection is likely to explain why first combat exposure matters more, as it may have caused the father to leave the military soon afterwards, before he could experience another such event. The size of the effect slightly varies with child age with larger effect close to test age (15). By investigating whether lower test scores coincide with mental health problems for the exposed father and his close family, we find that combat exposure affects not only the father's mental health (e.g., substance abuse diagnosis), but also that of the mother and children (higher use of mental health services and antidepressants).

Our study adds to the small literature that exploits natural experiments to estimate the impact of deployment (Cesur et al., 2013; Engel et al., 2010; Lyle, 2006). While most such studies focus on the deployment effect on soldiers' mental health (e.g., Cesur et al., 2013; Lyk-Jensen et al., 2016), few investigate the impact on their children (Engel et al., 2010; Lyle, 2006) or partner (Cesur and Sabia, 2016)—and those that do mostly look at correlations (e.g., Mansfield et al., 2011).[1]

We combine insights from several studies to contribute to scholarly knowledge on the impact of father's combat exposure on children's outcomes. Richardson et al. (2011), who studied the association between parental deployment and student achievement scores and behavioral health outcomes among children in North Carolina and Washington in 2002-2008, show slightly lower achievement scores for those whose parents deployed for more than 19 months than those whose parents deployed less or not at all. They find no significant effects for the number of deployments, by rank or seniority of the soldier. In a retrospective study on mental health diagnoses for veterans' children, Mansfield et al. (2011) find a dose-response pattern between parental deployment and increased mental health diagnoses in military children of all ages. Engel et al. (2010) and Lyle (2006), exploiting the exogeneity of parental deployment to the child's academic achievement, find modest adverse effects of deployment on test scores. Forrest et al. (2018), using a retrospective survey to compare children of veterans with children of non-veterans, study the intergenerational consequences of war among

[1] Angrist and Johnson IV (2000) found that absences due to Gulf War deployments had an impact on marital dissolution and spousal labor supply but no effect on child disability rate. They measured the child disability through the following question: "Are any of your dependents physically, emotionally, or intellectually handicapped, requiring specialized treatment or care?" Respondents replied either "yes, permanently," "yes, temporarily," or "no." In this framework, it is difficult to conclude whether the child's condition was a direct consequence of parent deployment.

the children of Australian Vietnam war veterans. They find significant enduring adverse effects of parental deployment on the mental health of children in military families.

Thus, while most studies investigating the impact of deployment on children show associations between parental deployment and child mental health, our study is the first to identify the causal effect of exposure to combat during deployment and its consequences for children's outcomes. Other studies were conducted with relatively small samples or research designs, with many relying solely on surveys of parents—none of which can demonstrate causality.

Our study exploits a natural experiment as-good-as-randomly assigning fathers to potential traumatizing events that are likely to affect their own mental health and that of their close family members. In so doing, we make three important contributions to the literature. The first is that, in modern war, we find combat exposure to be distributed as good as randomly among the deployed, meaning that our estimates are, methodologically speaking, obtained in the cleanest possible way. Second, we provide rare evidence of the causal effect of father's exposure to combat on children's outcomes. Third, as we follow families from the first potentially traumatizing event, we can study the mechanisms at play and contribute to the literature on growing up with a mentally ill parent. Taken together, our results have several important implications not only for military families but also, and most importantly, for understanding channels affecting children's mental health in general, and the relationship between traumatized parents and their non-exposed to trauma children in particular.

The paper proceeds as follows. Section 2 explains the institutional setting and access to health care in Denmark. Section 3 describes the data we use, and Section 4 presents our empirical approach. Section 5 presents our results, and Section 6 concludes.

2 Institutional setting and access to health care in Denmark

The Danish military system is characterized by two pillars: limited conscription and deployable professionals (Heurlin, 2006). Thus, the deployed soldiers are either from the Army Reaction Forces Training (Hærens Reaktionsstyrke Uddannelse, HRU), or from Army Standing Reaction Force (Haerens Staaende ReaktionsStyrke, SRS). HRU personnel are usually volunteers with short-terms contracts, while SRS soldiers are professionals with long-term contracts covering a full career (see Lyk-Jensen and Pedersen, 2019 for further details).[2] In contrast to soldiers in many other NATO countries, a

[2]Some HRU personnel are deployed during their gap year (Lyk-Jensen and Glad, 2018).

large number of Danish soldiers—especially the HRU soldiers—leave the military after one or two deployments. On average the Danish soldiers are deployed for a six-month period.

Although the Danish military has its own medical system, "Military Health System" (MHS), it is not an alternative to the civilian National Health Service (NHS). While the MHS mainly ensures that soldiers are fit for deployment and provides within-deployment medical support, only the NHS provides access to hospital treatment. As mentioned earlier, soldiers and their family members are treated in the same hospitals as civilians and have access to the same GPs and specialists.[3] Soldiers can be formally recorded as having a psychiatric diagnosis either as acute emergency cases or through contacts with hospitals (either admissions or day patients) via prescriptions from GPs, specialists, or military doctors. Moreover, all people living in Denmark have access to a GP, with expenses covered by the NHS. Given this free access to GPs and high subsidies for prescription drugs, Denmark constitutes an excellent case study for our purposes.

3 Empirical approach

In this paper, we exploit a natural experiment randomly assigning fathers to potential traumatizing events that are likely to affect their own mental health and possibly that of their close family members. We exploit the fact that combat exposure among the deployed soldiers is as good as random.

As previously mentioned, both the Iraq and Afghanistan missions are part of the GWOT and characterized as both "diffuse wars" (with the enemy often hidden among civilians and the threats diffuse) and an asymmetric warfare (with enemies of inferior strength using remotely detonated improvised explosive devices [IEDs], roadside bombs, and mines) (Buffaloe, 2006; Wallace, 2009). Therefore, predicting the probability of the soldiers' being involved in an exchange of shots or rocket attacks, along with the intensity of this exposure, is extremely difficult. All of these factors make the risk of exposure to intense combat (i.e., ambush, IED, or exchange of fire) as good as randomly distributed within and between units. Thus we can credibly estimate the causal effect of having a father exposed to combat on his children's test scores and mental health behavior.

To make sure that combat exposure among the deployed soldiers is as good as random, we conduct a balancing test explaining combat exposure (1/0) by soldiers pre-deployment characteristics such as

[3] The MHS also offers free psychological help from military psychologists or private psychologists, even after the soldier has left the military. However, military psychologists cannot prescribe medicine, nor can they refer soldiers to psychiatric hospitals.

year of birth, family background (e.g., parental education, and family income), conditional on their military characteristics (rank at first mission, the specific mission, and the type of unit).

We start by investigating the effect of the father's combat exposure on their children's tests scores for 9th grade. To measure the effect of the father's combat exposure on their children's test scores, we estimate the following equation:

$$y_i = \pi_0 + \pi_1 FATHERCOMBAT_i + \pi_2 X_i + \upsilon_i,$$

where y_i is the test score of the child i, $FATHERCOMBAT$ is a dummy indicating whether the father of child i is exposed to combat, and X is a set of control variables for child's family background. If combat exposure is random, we can directly estimate this equation with an OLS and clustering at the father's level.

As a placebo analysis, we compare the effect of combat exposure occurring up to the date of the child's test and combat exposure occurring after that test. Moreover, we investigate possible mechanisms through fathers', mothers', and children's mental health.

4 Data

We have access to administrative records from the Danish Ministry of Defense for all soldiers deployed on all 21 peace-enforcing missions in Afghanistan and Iraq during 2003-2012—about 12,000 deployments and 9,000 deployed soldiers. Our military register dataset contains individual information on the soldier's rank, type of unit, number of missions, mission place, mission dates, and mission types. Moreover, we have access to individual combat exposure for these 21 peace-enforcing missions in Afghanistan and Iraq in the same period.

Thanks to the unique Danish civil registration number for each individual in Denmark, military records are linked to other Statistics Denmark administrative registers containing information on family relationships, demographic characteristics (including education outcomes), and mental health outcomes.

4.1 Test scores and mental health measures

We have access to test scores from the spring of the final year of lower secondary school (9th grade, age 15). The test in Danish language skills consists of both an oral and a written test. The test in math consists of a written test and possibly an oral test (determined by lottery). The test scores we observe are the averages of the two subject-specific scores. We have the test scores in Danish (reading) and math for children born 1986-2004. We standardize these tests by year and subject (mean equal to zero and standard deviation equal to one).

As in Lyk-Jensen and Pedersen (2019) and Lyk-Jensen et al. (2016), we use objective measures for mental health. To measure the utilization of mental health services among soldiers and their family members, we use the Danish Psychiatric Central Research Register (Munk-Jørgensen and Mortensen, 1997; Mors et al., 2011). This administrative register also contains information about the type of diagnoses.

In addition, we use the Danish National Health Service Register (Schmidt et al., 2015), which provides information on health insurance subsidized treatment from psychiatrists and psychologists including children psychiatrists(Olivarius et al., 1997; Sahl Andersen et al., 2011), and the Danish national patient register for both somatic disease (Lynge et al., 2011) and specific diagnoses such as maltreatment or accidents.[4]

To examine the individual's purchase of mental health medication (MHM), as another indicator of psychological problems, we use data from the Danish National Prescription Registry (Lægemiddel-databasen), which classifies prescription medicine according to the Anatomical Therapeutic Chemical Classification (ATC) system. It contains data on redeemed drug prescriptions in Denmark from 1995 (Wallach Kildemoes et al., 2011).[5] We identified redeemed prescriptions for the following ATC-coded drug classes: antipsychotics (N05A), anxiolytics (N05B), hypnotics and sedatives (N05C), antidepressants (N06A), and psychostimulants (N06B). In the analysis, we both group these six group of medicine together (MHM) and separately investigate their purchase and the purchase of opioids (N02A).

We also examine suicide attempts and early death. In Denmark suicide attempt can be identified

[4]From LPR we look at accidents (V01-X59), assault (X85-Y09), and maltreatment syndromes (T74). For more details, see Gradus et al., 2015.

[5]From 1997, the Danish National Prescription Registry also includes the use of medicines in hospitals

from the National Patient Register and Psychiatric Central Research Register.[6] However, as these episodes of suicide attempts are under-reported in the registers (Nordentoft, 2007; Helweg-Larsen, 2006), we include a definition for possible suicide attempts—a definition including self-harm (regardless of intent e.g., poisoning) and injuries to the hand forearm, or both in combination with a primary diagnosis of a mental illness. [7]

4.2 Combat exposure data

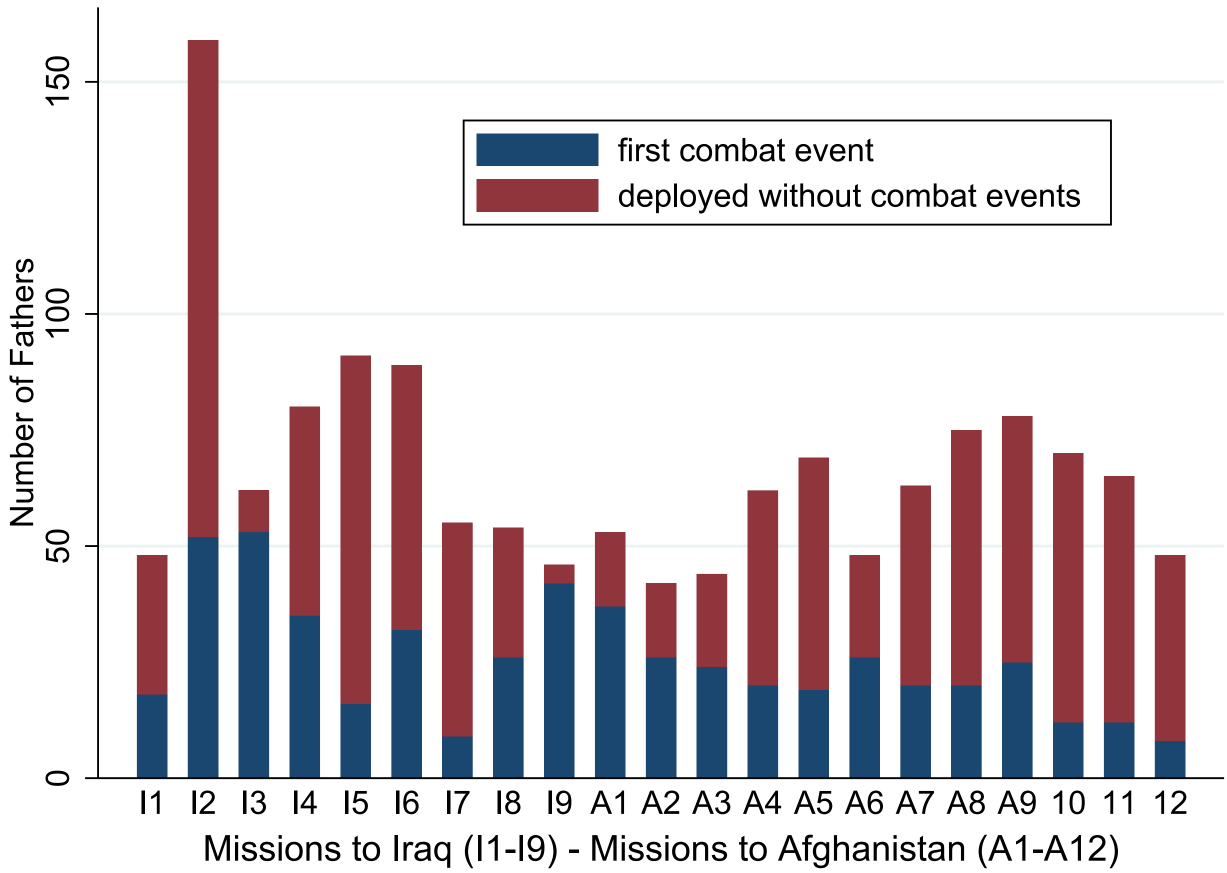
To characterize the level of combat exposure of the fathers, we use special events (SEs) collected from the military archives. In all, we have about 1,500 SEs distributed among the 21 missions and 9,000 deployed personnel. SEs are grouped into combat and non-combat events. Combat events include ambush, direct and indirect fire, improvised explosive devices (IEDs), combat and collateral damages, and combat support. Non-combat events include non-combat injury, accident (non-battle related), and prisoners taken. For each event affecting a Danish unit or soldier, we also have information on the date and place.

In this paper, we focus on how combat and non-combat events may directly affect the father and indirectly affect close family members (i.e., children and spouses). Figure 1 shows the distribution of combat exposure among the 1,400 fathers with children born 1986-2004 for the 21 missions (9 missions in Iraq and 12 missions in Afghanistan), Figure 2 shows the child's age at the first exposure or mission.

[6]We find suicide attempts in the registers either by using the International Classification for Diseases (ICD)-10 codes X60-X84 or by using the reason for contact to hospital for suicide attempt or self-harm.

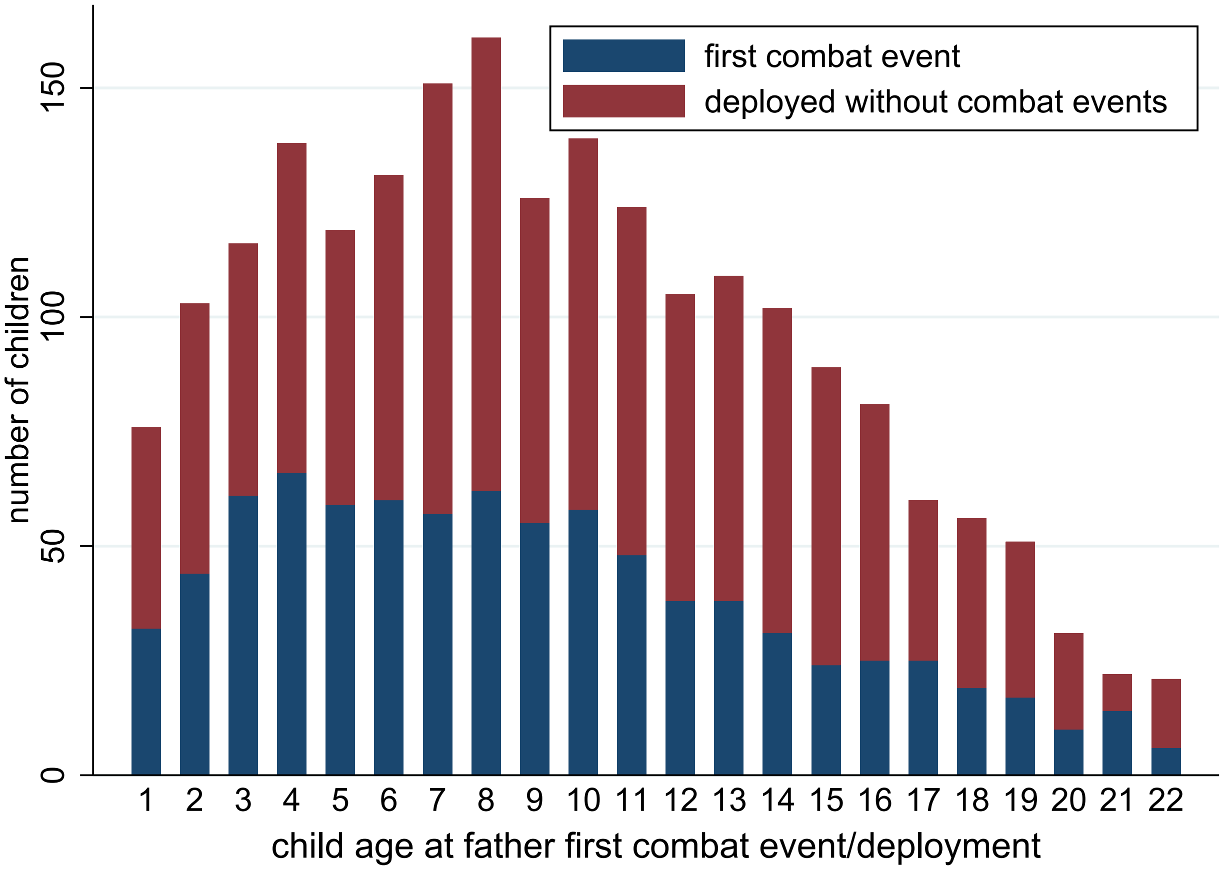
[7]We distinguish two groups of "probable suicide attempts." The first is a primary psychiatric diagnosis in combination with secondary diagnoses: self-cutting with sharp objects (S51, S55, S59, S61, S65, S69), poisoning with drugs (T36-T50), or poisoning with non-pharmaceutical substances (T52 -T60). The second is a primary diagnosis of poisoning with mild analgesics (T39, T40).

Figure 1: Father's First Combat Exposure by Mission.



NOTE.— The sample includes fathers deployed to Afghanistan or Iraq during the period 2003-2012. These fathers and a co-parent are born after 1954 with a child born 1986-2004. The child is resident in Denmark on January 1 of each year through age 16. Blue bars represent number of fathers experiencing a first combat event in a given mission of the 21 missions. Red bars represent number of fathers first deployed in a given mission, conditional on not experiencing a combat event during the 21 missions. Each mission lasts six months and usually have a two-week overlap. The last three missions to Iraq (I7-I9) coincided with the first three missions to Afghanistan (A1-A3) during 2006-2007.

Figure 2: Child's Age at Father First Combat Exposure



NOTE.— The sample includes children born 1986-2004 and resident in Denmark every 1 January until turning 16, with both parents born after 1954 and fathers deployed to Afghanistan or Iraq during 2003-2012. Blue bars represent number of children of a given age with a father experiencing a first combat event among these missions. Red bars represent number of children of a given age with a father first deployed in a given mission, conditional on not experiencing a combat event during the 21 missions.

4.3 Sample and descriptives

As previously mentioned, we focus on soldiers deployed to Iraq in 2003-2009 and to Afghanistan in 2006-2012. For our estimation sample we select deployed fathers of children with available tests scores, i.e., children born 1986-2004.[8]

[8]Given that (a) we only have 436 female soldiers from these missions and (b) too few of them had children born 1986-2004, we exclude the females from our study.

Table 1: Background Characteristics for Deployed Men

	Deployed (1)	Born>54 (2)	Parents>54 (3)	Child 86-04 (4)
Age pre dep	28.1167	27.9204	29.7007	38.4111
	(7.7825)	(7.4790)	(7.9088)	(6.7343)
Earnings pre dep	63.5174	63.3646	65.4750	72.5456
	(16.8862)	(16.5281)	(17.9222)	(22.7900)
Income pre dep	40.0864	40.0693	39.2072	37.7567
	(23.2506)	(23.2766)	(21.5635)	(17.2792)
High school	0.5189	0.5194	0.5106	0.4211
College	0.1485	0.1457	0.1947	0.3310
Brothers		0.7591	0.7677	0.7944
		(0.8100)	(0.8071)	(0.8303)
Sisters		0.7355	0.7387	0.7365
		(0.7704)	(0.7763)	(0.7792)
Half-sibs		0.6268	0.6159	0.4876
		(1.2018)	(1.2081)	(1.1129)
Mother high school		0.3999	0.3930	0.3295
Mother college		0.2542	0.2249	0.1609
Father high school		0.4734	0.4683	0.4326
Father college		0.2198	0.2112	0.1686
Individuals	8,923	8,706	4,938	1,401

NOTE.— Descriptive statistics for the year before first deployment to Afghanistan or Iraq. The sample for column 1 includes all men deployed to Afghanistan or Iraq in 2003-2012. Column 2 restricts this sample to those born after 1954. Column 3 further restricts this sample to deployed fathers with a co-parent also born after 1954. Column 4 further restricts this sample to having children born 1986-2004 with the child resident in Denmark on January 1 of each year through age 16. Household disposable income and labor earnings are reflated to 2020 and converted to thousand USD. Income is equivalized by the formula 1*first_adult+0.7*second_adult+0.5*number_of_children where adults are age 14 plus. The reference category for schooling is less than high school. Sisters, brothers, and half-siblings are counted. Means and standard deviations in parentheses.

Table 1 shows that the deployed with children born 1986-2004 are older, with higher earnings than all the deployed. Moreover, 33 percent of these deployed have a college education, compared to 15 percent among all the deployed.

Table 2: Military Records for Deployed Men

	Deployed (1)	Born>54 (2)	Parents>54 (3)	Child 86-04 (4)
Private	0.6249	0.6371	0.5482	0.3740
Sergeant	0.2013	0.2002	0.2473	0.2884
Officer	0.1320	0.1285	0.1723	0.2662
Combat unit	0.3501	0.3586	0.3218	0.1335
Support unit	0.5299	0.5292	0.5401	0.6003
Staff unit	0.1090	0.1018	0.1260	0.2427
Combat event	0.5736	0.5812	0.5409	0.3797
IDF	0.1753	0.1787	0.1608	0.0964
TIC	0.3776	0.3846	0.3329	0.1941
IED	0.3313	0.3380	0.2940	0.1499
Non-combat event	0.0795	0.0796	0.0798	0.0921
Prisoners taken	0.0134	0.0133	0.0148	0.0157
NCI	0.0493	0.0495	0.0482	0.0585
Accident	0.0210	0.0211	0.0211	0.0193
Individuals	8,923	8,706	4,938	1,401

NOTE.— Means of binary indicator variables for the first deployment to Afghanistan or Iraq. The sample for column 1 is all men deployed to Afghanistan or Iraq in 2003-2012. Column 2 restricts this sample to deployed men born after 1954. Column 3 further restricts this sample to deployed fathers with a co-parent also born after 1954. Column 4 further restricts this sample to having children born 1986-2004 with the child resident in Denmark on January 1 of each year through age. The omitted category for rank is without rank, and for unit type is missing. Combat event is an indicator variable taking the value one for a soldier experiencing a special event with primary classifications: IDF (indirect fire), TIC (troop in contact), IED (improvised explosive device). Non-combat events are special events with primary classifications: Prisoners taken, NCI (non-combat injury) or accident. Non-combat events are overwritten with zero if the soldier is ever exposed to a combat event.

Table 2 shows the military characteristics of the fathers compared to all the deployed to Iraq and

Afghanistan in 2003-2012. Deployed fathers of children born 1986-2004 are twice as likely to be officers than all the deployed combined, and they usually serve in staff units.

In Table 3, we compare the full population of children born 1986-2004 in Denmark with children born 1986-2004 of deployed fathers. The "household income 15," measured when the child is aged 15, is similar for the population and the deployed. However, as many officers belong to staff units, this category has higher family income. The size of a "deployed family" is slightly smaller than the general population, as shown by the child's number of sisters and brothers, while deployed fathers are more likely to come from larger families than the general population. The deployed fathers also appear to have higher education, especially those in staff units.[9]

Table 3: Background Characteristics for all Children, and Children with Deployed Fathers

	All (1)	Deployed (2)	Iraq (3)	Afghanistan (4)	Combat (5)	Support (6)	Staff (7)
Child male	0.5134	0.4946	0.5143	0.4767	0.5053	0.4866	0.5074
Income at 15	27.6250	27.6339	27.9394	27.3563	27.1952	27.1965	28.7523
	(12.4210)	(6.4461)	(6.6383)	(6.2561)	(5.7100)	(6.0858)	(7.3029)
Child's brothers	0.3962	0.3503	0.3275	0.3710	0.3333	0.3531	0.3515
	(0.6333)	(0.6117)	(0.5591)	(0.6553)	(0.6032)	(0.5984)	(0.6433)
Child's sisters	0.3728	0.3077	0.2841	0.3291	0.2105	0.3173	0.3279
	(0.6179)	(0.5685)	(0.5210)	(0.6078)	(0.4415)	(0.5908)	(0.5638)
Child's half-sibs	0.2147	0.2159	0.2059	0.2249	0.1123	0.2471	0.1926
	(0.6427)	(0.6011)	(0.5958)	(0.6060)	(0.3772)	(0.6430)	(0.5792)
Father high school	0.5134	0.4432	0.4071	0.4759	0.4421	0.5114	0.2981
Father college	0.2163	0.2526	0.2734	0.2336	0.0842	0.1390	0.5653
Mother high school	0.4606	0.5213	0.5087	0.5328	0.5439	0.5244	0.5051
Mother college	0.2507	0.2484	0.2509	0.2463	0.1825	0.2099	0.3583
Individuals	1,005,425	2,419	1,152	1,267	285	1,453	681

NOTE.— Descriptive statistics for children born 1986-2004 who are resident in Denmark on January 1 of each year through age 16, and have parents born after 1954. Column 1 includes all these children and column 2 restricts to those with a father deployed to Afghanistan or Iraq in period 2003-2012. Columns 3 and 4 split these children of the deployed by country of first deployment during the period. Columns 5-7 split these children by father's unit type at first deployment during the period. Household disposable income is reflated to 2020, converted to thousand USD, and equivalized by the formula 1*first_adult+0.7*second_adult+0.5*number_of_children where adults are age 14 plus. The reference category for schooling is less than high school. Child's sisters, brothers and half-siblings are counted. Means and standard deviations in parentheses.

Table 4 shows that 93 percent of the children of soldiers took tests (similar to the percentage in the full population) (see table 6), and that on average 38 percent of these children had a father exposed to combat, and that 9 percent of these children had a father exposed to non-combat event exclusively. Fathers can be deployed more than once and we use the first mission of exposure. As Iraq missions precede those in Afghanistan, the fathers deployed to Iraq appear more exposed than those deployed to Afghanistan (41% vs. 35%). Not surprisingly, fathers from combat units were more exposed.

[9]For comparison with U.S. soldiers, the U.S. Institute of Medicine (2013) shows that about 15 percent of U.S. soldiers deployed to Iraq and Afghanistan were 24 or younger, 59 percent were married, 49 percent had dependent children, and more than 60 percent had an education level of high school or less. On average the U.S. soldiers were deployed to 1.72 missions. Of those deployed, 57 percent deployed only once, and 43 percent deployed multiple times. The average length for all branches and components was 7.7 months.

Table 4: Descriptive Statistics for Fathers' Combat Exposure and Children's Test Scores

	Deployed (1)	Iraq (2)	Afghanistan (3)	Combat (4)	Support (5)	Staff (6)	Exposure (7)	None (8)
Combat event	0.3797	0.4137	0.3473	0.7754	0.3781	0.1850	1.0000	0.0000
Non-combat event	0.0921	0.0526	0.1297	0.0695	0.1141	0.0536	0.0000	0.1484
Test taken	0.9285	0.9288	0.9282	0.9018	0.9298	0.9369	0.9293	0.9280
Test score	0.0319	-0.0015	0.0619	-0.1205	-0.0527	0.2709	-0.0639	0.0852
	(0.9672)	(0.9690)	(0.9646)	(0.9876)	(0.9676)	(0.9146)	(0.9748)	(0.9588)
Fathers	1,401	684	717	187	841	373	532	869
Children	2,419	1,152	1,267	285	1,453	681	877	1,542
Scores	30,474	14,428	16,046	3,455	18,330	8,689	10,900	19,574

NOTE.— The sample contains children born 1986-2004 and resident in Denmark on January 1 of each year through age 16, with parents born after 1954 and fathers deployed in Iraq or Afghanistan 2003-2012. Combat event is an indicator variable taking the value one for the father's first combat exposure. Similarly, non-combat event takes the value one for the father's first exposure to a non-combat event, conditional on never being exposed to a combat event. Both rows present means by father and standard deviations in parentheses. Test taken is an indicator taking the value one if the child has at least one test score in 9th grade and zero otherwise. The row presents means by child and standard deviations in parentheses. Test score includes all Danish and Math test scores in 9th grade. We standardize test scores by subject and year for all children with parents in these cohorts. The row presents means weighted by child, with standard deviations in parentheses. Columns 2-3 split the sample by country of fathers' first event exposure or deployment; columns 4-6 split the sample by unit type for the fathers' first event exposure or deployment. Columns 7-8 split the sample by exposure to combat events.

Table 4 also shows simple statistics for the children's tests scores. We pool all the tests (math and Danish), for all 30,460 tests taken by the children of soldiers. All scores are standardized by subject and year. The figures show that children with fathers from staff units have higher scores, with the lowest score for children with fathers from combat units. Children of exposed fathers have lower test scores than children of non-exposed fathers.

4.4 Combat exposure balancing test

In Table 5, we test the balancing of combat exposure on the background characteristics of deployed fathers and their families after controlling for dummies for year of birth, mission, type of unit, and rank. Using an extensive set of predetermined variables, we show that none of them can predict the occurrence of combat or damage events, according to F-statistics of joint significance of covariates. Table 5 shows that combat or non-combat event exposure is largely independent of the soldier's family characteristics as measured in the year before childbirth. Columns 1 and 4 cover father's characteristics; columns 2 and 5, mother's characteristics; and columns 3 and 6, children's and other family characteristics. We find insignificant F-statistics across all specifications for both exposures. Conditional on the specific mission, rank, unit type, and year of birth, we find that combat exposure and non-combat event exposure are as good as randomly distributed among fathers.[10]

[10]When we only control for fathers' rank, combat exposure and non-combat events are also as good as randomly distributed among fathers.

Table 5: Balancing Tests for Exposure to Combat and Non-Combat Events

	Combat			Non-combat		
	(1)	(2)	(3)	(4)	(5)	(6)
Father high school	-0.0341	-0.0344	-0.0345	0.0134	0.0140	0.0134
	(0.0281)	(0.0281)	(0.0282)	(0.0169)	(0.0170)	(0.0170)
Father college	-0.0959**	-0.0869*	-0.0886*	0.0184	0.0186	0.0179
	(0.0482)	(0.0485)	(0.0491)	(0.0291)	(0.0293)	(0.0296)
Father's mother HS	0.0290	0.0307	0.0312	0.00674	0.00443	0.00629
	(0.0272)	(0.0273)	(0.0275)	(0.0164)	(0.0165)	(0.0166)
Father's mother col.	0.00129	-0.00189	-0.00166	-0.00869	-0.00713	-0.00650
	(0.0368)	(0.0369)	(0.0371)	(0.0222)	(0.0223)	(0.0224)
Father's father HS	-0.00314	-0.00301	-0.00631	-0.00970	-0.00755	-0.0105
	(0.0262)	(0.0262)	(0.0266)	(0.0158)	(0.0159)	(0.0160)
Father's father col.	-0.00996	-0.0186	-0.0173	-0.00271	-0.000413	0.00369
	(0.0367)	(0.0368)	(0.0370)	(0.0221)	(0.0223)	(0.0223)
Father's brothers	0.0180	0.0146	0.0143	-0.00510	-0.00556	-0.00592
	(0.0142)	(0.0142)	(0.0143)	(0.00856)	(0.00860)	(0.00864)
Father's sisters	-0.00860	-0.00690	-0.00598	-0.0107	-0.0111	-0.0109
	(0.0155)	(0.0155)	(0.0156)	(0.00936)	(0.00939)	(0.00941)
Father's half-sibs	-0.00144	-0.00312	-0.00193	0.0127*	0.0119*	0.0122*
	(0.0114)	(0.0115)	(0.0116)	(0.00690)	(0.00695)	(0.00698)
Mother high school		0.0194	0.00815		0.00176	0.00284
		(0.0302)	(0.0309)		(0.0183)	(0.0186)
Mother college		-0.0182	-0.0334		0.00837	0.0134
		(0.0386)	(0.0399)		(0.0233)	(0.0241)
Mother's mother HS		-0.0536**	-0.0533**		-0.00716	-0.00755
		(0.0267)	(0.0269)		(0.0161)	(0.0162)
Mother's mother col.		0.0266	0.0285		0.00888	0.00907
		(0.0391)	(0.0392)		(0.0236)	(0.0237)
Mother's father HS		-0.00710	-0.00565		-0.0138	-0.0111
		(0.0257)	(0.0258)		(0.0155)	(0.0155)
Mother's father col.		0.0287	0.0306		-0.0490**	-0.0458**
		(0.0376)	(0.0378)		(0.0227)	(0.0228)
Mother's brothers		0.0143	0.0153		-0.00871	-0.00850
		(0.0147)	(0.0147)		(0.00886)	(0.00888)
Mother's sisters		-0.0105	-0.00925		-0.00804	-0.00848
		(0.0143)	(0.0143)		(0.00863)	(0.00865)
Mother's half-sibs		-0.0158	-0.0138		0.00652	0.00584
		(0.0129)	(0.0131)		(0.00782)	(0.00788)
Child male			-0.00105			0.0115
			(0.0232)			(0.0140)
Income at 15			0.0000949			-0.00199
			(0.00218)			(0.00132)
Child's brothers			-0.0298			-0.00287
			(0.0247)			(0.0149)
Child's sisters			-0.00932			0.0170
			(0.0273)			(0.0164)
Child's half-sibs			-0.0270			-0.0104
			(0.0220)			(0.0133)
F-Statistic	0.852	1.125	0.953	0.597	0.706	0.833
F-Stat p-value	0.568	0.321	0.532	0.801	0.808	0.706
Partial-R^2	0.00593	0.0156	0.0192	0.00416	0.00985	0.0168
Observations	1,401	1,401	1,401	1,401	1,401	1,401

NOTE.— The sample contains men born after 1954 deployed to Iraq or Afghanistan in 2003-2012. These men were fathers of children born 1986-2004. These children are resident in Denmark on January 1 of each year until age 16. Columns present coefficients from different OLS regressions. The dependent variable for columns 1-3 is an indicator taking the value one if the father was exposed to a combat event while deployed, and zero otherwise. The dependent variable for columns 4-6 is an indicator taking the value one if the father was exposed to a non-combat event, conditional on never being exposed to a combat event, and the value zero otherwise. Additional controls included but not shown are dummies for mission, rank (private, sergeant, officer, other), unit type (combat, support, staff, other), year of birth of father and mother (in columns 2, 3, 5 and 6), and year of birth of child (in columns 3 and 6). For these regressions, each father has one observation, and we choose the first child born in the cohort range with his mother. Standard errors in parentheses.* p <0.10, ** p <0.05, *** p <0.01.

5 Results

This section presents the association between fathers' deployment and children's test scores, and the causal effect of combat exposure on test scores, because combat exposure is balanced on observed characteristics conditional on deployment. First, we explore heterogeneous responses by child age of exposure and, second, because children are around the same age at end-of-compulsory schooling test taking, we can identify a potentially "immune group" who are tested before fathers' combat exposure and for whom we strongly expect that test scores should be unrelated to exposure. Third, for a sub-sample of sibling pairs we conduct a difference-in-differences analysis for fathers' combat exposure. To check the robustness of our estimates, we (a) examine the sensitivity of combat exposure effects to excluding different types of events, (b) perform a placebo analysis of effects of non-combat related events that also feature in military communications, and (c) analyze the effect of single versus multiple combat events on test scores. Finally, we explore potential mechanisms for the combat exposure effects on test scores, in terms of mental health outcomes for the father, the mother, and the child.

5.1 Deployment, Combat Exposure, and Test Scores

Table 3 has shown that deployed fathers are somewhat similar to all Danish fathers in terms of socioeconomic status, with similar household income at age 15, whereas the size of the deployed family is smaller (lower numbers of sisters and brothers of the child). Table 6 shows that, after we control for an extensive set of observed characteristics, fathers' deployment is not associated with children's test scores.

Table 6: Deployment and Children's Test Scores

			Sex		Assessment		Subject	
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
	Tested	All Tests	Female	Male	Teacher	Exam	Danish	Math
Deployed	-0.00244	0.00547	0.00421	0.00557	0.000844	0.00862	0.0256	-0.0301
	(0.00558)	(0.0162)	(0.0204)	(0.0222)	(0.0168)	(0.0165)	(0.0170)	(0.0184)
Child male	-0.0326***	-0.263***			-0.278***	-0.244***	-0.421***	0.00441***
	(0.000509)	(0.00143)			(0.00151)	(0.00144)	(0.00145)	(0.00171)
Exam		-0.0213***	-0.0505***	0.00688***			-0.0153***	-0.0350***
		(0.000511)	(0.000688)	(0.000737)			(0.000581)	(0.000672)
Maths		0.00294***	-0.175***	0.179***	0.0371***	0.0272***		
		(0.000937)	(0.00122)	(0.00130)	(0.000931)	(0.00160)		
Mean dep. var.	0.927	-0.00103	0.142	-0.142	0.0221	-0.00772	0.00158	0.00228
Mean deployed	0.00241	0.00241	0.00250	0.00232	0.00241	0.00241	0.00241	0.00241
R^2	0.0443	0.159	0.159	0.152	0.170	0.146	0.174	0.163
Fathers	548,756	525,928	350,284	352,658	523,598	522,844	525,042	524,262
Children	1,004,994	931,933	461,680	470,253	923,900	923,240	929,076	926,774
Observations	1,004,994	12,716,404	6,322,064	6,394,340	6,703,580	6,012,824	7,957,731	4,758,673

NOTE.— The sample contains children born 1986-2004 and resident in Denmark on January 1 of each year through age 16, with parents born after 1954. Columns 2-8 are restricted to children with a 9th grade test score in math or Danish. Columns 3-8 further split the test score sample according to the sex of the child, assessment method, and test subject. Each column presents estimates from separate OLS regressions. In column 1 the dependent variable is an indicator taking the value one if a test score is observed for the child, and zero otherwise. In columns 2-8 the dependent variable is the standardized test score. Deployed is an indicator variable taking the value one if the father was deployed in Afghanistan or Iraq in 2003-2012, and taking the value zero otherwise. For column 1, other variables included in the regressions but not shown are the same as in column 3 of Table 5. Columns 2-8 also include dummies test year. Observations are per child in column 1, and test scores weighted by child in columns 2-8. Standard errors clustered by father in parentheses. * p <0.10, ** p <0.05, *** p <0.01.

Several studies have analyzed the association between fathers' deployment and children's outcomes (White et al., 2011; De Pedro et al., 2011; Frederiksen et al., 2021).[11] Lyle (2006) studies children of soldiers stationed in Texas in 1997 or 1998 and who were deployed to peace-enforcing missions to the Balkans, show-of-force maneuvers in the Middle East, or humanitarian aid missions in developing countries. In contrast, Engel et al. (2010) focus on children whose parents were deployed to peace-enforcing missions in Iraq and Afghanistan in 2002-2005. Lyle (2006) finds that parental absences—due to military deployment—affect children's test scores by a tenth of a standard deviation. Engel et al. (2010) find that scores for certain academic subjects are more affected (worse for math than for reading). Both studies explain the modest effect by the fact that military schools are better equipped to manage deployments than non-military schools.[12]

In contrast to both Lyle (2006) and Engel et al. (2010), who use the exogenous variation in military deployment to study the impact of deployment as work-related parental absence on children's

[11] Frederiksen et al. (2021) compare a sample of children of formerly deployed Danish fathers with a sample of control children from the Danish population in a cross-sectional study. Their findings show that in general the well-being of the children of deployed is not different from the well-being of the control children.

[12] In both cases children attend military schools (Defense Department schools, Engel et al., 2010) or schools on military installations (Lyle, 2006)), and their comparison group is non-deployed personnel.

attainment, we focus on the effect of the father's combat exposure on their children's 9th grade test score. As both exposed and non-exposed fathers are deployed and therefore absent, we measure the additional effect of having a father exposed to combat on children's test scores, compared to children having a deployed, but non-exposed father. In our case, all test scores are measured at the same age but with exposure occurring at different ages.

Given that we have shown (Table 5) that combat exposure among the deployed is as good as random, we can now credibly estimate the effect of fathers' combat exposure on children's test scores. These estimates appear in Table 7. While about seven percent of children do not take a test at the end of 9th grade, column 1 shows no effect of combat exposure on children's probability of test taking. That combat exposure is not systematically related to observing a test score demonstrates that no effects on test scores are driven by selection into the test. Column 2 shows that combat exposure reduces test scores by 13 percent of a standard deviation—a magnitude of about half the test score difference by sex, as shown by the male coefficient. When we split the sample by sex, assessment method, and test subject in columns 3-8 combat exposure effects are very similar.

Table 7: Effects of Fathers' Combat Exposure on Children's Test Scores. Regardless of Combat Exposure Timing Relative to the Test.

			Sex		Assessment		Subject	
	(1) Tested	(2) All tests	(3) Female	(4) Male	(5) Teacher	(6) Exam	(7) Danish	(8) Math
Combat exposure	0.00903	-0.125***	-0.127**	-0.117**	-0.113***	-0.109***	-0.133***	-0.112**
	(0.0135)	(0.0374)	(0.0501)	(0.0531)	(0.0387)	(0.0381)	(0.0392)	(0.0435)
Male	-0.0330***	-0.268***			-0.291***	-0.240***	-0.444***	0.0297
	(0.0107)	(0.0283)			(0.0299)	(0.0292)	(0.0297)	(0.0331)
Exam		-0.0219**	-0.0585***	0.0139			-0.0223**	-0.0325***
		(0.00936)	(0.0122)	(0.0135)			(0.0110)	(0.0124)
Maths		-0.0347*	-0.193***	0.134***	0.00689	0.0226		
		(0.0195)	(0.0251)	(0.0276)	(0.0191)	(0.0374)		
Mean dep. var.	0.928	0.0223	0.155	-0.119	0.0414	0.0192	0.0489	-0.0148
Mean exposure	0.362	0.363	0.370	0.354	0.359	0.360	0.362	0.362
R^2	0.0963	0.178	0.218	0.203	0.198	0.158	0.200	0.192
Fathers	1,401	1,346	902	848	1,335	1,337	1,343	1,337
Children	2,418	2,245	1,156	1,089	2,224	2,226	2,238	2,231
Observations	2,418	30,459	15,726	14,733	16,072	14,387	19,034	11,425

NOTE.— The sample contains children born 1986-2004 and resident in Denmark on January 1 of each year through age 16, with parents born after 1954 and fathers deployed in Iraq or Afghanistan in 2003-2012. Columns 2-8 are restricted to children with a 9th grade test score in math or Danish. Columns 3-8 further split the test score sample according to the sex of the child, assessment method, and test subject. Each column presents estimates from separate OLS regressions. In column 1 the dependent variable is an indicator taking the value one if a test score is observed for the child, and zero otherwise. In columns 2-8 the dependent variable is the standardized test score. Combat exposure is an indicator variable taking the value one if the father was exposed to a combat event, and zero otherwise. For column 1, other variables included in the regressions but not shown are the same as in column 3 of Table 5; columns 2-8 also include dummies for the test year. Observations are per child in column 1, and test scores weighted by child in columns 2-8. Standard errors clustered by father in parentheses. * p <0.10, ** p <0.05, *** p <0.01.

5.2 Heterogeneity

To check the potential threat to identification that our findings may be driven by unobserved heterogeneity, we use differences between children's ages at the father's combat exposure to explore substantive differences in test score effects by age of exposure.

5.2.1 Threats to Identification—Unobserved Heterogeneity

While balancing tests add to the credibility of our quasi-randomization, we can only test for the significance of observed pre-determined characteristics in explaining combat exposure. However, combat exposure and test scores may be correlated with a third variable that we do not observe, and this third variable may drive the results in Table 7. For example, if fathers who are more risk-taking are more likely to be exposed to combat, the risk-taking type itself may be driving the observed relationship with test scores, rather than combat exposure per se. Consequently, if the father's type is driving the association, children of such fathers exposed to combat ought to display similar relationships between exposure and test scores regardless of test timing.

In this sub-section we explore this threat to identification in two ways. First, because tests are taken at around age 15 and the children in our sample are aged 1-22 when the father is first exposed to combat (see Figure 1), we observe children both before and after their 9th grade test. Second, we observe a large proportion of siblings with differential combat exposure and, by controlling for factors shared within the family and fixed over time but potentially unobserved, we perform a differences-in-differences analysis for these sibling pairs.

Table 8: Effects of Fathers' Pre-test Combat Exposure on Children's Test Scores

		Sex		Assessment		Subject	
	(1)	(2)	(3)	(4)	(5)	(6)	(7)
	All tests	Female	Male	Teacher	Exam	Danish	Maths
Combat exposure	-0.138***	-0.148***	-0.153***	-0.121***	-0.117***	-0.133***	-0.126***
	(0.0402)	(0.0524)	(0.0578)	(0.0423)	(0.0406)	(0.0421)	(0.0479)
Mean dep. var.	0.0321	0.165	-0.110	0.0536	0.0288	0.0635	-0.0118
Mean exposure	0.372	0.382	0.362	0.368	0.369	0.371	0.372
R^2	0.188	0.231	0.220	0.186	0.158	0.167	0.203
Fathers	1,238	801	742	1,227	1,228	1,234	1,231
Children	1,915	989	926	1,897	1,896	1,909	1,904
Observations	25,841	13,398	12,443	13,712	12,129	16,169	9,672

NOTE.— The sample includes children born 1986-2004 and resident in Denmark on January 1 of each year through age 16, with parents born after 1954 and the father deployed in Afghanistan or Iraq in 2003-2012. Columns 2-8 are restricted to children with a 9th grade test score in math or Danish. Columns 3-8 further split the test score sample according to the sex of the child, assessment method, and test subject. Each column presents estimates from separate OLS regressions. In column 1 the dependent variable is an indicator taking the value one if a test score is observed for the child, and zero otherwise. In columns 2-8 the dependent variable is the standardized test score. Combat exposure is an indicator variable taking the value one if the father was exposed to a combat event before the child in question was of test-taking age (for column 1) or before the child took the test (for columns 2-8), and zero otherwise. For columns 2-8, other variables included in the regressions but not shown are similar to those as in column 3 of Table 5. For column 1, other variables included in the regressions but not shown are the same as in column 3 of Table 5, and with in addition the test-related variables. Observations are per child in column 1, and test scores weighted by child in columns 2-8. Standard errors clustered by father in parentheses* p <0.10, ** p <0.05, *** p <0.01.

Estimates presented in Table 7 pooled all children of deployed fathers and used combat exposure regardless of its timing relative to the test. Table 8 presents estimates for a sample where the father is either first exposed to combat before the child's test-taking age or is never exposed to combat but is first deployed before the child's test-taking age. As expected, while combat exposure point estimates are larger in Table 8 than in Table 7, the one percent of a standard deviation differences in effects are not significant.

Table 9: Effects of Fathers' Post-Test Combat Exposure on Children's Test Scores

		Sex		Assessment		Subject	
	(1)	(2)	(3)	(4)	(5)	(6)	(7)
	All tests	Female	Male	Teacher	Exam	Danish	Maths
Combat exposure	-0.0767	-0.217	0.219	-0.0484	-0.0805	-0.112	-0.0735
	(0.0998)	(0.134)	(0.136)	(0.109)	(0.109)	(0.120)	(0.108)
Mean dep. var.	-0.0389	0.0885	-0.167	-0.0361	-0.0304	-0.0430	-0.0347
Mean exposure	0.312	0.297	0.326	0.311	0.308	0.312	0.311
R^2	0.254	0.368	0.392	0.288	0.208	0.258	0.290
Fathers	276	160	158	274	275	275	273
Children	330	167	163	327	330	329	327
Observations	4,618	2,328	2,290	2,360	2,258	2,865	1,753

NOTE.— The sample includes children born 1986-2004 who are resident in Denmark on January 1 of each year through age 16, with parents born after 1954 and the father deployed in Afghanistan or Iraq in 2003-2012. Columns 2-8 are restricted to children with a 9th grade test score in math or Danish. Columns 3-8 further split the test score sample according to the sex of the child, assessment method, and test subject. Each column presents estimates from separate OLS regressions. In column 1 the dependent variable is an indicator taking the value one if a test score is observed for the child, and zero otherwise. In columns 2-8 the dependent variable is the standardized test score. Combat exposure is an indicator variable taking the value one if the father was exposed to a combat event after the child in question was of test-taking age (for column 1) or after the child took the test (for columns 2-8), and zero otherwise. For columns 2-8, other variables included in the regressions but not shown are similar to those in column 3 of Table 5. For column 1, other variables included in the regressions but not shown are the same as in column 3 of Table 5, with in addition the test-related variables. Observations are per child in column 1, and test scores weighted by child in columns 2-8. Standard errors clustered by father in parentheses.* p <0.10, ** p <0.05, *** p <0.01.

To complement Table 8, Table 9 presents estimates for a sample where the father is either first exposed to combat after the child's test-taking age or is never exposed to combat but first deployed after the child's test-taking age. As expected, the combat exposure point estimates are insignificant. Thus we find no support for the "type of father" threat to identification, whereby if the father type is driving the association, fathers exposed to combat ought to display similar relationships between exposure and scores regardless of test timing.

Table 10: Combat Exposure and Test Scores for Sibling Pairs

			Sex		Assessment		Subject	
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
	Tested	All tests	Female	Male	Teacher	Exam	Danish	Maths
Combat event pre-test	-0.00417	-0.168***	-0.00337	0.0921	-0.166***	-0.188***	-0.188***	-0.181***
	(0.0197)	(0.0564)	(0.126)	(0.138)	(0.0592)	(0.0590)	(0.0606)	(0.0691)
Pre-test	-0.0347	-0.0750	-0.0561	-0.440**	-0.0237	0.00752	-0.00718	-0.0135
	(0.0311)	(0.0867)	(0.161)	(0.219)	(0.0939)	(0.0934)	(0.0962)	(0.107)
Mean dep. var.	0.934	0.0709	0.224	-0.0747	0.109	0.0765	0.115	0.0384
Mean exposure	0.292	0.293	0.315	0.325	0.289	0.289	0.292	0.290
R^2	0.162	0.204	0.331	0.392	0.228	0.180	0.195	0.243
Fathers	600	591	153	128	525	521	529	526
Children	1,200	1,182	306	256	1,050	1,042	1,058	1,052
Observations	1,200	15,298	4,068	3,279	7,614	6,768	9,053	5,395

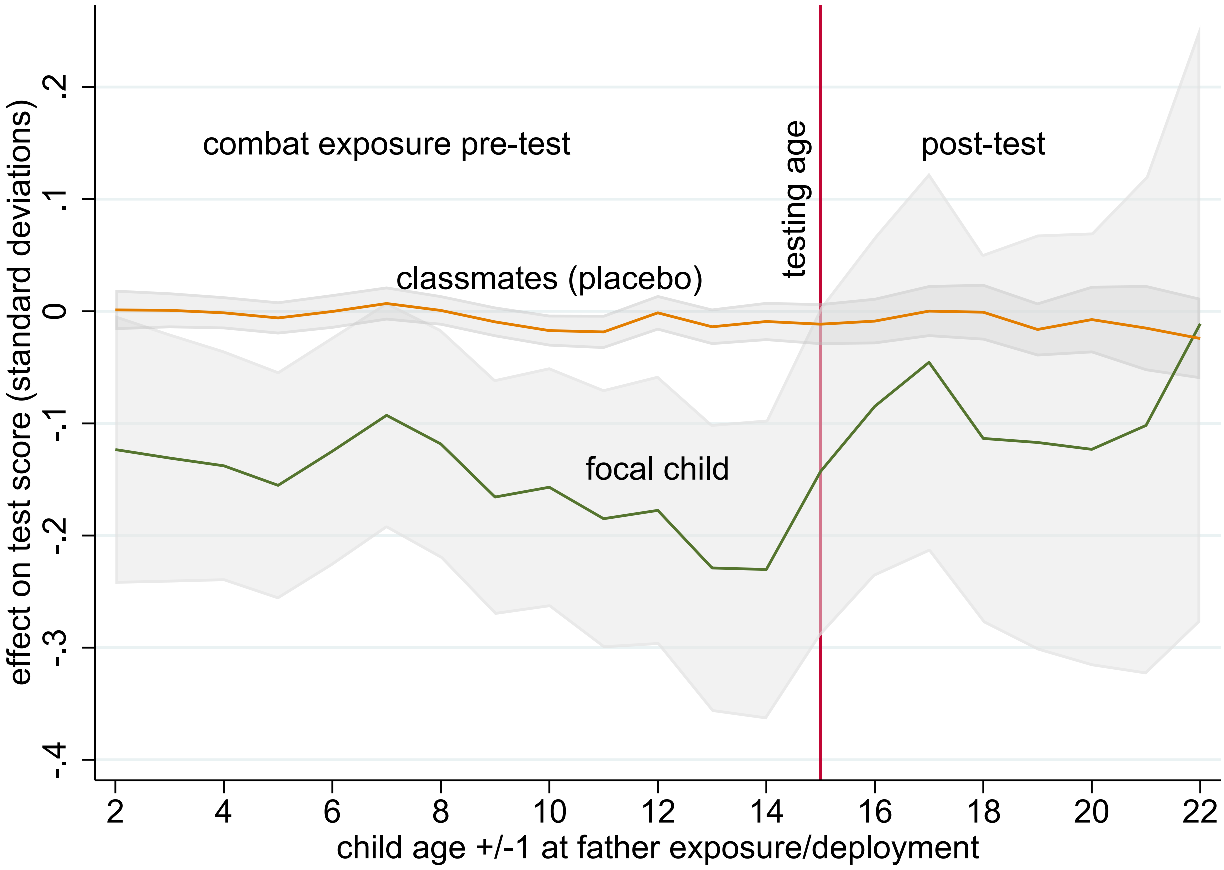
NOTE.— The sample includes siblings (same mother and father) born 1986-2004 who are resident in Denmark every January 1 of each year through age 16, with both parents born after 1954 and the father deployed in Afghanistan or Iraq in 2003-2012. We drop siblings born less than a month apart and select the first two remaining siblings in the cohort range. Columns 2-8 are restricted to children with a 9th grade test score in math or Danish. Columns 3-8 further split the test score sample according to the sex of the child, assessment method, and test subject. For columns 2-8 the sample is further restricted to observing at least one test score for each sibling. Each column presents estimates from separate OLS regressions. In column 1 the dependent variable is an indicator taking the value one if a test score is observed for the child, and zero otherwise. In columns 2-8 the dependent variable is the standardized test score. Pre-combat is an indicator variable taking the value one if the father was exposed to a combat event before the child in question was of test-taking age (for column 1) or before the child took the test (for columns 2-8), and zero otherwise. Pre-test is an indicator variable taking the value one if the father was either first deployed (but never exposed to a combat event), or exposed to a combat event, before the child in question was of test-taking age (for column 1) or before the child took the test (for columns 2-8). Observations are per child in column 1, and test scores weighted by child in columns 2-8. Standard errors clustered by father in parentheses.* p <0.10, ** p <0.05, *** p <0.01.

An alternative way of testing the robustness of our estimates to unobserved characteristics is to consider sibling differences. Exploiting the fact that some fathers are first exposed to combat after an older sibling is tested but before a younger sibling is tested, we conduct a sibling differences-in-differences analysis. Table 10, column 1, shows no effect of combat exposure on test-taking. Column 2 shows that combat exposure reduces test scores by 17 percent of a standard deviation—an effect somewhat larger than the 13 percent for the full sample. Within our sample, we have a small number of same-sex sibling pairs (as shown in columns 3 and 4), and estimates split by sex of child are insignificant. However, estimates split by assessment method, and test subject are very similar to those for all tests.

5.2.2 Children's Age at Fathers' First Combat Exposure

Apart from using the child's age at first exposure to explore robustness to unobserved heterogeneity, we also explore substantive differences in effects by age. Figure 3 presents estimates from sub-samples centered on different children's ages at the father's first combat exposure, or at the father's first deployment if never exposed (denoted focal child). Exposure effects are significant pre-school, and then again from age 9, increasing in magnitude until age 14 —one year before 9th grade tests are typically taken. The point estimate for combat exposure effect around age 14 is a drop of 20 percent of a test score standard deviation allowing us to rule out effects with a drop smaller than 10 percent. While some attenuation in effects measured at the end of compulsory schooling may be expected for exposures back in the early primary school years, that pre-school exposures at ages 4-6 are still measurable is striking.

Figure 3: Combat Exposure Effects on Test Scores by Child Age at First Exposure

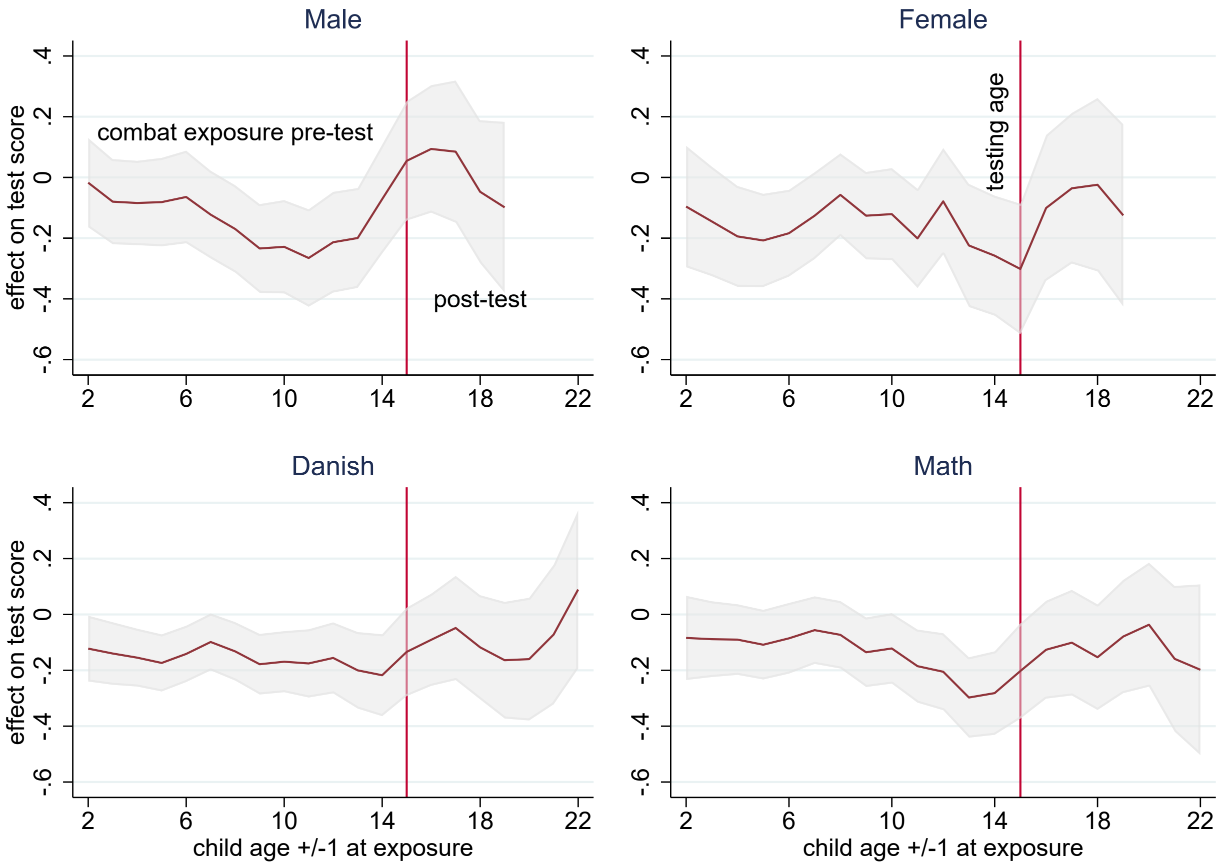


NOTE.— The figure shows combat exposure indicator coefficients from OLS regressions explaining test scores when we use the same specification as in column 2 of Table 7. The line "focal child" shows point estimates when we use the same sample from the same column, restricted to rolling three-year windows of child age at father's first combat exposure or deployment. The line "classmates (placebo)" shows point estimates when we use a sample of classmates (same school, grade and year) taking the same 9th grade tests as the focal child. Shaded bands indicate 95 percent confidence intervals. The vertical line indicates typical 9th grade testing age of 15; left of the line indicates father's first exposure or deployment before the child is tested; right of the line indicates father's first exposure or deployment after the child was tested.

The vertical line in Figure 3 represents the typical 9th grade testing age of 15, with ages to the left indicating a pre-test combat exposure for the given age, and ages to the right a post-test exposure. Consistent with the differences in mean estimates between Tables 8 and 9, the effects of first combat exposure after testing become insignificant.

While our finding of zero effects for focal children first exposed after testing serves as a control in which we use an "immune group" of deployed but not yet exposed children, we can broaden the scope of potential control groups by considering similar children of non-deployed fathers. The curved line around zero in Figure 3—denoted "classmates (placebo)" samples children in 9th grade in the same school and year as the focal child—explains the test scores of these classmates with fathers' combat exposure for the focal child. In the absence of spillovers in the classroom from combat exposure of the focal child, we would expect no classmate test score response. Indeed, we find a precisely estimated zero effect for all ages.

Figure 4: Effects of Combat Exposure by Child Age at First Exposure, Sex of Child and Test Subject.



NOTE.— The figure shows coefficients of combat exposure indicators from OLS regressions explaining test scores using the same specification as in column 2 of Table 7. Using the same sample as in column 2 of Table 7, the upper panels split the sample by the sex of the child, and the lower panels split by test subject. The lines shows point estimates restricting to rolling three-year windows of the child's age at the father's first combat exposure or deployment. Shaded bands indicate 95 percent confidence intervals. The vertical line indicates typical 9th grade testing age of 15; left of the line indicates the father's first exposure or deployment before the child is tested; right of the line indicates the father's first exposure or deployment after the child was tested.

To further explore heterogeneity by age at exposure, we split the sample by the sex of the child and test subject. Figure 4 shows the results While daughters are most affected by combat exposure pre-school or right before the test, sons are most affected by exposure in primary school. Although

Danish scores are similarly affected by combat exposure at any pre-test age, math scores are most affected by exposure in the three years up to the test. We find no obvious differences in age profiles by assessment method of the test (not shown).

5.3 Robustness

We have coded combat exposure as a binary indicator taking the value one if a father is recorded in military communications to have been exposed to any of the six different types of SEs related to combat. As there are several choices in this coding that might affect our findings, in this subsection we examine the sensitivity of estimates to these choices in three ways. First, we re-estimate the model after dropping men affected by different types of combat-related events. Second, to check whether being mentioned in military communications per se affects test scores, we collect events associated with individuals who are mentioned in military communications but are not combat related, and regress test scores on these non-combat related events. Third, to analyze the intensive margin in terms of number of combat exposures, we recode combat exposure as two dummy variables: an indicator for only having experienced a single combat event, and an indicator for having experienced two or more events.

Table 11: Combat Exposure and Test Scores - Sensitivity to Event Exclusions

	Combat measures			Other measures		
	(1)	(2)	(3)	(4)	(5)	(6)
Excluding:	IDF	TIC	IED	Minor Injury	WIAKIA	Repatriated
Combat exposure	-0.124***	-0.129***	-0.156***	-0.104**	-0.124***	-0.114***
	(0.0376)	(0.0395)	(0.0389)	(0.0405)	(0.0375)	(0.0384)
Mean dep. var.	0.0219	0.0239	0.0208	0.0403	0.0211	0.0274
Mean exposure	0.362	0.326	0.341	0.339	0.362	0.354
R^2	0.178	0.181	0.181	0.192	0.178	0.178
Fathers	1,345	1,272	1,300	1,149	1,339	1,282
Children	2,242	2,124	2,173	1,901	2,233	2,148
Observations	30,420	28,868	29,499	25,838	30,306	29,163

NOTE.— The sample includes children born 1986-2004 who are resident in Denmark on January 1 of each year through age 16, with parents born after 1954 and fathers deployed in Afghanistan or Iraq in 2003-2012. Columns 1-3 drop children of fathers who experienced three specific types of combat events: (1) indirect fire, (2) troops in contact, and (3) improvised explosive device. Columns 4-6 drop children of fathers who experienced other events: (4) minor injury (requiring registered medical attention), (5) wounded or killed in action, (6) repatriated before end of mission. The dependent variable is the standardized test score. Combat exposure is an indicator variable taking the value one if the father was exposed to a combat event, and zero otherwise. Other variables included in the regressions but not shown are the same as in column 3 of Table 5. Observations are test scores weighted by child. Standard errors clustered by father in parentheses* p <0.10, ** p <0.05, *** p <0.01.

As single types of events may be driving our overall findings, we check for this possibility by excluding men exposed to specific event types. In Table 11, columns 1-3, we drop men subject to each of the three most frequent types of events mentioned in military communications. In columns

4-6 we drop men with combat exposure recorded elsewhere in the military administration. The table shows that the estimates are robust to excluding men exposed according to these six types of combat event, with effect sizes varying between 10 and 13 percent.

Thus far, we have analyzed combat exposure effects based on individuals exposed to combat events. However, any individual mention in military communications may have an effect on test scores, regardless of the type of event. We classify the SEs from military communications to which we have research access into three groups of event types according to whether an individual is identified in connection with a (a) combat, (b) non-combat event, or (c) event occurring without a link to specific individual(s). An example of "(c)" could be that while Danish and UK soldiers shared the same base in Afghanistan, a UK soldier was killed in an action, in which no Danish soldier was directly affected, even though the Danish and UK soldiers shared the same base in Afghanistan. Using non-combat events rather than combat events as the covariate of interest in Table 12, we replicate the analysis of Table 7. Table 12 shows that exposure to non-combat events has no effect on test scores. Thus we find support for using military communications specifically involving combat exposure, rather than communications classified differently.

Table 12: Father Non-Combat Event and Test Scores

			Sex		Assessment		Subject	
	(1) Tested	(2) All tests	(3) Female	(4) Male	(5) Teacher	(6) Exam	(7) Danish	(8) Math
Non-Combat Event	-0.00909	0.0207	0.106	-0.123	0.0159	0.0322	0.0254	0.0741
	(0.0242)	(0.0654)	(0.0858)	(0.0917)	(0.0668)	(0.0688)	(0.0734)	(0.0716)
Mean dep. var.	0.928	0.0223	0.155	-0.119	0.0414	0.0192	0.0489	-0.0148
Mean exposure	0.0935	0.0909	0.0934	0.0882	0.0908	0.0907	0.0907	0.0910
R^2	0.0923	0.175	0.213	0.200	0.175	0.143	0.151	0.190
Fathers	1,401	1,346	902	848	1,335	1,337	1,343	1,337
Children	2,418	2,245	1,156	1,089	2,224	2,226	2,238	2,231
Observations	2,418	30,459	15,726	14,733	16,072	14,387	19,034	11,425

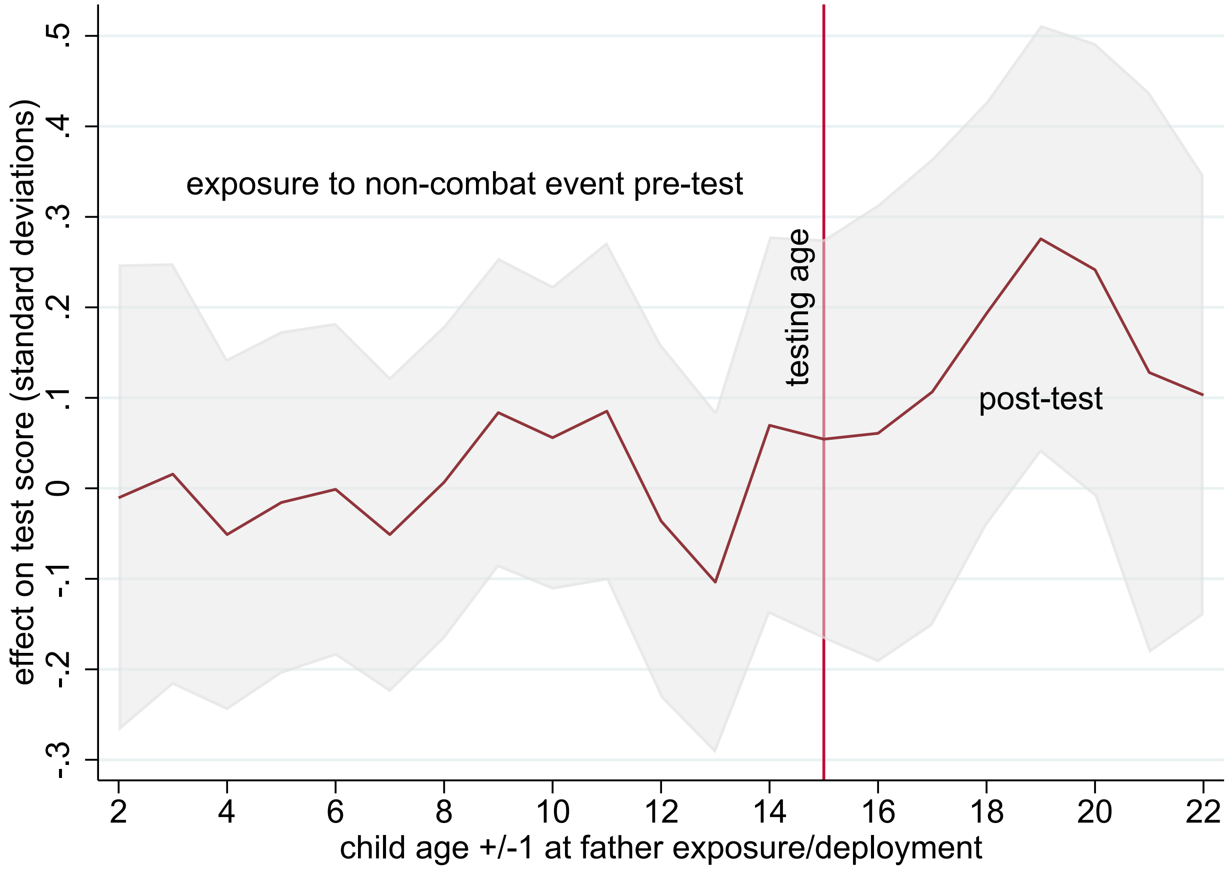
NOTE.— The sample includes children born 1986-2004 who are resident in Denmark on January 1 of each year through age 16, with parents born after 1954 and fathers deployed in Afghanistan or Iraq in 2003-2012. Columns 2-8 are restricted to children with a 9th grade test score in math or Danish. Columns 3-8 further split the test score sample according to the sex of the child, and assessment method, and test subject. Each column presents estimates from separate OLS regressions. In column 1 the dependent variable is an indicator taking the value one if a test score is observed for the child, and zero otherwise. In columns 2-8 the dependent variable is the standardized test score. Non-combat event is an indicator taking the value one if the father was exposed to a non-combat event, conditional on never being exposed to a combat event, and zero otherwise. For columns 2-8, other variables included in the regressions but not shown are similar to those in column 3 of Table 5. For column 1, other variables included in the regressions but not shown are the same as in column 3 of Table 5, and in addition test-related variables. Observations are per child in column 1, and test scores weighted by child in columns 2-8. Standard errors clustered by father in parentheses.* p <0.10, ** p <0.05, *** p <0.01.

We supplement the average estimates in Table 12 with a placebo analysis of the effects of exposure to non-combat events by the age of the child around the time of the father's exposure.[13] In the same

[13] Figure A.1 shows the age distribution of the children of fathers exposed exclusively to non-combat events.

way as we graphed combat exposure effects by child age in Figure 3, we graph effects by the age of first non-combat event exposure in Figure 5. Estimates of the effects of non-combat are not significant at any age and rather imprecisely estimated.

Figure 5: Non-Combat Exposure Effects on Test Scores by Child Age at First Exposure



NOTE.— The figure presents coefficients on non-combat exposure indicators (conditional on never being exposed to a combat event) from OLS regressions explaining test scores, using the same specification as in column 2 of Table 7. The line shows point estimates using the same sample as in column 2 of Table 7, restricting to rolling three-year windows of the child's age at the father's first non-combat exposure or deployment. The vertical line indicates typical 9th grade testing age of 15; left of the line indicates the father's first non-combat exposure or deployment before the child is tested; right of the line indicates the father's first non-combat exposure or deployment after the child was tested.

Thus far we have coded combat exposure as a binary outcome and focused on the extensive margin of whether or not a father experiences any combat. However, as many fathers experience several combat events, there may be a dose-response relationship, with the number of combat events also affecting test scores. In Table 13 we code combat exposure as ever experiencing only a single event, or experiencing more than one combat event. We can see that even once experiencing a single combat event has the largest effect on test scores, causing an 18 percent of a standard deviation drop in test scores, compared to a 10 percent drop due to two or more events. As the first combat exposure may have caused the father to leave the military soon afterwards, before he could experience another such event, selection is likely to explains what at first glance appears an counterintuitive finding. Similarly, multiple combat events are more likely experienced by soldiers with more deployments—and who may also be more resilient.

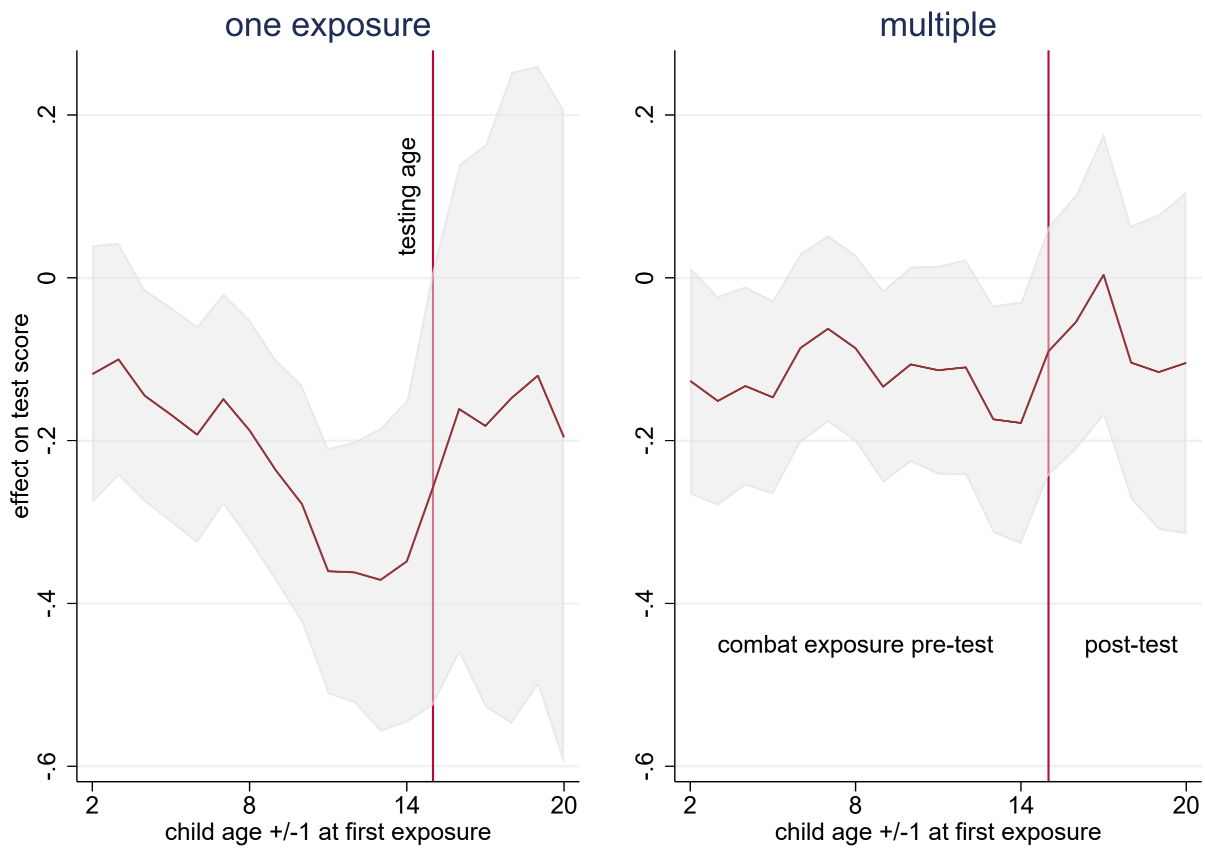
Table 13: Multiple Combat Events and Test Scores

			Sex		Assessment		Subject	
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
	Tested	All Tests	Female	Male	Teacher	Exam	Danish	Math
One Combat Event	-0.00746	-0.177***	-0.152**	-0.190***	-0.174***	-0.155***	-0.209***	-0.124**
	(0.0207)	(0.0517)	(0.0746)	(0.0705)	(0.0545)	(0.0555)	(0.0572)	(0.0626)
More than one CE	0.0183	-0.0990**	-0.116**	-0.0743	-0.0747*	-0.0798*	-0.0826*	-0.106**
	(0.0148)	(0.0428)	(0.0549)	(0.0615)	(0.0447)	(0.0431)	(0.0456)	(0.0504)
Mean dep. var.	0.928	0.0223	0.155	-0.119	0.0414	0.0192	0.0489	-0.0148
Mean exposure	0.362	0.363	0.370	0.354	0.359	0.360	0.362	0.362
R^2	0.0930	0.178	0.214	0.202	0.177	0.145	0.154	0.192
Fathers	1,401	1,346	902	848	1,335	1,337	1,343	1,337
Children	2,418	2,245	1,156	1,089	2,224	2,226	2,238	2,231
Observations	2,418	30,459	15,726	14,733	16,072	14,387	19,034	11,425

NOTE.— The sample includes children born 1986-2004 who are resident in Denmark on January 1 of each year through age 16, with parents born after 1954 and fathers deployed in Afghanistan or Iraq in 2003-2012. Columns 2-8 are restricted to children with a 9th grade test score in math or Danish. Columns 3-8 further split the test score sample according to the sex of the child, assessment method, and test subject. Each column presents estimates from separate OLS regressions. In column 1 the dependent variable is an indicator taking the value one if a test score is observed for the child, and zero otherwise. In columns 2-8 the dependent variable is the standardized test score. One combat event is an indicator variable taking the value one if the father was exposed to a single combat event, and zero otherwise. Two or more combat events is an indicator variable taking the value one if the father was exposed to more than combat event, and zero otherwise. For columns 2-8, other variables included in the regressions but not shown are similar to those in column 3 of Table 5. For column 1, other variables included in the regressions but not shown are the same as in column 3 of Table 5, with test-related variables in addition. Observations are per child in column 1, and test scores weighted by child in columns 2-8. Standard errors clustered by father in parentheses.* p <0.10, ** p <0.05, *** p <0.01.

Selection issues for the distinction between the effects of single and multiple combat events notwithstanding, we can explore the variation in these effects by child's age at father's first combat exposure. Figure 6 shows that single exposure effects are increasing in magnitude throughout childhood, with a decrease of a 40 percent of a standard deviation test score for single exposure at ages 12-14. Moreover, we can rule out decreases of less than 20 percent of a standard deviation. The effect of multiple combat exposures is smaller and insignificant at some ages, even though the lack of an age profile may be due to the child's age being measured at first exposure.

Figure 6: Effects of Combat Exposure by Child Age at First Exposure and Number of Combat Events.



NOTE.— The figure shows coefficients on single and multiple combat exposure indicators from OLS regressions explaining test scores using the same specification and sample as in column 2 of Table 13. The left pane shows coefficients from a single combat event indicator variable taking the value one if the father was exposed to a single combat event, and zero otherwise. The right pane shows coefficients from an indicator variable taking the value one if the father was exposed to more than combat event, and zero otherwise. The lines show point estimates restricting to rolling three-year windows of child's age at father's first combat exposure or deployment. Shaded bands indicate 95 percent confidence intervals. The vertical line indicates typical 9th grade testing age of 15; left of the line indicates the father's first exposure or deployment before the child is tested; right of the line indicates the father's first exposure or deployment after the child was tested.

Taken together, our robustness checks for coding combat exposure suggest that inclusions and exclusions from our definition do not change the findings. Moreover, military communications per se are not driving the results. Consequently, modeling the extensive margin of combat exposure is a parsimonious choice that is not subject to selection issues affecting the intensive margin.

5.4 Mechanisms—Mental Health Outcomes

One possible mechanism driving the effects of fathers' combat exposure on children's test scores is the impact of combat exposure on the parents' mental health which may in turn impact the children's mental health outcomes and could explain their lower test scores.[14] In Table 14, we investigate the use of mental health services such as psychiatric hospitalization (both inpatient and outpatient), contact with psychologists and psychiatrists outside of a hospital setting, suicide attempts, and the purchase of psychotropic medication. [15]

Table 14: Combat Exposure and Family Mental Health

	(1) Psychiatric Hospitalization	(2) Substance Abuse Diagnosis	(3) PTSD Diagnosis	(4) Psychologist Contact	(5) Psychiatrist Contact	(6) Suicide Attempt	(7) Psychotropic Medication
Panel A: Child outcomes							
Combat exposure	0.0197	0.0010	0.0001	0.0048	0.0453**	0.0203*	0.0034
	(0.0215)	(0.0033)	(0.0035)	(0.0072)	(0.0193)	(0.0122)	(0.0153)
Boy exposed	-0.0202	0.0023	-0.0045	-0.0117	-0.0688***	-0.0140	-0.0087
	(0.0259)	(0.0050)	(0.0031)	(0.0087)	(0.0227)	(0.0153)	(0.0189)
R^2	0.0226	0.0349	0.0224	0.0209	0.0513	0.0223	0.0249
Mean of dep var	0.154	0.0046	0.0033	0.0157	0.117	0.0227	0.0802
Observations	2,418	2,418	2,418	2,418	2,418	2,418	2,418
Panel B: Mother outcomes							
Combat exposure	0.0329**	-0.0010	0.0052	0.0072	-0.0120	0.0078	0.0391***
	(0.0153)	(0.0054)	(0.0049)	(0.0079)	(0.0205)	(0.0071)	(0.0143)
R^2	0.0076	0.0079	0.0027	0.0022	0.0026	0.0035	0.0109
Mean of dep var	0.0874	0.0100	0.0080	0.0214	0.172	0.0134	0.0748
Observations	1,498	1,498	1,498	1,498	1,498	1,498	1,498
Panel C: Father outcomes							
Combat exposure	0.0151	0.0178***	0.0126	-0.0008	-0.00820	0.00405	0.0141
	(0.0163)	(0.0065)	(0.0136)	(0.0042)	(0.0126)	(0.0056)	(0.0148)
R^2	0.0368	0.0112	0.0280	0.0043	0.0020	0.0027	0.0248
Mean of dep var	0.0964	0.0136	0.0642	0.0057	0.0528	0.0071	0.0771
Observations	1,401	1,401	1,401	1,401	1,401	1,401	1,401

NOTE.—The sample includes children born 1986-2004 who are resident in Denmark on January 1 of each year through age 16, have both parents born after 1954 and the father was deployed in Afghanistan or Iraq in 2003-2012. Each column within each panel presents estimates from separate OLS regressions. Panels present outcomes for different family members. Each column has a different dependent variable which is an indicator taking the value one if the mental health outcomes is registered after a combat event (or after first deployment in the absence of a combat event), and zero otherwise. Combat exposure is an indicator variable taking the value one if the father was exposed to a combat event, and zero otherwise. "Boy exposed" is an indicator variable interacting combat exposure with a male child indicator. Substance abuse diagnosis includes alcohol abuse and dependence (F10.1, F10.2 and F10.3), and drug abuse and dependence (F11.2, F11.2, F13.1, F13.2 and F14.2). All regressions control for the rank of the father. Child regressions also control for the child's year of birth. Standard errors clustered by father in parentheses. * p <0.10, ** p <0.05, *** p <0.01.

Given that the literature on mental health consequences of a deployment has often emphasized the comorbidity of substance abuse diagnosis and PTSD (e.g., Thomas et al., 2010; Wilk et al., 2010; Seal et al., 2011), we also investigate these diagnoses in our sample. We find that combat exposure does not cause PTSD, whereas combat exposure causes substance abuse (Table 14, panel C, column 2). In the full population of those deployed in 1992-2012, the prevalence of PTSD is 4.9 percent, while among the deployed fathers of children born 1986-2004 it is 6.4 percent. MacManus et al. (2014)

[14]We do not have information about the psychological treatment provided by the military, because the military does not provide medical treatment for mental health problems. The most serious cases would have been referred to the public health care system, and observed in our data.

[15]All prescriptions of psychotropic medication for children under age six are regulated by the Health Authority's specialist guidelines (VEJ nr 9733 of 9 July 2019: https://www.retsinformation.dk/eli/retsinfo/2019/9733). Nonetheless both GPs and specialists can prescribe psychotropic medication to these children.

reviewing the literature related to UK military deployments, concluding that soldiers have remained resilient despite prolonged combat missions in Iraq and Afghanistan. However, one exception was the high rates of alcohol misuse associated with deployment. In our study, we find that combat exposure leads to a diagnosis of substance abuse.

For children, Table 14 shows that combat exposure increases the likelihood of seeing a psychiatrist by 38 percent and of attempted suicide by 89 percent for girls. Table 14, Panel A, also shows that boys whose father was exposed are less likely to see a psychiatrist. The prevalence of mental health service use among children of the deployed shown in Table 14, Panel A (child's outcomes) is similar to that in the general population born 1986-2004 (see table A.5). Table 14, Panel B shows that mothers of children whose father was exposed to combat are more likely to be prescribed psychotropic medication, and to be admitted to a psychiatric hospital.

Table 15: Combat Exposure and Family Medication - Psychotropics and Opioids

	(1) Antipsychotics	(2) Anxiolytics	(3) Sedatives	(4) Antidepressants	(5) Psychostimulants	(6) Opioids
Panel A: Child outcomes						
Combat exposure	0.0072	0.0092	0.0040	0.0245**	0.0046	0.0065
	(0.0107)	(0.0063)	(0.0094)	(0.0123)	(0.0101)	(0.0064)
Son of exposed	-0.0003	-0.0115*	0.0081	-0.0283*	-0.0091	-0.0071
	(0.0135)	(0.0068)	(0.0121)	(0.0146)	(0.0116)	(0.0074)
R^2	0.0312	0.0181	0.0094	0.0422	0.0126	0.0130
Mean of dep var	0.0347	0.0099	0.0294	0.0413	0.0277	0.0107
Observations	2,418	2,418	2,418	2,418	2,418	2,418
Panel B: Mother outcomes						
Combat exposure	0.0090	0.0166*	0.0010	0.0337**	0.0089	0.0152*
	(0.0102)	(0.0091)	(0.0098)	(0.0134)	(0.0058)	(0.0085)
R^2	0.0041	0.0069	0.0028	0.0110	0.0034	0.0075
Mean of dep var	0.0367	0.0287	0.0334	0.0654	0.0113	0.0254
Observations	1,498	1,498	1,498	1,498	1,498	1,498
Panel C: Father outcomes						
Combat exposure	0.0203*	0.00003	-0.0009	0.0097	-0.0020	0.0076
	(0.0117)	(0.0081)	(0.0104)	(0.0138)	(0.0030)	(0.0083)
R^2	0.0220	0.0039	0.0059	0.0207	0.0024	0.0082
Mean of dep var	0.0464	0.0214	0.0357	0.0657	0.0029	0.0221
Observations	1,401	1,401	1,401	1,401	1,401	1,401

NOTE.— The sample includes children born 1986-2004 who are resident in Denmark on January 1 of each year through age 16, with parents born after 1954 and fathers deployed in Afghanistan or Iraq in 2003-2012. Each column within each panel presents estimates from separate OLS regressions. Panels present outcomes for different family members. Each column has a different dependent variable, which is an indicator taking the value one if the medication is purchased after a combat event (or after first deployment in the absence of a combat event), and zero otherwise. Combat exposure is an indicator variable taking the value one if the father was exposed to a combat event, and zero otherwise. Boy exposed is an indicator variable interacting combat exposure with a male child indicator. ATC codes: N05A (Antipsychotics), N05B (Anxiolytics), N05C (Hypnotics and sedatives), N06A (Antidepressants), N06B (Psychostimulants), N02A (Opioids). All regressions control for the rank of the father. Child regressions also control for the child's year of birth. Standard errors clustered by father in parentheses * p <0.10, ** p <0.05, *** p <0.01.

To further investigate the effect of combat exposure on family members, we explore the purchase of psychotropic medication (MHM) and opioids. Table 15, Panel A shows that children—especially daughters—of combat-exposed fathers are more likely to purchase anti-depressants. Again, once we compare the purchase of MHM of the children of the deployed with the rest of the population of children born 1986-2004, we find that the children of the deployed purchase less MHM (see Table A.5). Table 15, Panel B also shows an increase in the purchase of antidepressants for the mothers, while the effect for the fathers is relatively weak. This finding could reflect either a healthy warrior effect (Larson et al., 2008) or help-seeking behavior with a lower use of mental health services in general (Møller et al., 2020).

6 Conclusion

Using rare Danish data, we follow fathers and their families in Denmark after one or several potentially traumatizing events occurring during the fathers' military deployment. To do so, we combine Danish military communications about incidents involving fathers deployed in peace-enforcing missions in Afghanistan and Iraq, with administrative data about these fathers and their families. While the deployed fathers and their co-parents have somewhat less schooling than non-deployed parents, conditional on deployment, exposure to combat is uncorrelated with pre-determined characteristics. Because combat exposure is as-good-as randomly distributed, we can therefore identify the causal effect of combat exposure on these families.

We find that military deployment of fathers per se is not associated with differences in the nationwide children's test scores at the end of compulsory school, around age 15. However, conditional on deployment, combat exposure causes a significant reduction in test scores compared to the scores of children of deployed fathers not exposed to combat, with an effect size of 13 percent of a standard deviation. The results are robust to a sibling differences specification, and to several falsifications tests, considering fathers' combat exposure after children's tests are taken, classmates of children with fathers exposed to combat, and events unrelated to combat, but mentioned in military communications.

Exploring heterogeneity, we find substantive differences in the effects of combat by the age of the child at exposure. Combat exposure effects are first significant pre-school, and then again from age nine, increasing in size until age 14, right before test taking, causing a drop in test scores of 20 percent of a standard deviation. Daughters are most affected by their fathers' combat exposure pre-school and right before testing, whereas sons are most affected by their fathers' combat exposure during primary school.

Investigating possible mechanisms for our test score findings by analyzing mental health in the family, we find significant effects for several mental health indicators for these fathers, their children, and the mothers of their children. The fathers are more likely to suffer from substance abuse, while the mothers and daughters see psychiatrists more often (mothers within a hospital setting, daughter not), and are more likely to purchase antidepressants.

Our results have implications for assessing the costs of deployment in general and exposure to combat in particular. We find that the impact of combat exposure is transmitted to other family members. A clear policy implication is for health and social authorities to consider creating programs that mitigate the effects of parental trauma on indirectly exposed children.

Declaration of competing interest The authors declare that they have no conflict of interest.

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Appendix

A Additional tables and figures

A.1 Tables

Table A.1: Grandparent Characteristics and Father Deployment Status

	All	Deployed	Iraq	Afghanistan	Combat	Support	Staff
Father's mother HS	0.2507	0.3175	0.2700	0.3607	0.3088	0.3145	0.3275
	(0.4334)	(0.4656)	(0.4441)	(0.4804)	(0.4628)	(0.4645)	(0.4696)
Father's mother col.	0.1092	0.1430	0.1710	0.1176	0.1368	0.1198	0.1953
	(0.3119)	(0.3502)	(0.3767)	(0.3223)	(0.3443)	(0.3248)	(0.3967)
Father's father HS	0.3333	0.4026	0.3898	0.4144	0.4105	0.4322	0.3363
	(0.4714)	(0.4905)	(0.4879)	(0.4928)	(0.4928)	(0.4956)	(0.4728)
Father's father col.	0.1249	0.1621	0.1710	0.1539	0.1193	0.1184	0.2731
	(0.3306)	(0.3686)	(0.3767)	(0.3610)	(0.3247)	(0.3232)	(0.4459)
Mother's mother HS	0.2706	0.3394	0.3429	0.3362	0.3544	0.3386	0.3348
	(0.4443)	(0.4736)	(0.4749)	(0.4726)	(0.4792)	(0.4734)	(0.4723)
Mother's mother col.	0.1166	0.1368	0.1233	0.1492	0.1509	0.1211	0.1645
	(0.3210)	(0.3437)	(0.3289)	(0.3564)	(0.3586)	(0.3264)	(0.3710)
Mother's father HS	0.3577	0.4031	0.3924	0.4128	0.4316	0.4123	0.3715
	(0.4793)	(0.4906)	(0.4885)	(0.4925)	(0.4962)	(0.4924)	(0.4836)
Mother's father col.	0.1300	0.1455	0.1484	0.1429	0.1368	0.1191	0.2056
	(0.3363)	(0.3527)	(0.3557)	(0.3501)	(0.3443)	(0.3240)	(0.4044)
Mother's brothers	0.7924	0.8020	0.8351	0.7719	0.8140	0.8121	0.7753
	(0.8735)	(0.7892)	(0.8065)	(0.7723)	(0.7295)	(0.7801)	(0.8319)
Mother's sisters	0.7257	0.7234	0.7144	0.7316	0.7754	0.7116	0.7269
	(0.8522)	(0.8119)	(0.8599)	(0.7660)	(0.8953)	(0.7856)	(0.8307)
Father's brothers	0.7913	0.8144	0.7674	0.8571	0.7860	0.8245	0.8047
	(0.8967)	(0.8545)	(0.8387)	(0.8668)	(0.7781)	(0.8593)	(0.8753)
Father's sisters	0.6998	0.7363	0.7109	0.7593	0.8140	0.7619	0.6490
	(0.8221)	(0.7786)	(0.7858)	(0.7715)	(0.8582)	(0.7827)	(0.7267)
Mother's half-sibs	0.2984	0.3406	0.3273	0.3528	0.3754	0.3482	0.3098
	(0.8897)	(0.8969)	(0.8772)	(0.9147)	(0.8697)	(0.8868)	(0.9296)
Father's half-sibs	0.2372	0.3915	0.4427	0.3449	0.7053	0.4226	0.1938
	(0.7977)	(1.0262)	(1.0546)	(0.9977)	(1.5026)	(1.0294)	(0.6756)
Individuals	1,005,425	2,419	1,152	1,267	285	1,453	681

NOTE.— Descriptive statistics for grandparents for children born 1986-2004 who are resident in Denmark every 1 January until turning 16, and have both parents born after 1954. Column 1 includes grandparents of all these children. Column 2 restricts the sample to grandparents of children with a father deployed to Afghanistan or Iraq during the period 2003-2012. Columns 3-4 split the deployed sample by country of mission, and columns 5-7 split the deployed sample according to type of unit. Statistics are means of indicator variables for highest schooling level being high school (HS) or college (col.), and means and standard deviations (in parentheses) of counts for maternal and paternal siblings. Observations are in the year before the child is born.

Table A.2: Balancing Tests for Exposure to Combat - Relative to Test Time.

	Exposure Before Test			Exposure After Test			Exposure Anytime		
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
Father high school	-0.0387	-0.00131	-0.0110	-0.0196	-0.0207	-0.0227	-0.0271	-0.0258	-0.0279
	(0.0653)	(0.0656)	(0.0659)	(0.0307)	(0.0307)	(0.0308)	(0.0289)	(0.0290)	(0.0291)
Father college	-0.156	-0.140	-0.154	-0.0773	-0.0746	-0.0743	-0.0889*	-0.0829*	-0.0838*
	(0.114)	(0.114)	(0.115)	(0.0533)	(0.0536)	(0.0539)	(0.0499)	(0.0502)	(0.0505)
Father's mother HS	-0.0409	-0.0218	-0.00422	0.0248	0.0244	0.0251	0.0265	0.0267	0.0278
	(0.0722)	(0.0723)	(0.0724)	(0.0295)	(0.0297)	(0.0298)	(0.0281)	(0.0282)	(0.0283)
Father's mother col.	-0.0384	-0.0276	0.0592	-0.00388	-0.00638	-0.00978	-0.00205	-0.00592	-0.00766
	(0.130)	(0.132)	(0.134)	(0.0386)	(0.0389)	(0.0391)	(0.0376)	(0.0378)	(0.0379)
Father's father HS	0.0421	0.00741	-0.0185	0.00192	0.00235	-0.000546	-0.00205	-0.00245	-0.00381
	(0.0698)	(0.0706)	(0.0703)	(0.0284)	(0.0285)	(0.0288)	(0.0269)	(0.0270)	(0.0272)
Father's father col.	-0.0201	-0.00938	-0.00877	0.00525	-0.00771	-0.00987	-0.0102	-0.0193	-0.0213
	(0.115)	(0.117)	(0.120)	(0.0395)	(0.0398)	(0.0400)	(0.0379)	(0.0381)	(0.0383)
Father's brothers	0.0111	0.0120	0.0310	0.0292*	0.0278*	0.0277*	0.0199	0.0177	0.0178
	(0.0311)	(0.0312)	(0.0313)	(0.0159)	(0.0159)	(0.0160)	(0.0148)	(0.0148)	(0.0149)
Father's sisters	-0.0426	-0.0611	-0.0455	-0.00910	-0.00640	-0.00568	-0.00813	-0.00690	-0.00583
	(0.0384)	(0.0385)	(0.0384)	(0.0169)	(0.0169)	(0.0170)	(0.0160)	(0.0160)	(0.0161)
Father's half-sibs	0.0399	0.0378	0.0325	0.00324	0.00156	0.00214	0.00217	0.00131	0.00164
	(0.0322)	(0.0324)	(0.0326)	(0.0127)	(0.0128)	(0.0128)	(0.0121)	(0.0121)	(0.0122)
Mother high school		0.0278	-0.0122		0.0307	0.0242		0.0235	0.0158
		(0.0699)	(0.0702)		(0.0335)	(0.0342)		(0.0307)	(0.0313)
Mother college		-0.0675	-0.103		0.00765	0.00224		0.00580	-0.00184
		(0.0950)	(0.0973)		(0.0422)	(0.0438)		(0.0393)	(0.0407)
Mother's mother HS		-0.0803	-0.0805		-0.0373	-0.0351		-0.0511*	-0.0492*
		(0.0682)	(0.0690)		(0.0286)	(0.0287)		(0.0274)	(0.0275)
Mother's mother col.		-0.0676	-0.0474		0.0311	0.0351		0.0229	0.0262
		(0.125)	(0.125)		(0.0414)	(0.0415)		(0.0403)	(0.0404)
Mother's father HS		0.125**	0.139**		-0.0325	-0.0360		-0.0107	-0.0120
		(0.0621)	(0.0617)		(0.0277)	(0.0278)		(0.0263)	(0.0264)
Mother's father col.		0.158	0.115		0.0216	0.0183		0.0259	0.0255
		(0.0992)	(0.101)		(0.0403)	(0.0404)		(0.0388)	(0.0389)
Mother's brothers		0.0845**	0.0965***		0.000430	0.000623		0.0127	0.0132
		(0.0337)	(0.0343)		(0.0162)	(0.0163)		(0.0152)	(0.0153)
Mother's sisters		-0.00878	-0.00907		-0.0107	-0.00732		-0.00642	-0.00369
		(0.0370)	(0.0381)		(0.0158)	(0.0159)		(0.0149)	(0.0150)
Mother's half-sibs		0.0323	0.0329		-0.0110	-0.00902		-0.0156	-0.0144
		(0.0438)	(0.0438)		(0.0138)	(0.0139)		(0.0133)	(0.0135)
Child male			0.0321			-0.0353			-0.0251
			(0.0579)			(0.0249)			(0.0237)
Income at 15			-0.00549			-0.000966			-0.00101
			(0.00658)			(0.00234)			(0.00225)
Child's brothers			-0.164**			-0.0135			-0.0291
			(0.0753)			(0.0246)			(0.0245)
Child's sisters			-0.107			-0.0581**			-0.0438
			(0.0830)			(0.0287)			(0.0285)
Child's half-sibs			-0.107*			-0.00557			-0.0104
			(0.0601)			(0.0230)			(0.0233)
F-Statistic	0.582	1.196	1.385	0.823	0.936	0.901	0.769	0.939	0.868
F-Stat p-value	0.811	0.268	0.113	0.595	0.534	0.609	0.645	0.531	0.657
Partial-R^2	0.0261	0.104	0.168	0.00654	0.0149	0.0207	0.00559	0.0136	0.0183
Observations	276	276	276	1,238	1,238	1,237	1,346	1,346	1,345

NOTE.— The sample contains fathers as that described in the note to Table 4. Columns of the table present coefficients from different OLS regressions. The dependent variable in columns 7-9 is an indicator taking the value one if the father was exposed to a combat event while deployed, and taking the value zero otherwise. The dependent variable in columns 1-3 is an indicator variable taking the value one if the father was exposed to a combat event before the child in question took the test, and taking the value zero otherwise. The dependent variable in columns 4-6 is an indicator variable taking the value one if the father was exposed to a combat event after the child in question took the test, and taking the value zero otherwise. Additional controls included but not shown are dummies for mission, rank (private, sergeant, officer, other), unit type (combat, support, staff, other), year of birth of father, mother (in columns 2, 3, 5 and 6), and child (in columns 3 and 6). For these regressions, each father has one observation and we choose the first child born in the cohort range together with the mother. Standard errors in parentheses.* p <0.10, ** p <0.05, *** p <0.01.

Table A.3: Balancing Tests for Exposure to Combat - Excluding Different Event Types

	(1) IDF	(2) TIC	(3) IED	(4) Minor Injury	(5) WIAKIA	(6) Repatriated
Child male	-0.0187	-0.0170	-0.0165	-0.0250	-0.0211	-0.00869
	(0.0237)	(0.0239)	(0.0237)	(0.0252)	(0.0238)	(0.0242)
Income at 15	-0.00227	-0.00182	-0.00129	-0.00213	-0.00186	-0.00260
	(0.00226)	(0.00229)	(0.00227)	(0.00241)	(0.00227)	(0.00231)
Copenhagen	0.00539	0.00987	0.0122	0.0224	0.00122	-0.00754
	(0.0491)	(0.0488)	(0.0492)	(0.0513)	(0.0494)	(0.0502)
Odense	-0.0492	-0.0428	-0.0296	-0.0836	-0.0456	-0.0697
	(0.0825)	(0.0842)	(0.0812)	(0.0865)	(0.0826)	(0.0840)
Aarhus	-0.000237	-0.0588	0.0230	0.0166	0.00183	-0.00272
	(0.0550)	(0.0570)	(0.0553)	(0.0590)	(0.0551)	(0.0553)
Child's brothers	-0.0251	-0.0219	-0.0282	-0.0391	-0.0243	-0.0268
	(0.0243)	(0.0243)	(0.0247)	(0.0266)	(0.0244)	(0.0257)
Child's sisters	-0.0241	-0.0191	-0.0195	-0.0449	-0.0231	-0.0266
	(0.0279)	(0.0280)	(0.0278)	(0.0300)	(0.0280)	(0.0285)
Father high school	-0.0276	-0.0355	-0.0380	-0.0119	-0.0320	-0.0136
	(0.0290)	(0.0293)	(0.0290)	(0.0315)	(0.0291)	(0.0298)
Father college	-0.0636	-0.0528	-0.0604	-0.0358	-0.0642	-0.0472
	(0.0502)	(0.0507)	(0.0499)	(0.0523)	(0.0503)	(0.0510)
Mother high school	-0.0126	-0.0139	-0.00651	-0.0251	-0.0132	-0.0192
	(0.0318)	(0.0322)	(0.0319)	(0.0346)	(0.0320)	(0.0326)
Mother college	-0.0243	-0.0213	-0.0120	-0.0317	-0.0200	-0.0313
	(0.0404)	(0.0408)	(0.0405)	(0.0437)	(0.0405)	(0.0412)
Father's mother HS	0.0330	0.0205	0.0281	0.0420	0.0318	0.0224
	(0.0285)	(0.0290)	(0.0285)	(0.0307)	(0.0287)	(0.0291)
Father's mother col.	0.00410	-0.0212	-0.00643	0.00752	-0.00436	-0.00105
	(0.0379)	(0.0385)	(0.0379)	(0.0406)	(0.0381)	(0.0384)
Father's father HS	-0.00249	0.00880	-0.0166	0.00410	-0.00165	0.0138
	(0.0272)	(0.0276)	(0.0272)	(0.0291)	(0.0273)	(0.0278)
Father's father col.	-0.0195	-0.00211	-0.0251	-0.00108	-0.0130	-0.00463
	(0.0383)	(0.0385)	(0.0384)	(0.0412)	(0.0385)	(0.0388)
Mother's mother HS	-0.0383	-0.0526*	-0.0295	-0.0241	-0.0386	-0.0266
	(0.0276)	(0.0280)	(0.0275)	(0.0297)	(0.0277)	(0.0282)
Mother's mother col.	0.0205	0.0152	0.0282	0.0511	0.0292	0.0374
	(0.0407)	(0.0413)	(0.0405)	(0.0435)	(0.0407)	(0.0418)
Mother's father HS	-0.0146	0.000684	-0.0185	0.00801	-0.0114	-0.0222
	(0.0262)	(0.0266)	(0.0263)	(0.0284)	(0.0263)	(0.0268)
Mother's father col.	0.0299	0.0354	0.0277	0.0299	0.0307	0.0275
	(0.0390)	(0.0399)	(0.0389)	(0.0415)	(0.0391)	(0.0398)
Mother's brothers	0.0155	0.0139	0.0198	0.0170	0.0150	0.0154
	(0.0153)	(0.0154)	(0.0152)	(0.0162)	(0.0155)	(0.0156)
Mother's sisters	-0.00870	-0.0121	-0.0110	-0.0130	-0.00886	-0.00644
	(0.0151)	(0.0152)	(0.0151)	(0.0163)	(0.0151)	(0.0154)
Father's brothers	0.0171	0.00993	0.0179	0.0307*	0.0149	0.00730
	(0.0148)	(0.0149)	(0.0148)	(0.0158)	(0.0149)	(0.0151)
Father's sisters	-0.00563	-0.000440	-0.0141	0.00886	-0.00547	-0.00385
	(0.0161)	(0.0163)	(0.0161)	(0.0174)	(0.0162)	(0.0163)
Mother's half-sibs	-0.0167	-0.0102	-0.0164	-0.0196	-0.0157	-0.0214
	(0.0132)	(0.0131)	(0.0133)	(0.0144)	(0.0132)	(0.0135)
Father's half-sibs	0.000951	-0.00188	0.000396	-0.00268	0.00204	0.00719
	(0.0122)	(0.0125)	(0.0124)	(0.0132)	(0.0123)	(0.0127)
Child's half-sibs	-0.0168	-0.0159	-0.00700	0.00526	-0.0126	-0.0162
	(0.0234)	(0.0233)	(0.0235)	(0.0254)	(0.0235)	(0.0236)
F-Statistic	0.713	0.677	0.754	0.834	0.691	0.650
F-Stat p-value	0.853	0.888	0.809	0.704	0.875	0.910
Partial-R^2	0.0151	0.0152	0.0165	0.0209	0.0147	0.0145
Observations	1,345	1,272	1,300	1,149	1,339	1,282

NOTE.— The sample contains fathers as that described in the note to Table 4. Columns of the table present coefficients from different OLS regressions. Columns 1-3 drop children of fathers who experienced specific types of combat event: (1) Indirect fire, (2) Troops in contact, (3) Improvised explosive device. Columns 4-6 drop children of fathers who experienced other events: (4) minor injury (requiring registered medical attention), (5) wounded or killed in action, (6) repatriated before end of mission. The dependent variable is an indicator taking the value one if the father was exposed to a combat event while deployed, and taking the value zero otherwise. Additional controls included but not shown are dummies for mission, rank (private, sergeant, officer, other), unit type (combat, support, staff, other), year of birth of father, mother, and child. For these regressions, each father has one observation and we choose the first child born in the cohort range together with the mother. Standard errors in parentheses.* p <0.10, ** p <0.05, *** p <0.01.

Table A.4: Balancing Tests for Non-Combat Events - Relative to Test Time.

	Exposure Before Test			Exposure After Test			Exposure Anytime		
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
Father high school	0.0614	0.0497	0.0363	0.00485	0.00544	0.00374	0.00864	0.00784	0.00522
	(0.0412)	(0.0422)	(0.0433)	(0.0178)	(0.0179)	(0.0180)	(0.0173)	(0.0174)	(0.0175)
Father college	0.0625	0.0553	0.0414	0.0230	0.0242	0.0196	0.0249	0.0237	0.0205
	(0.0722)	(0.0734)	(0.0750)	(0.0304)	(0.0307)	(0.0310)	(0.0294)	(0.0296)	(0.0299)
Father's mother HS	0.00229	-0.00615	0.00135	0.0151	0.0139	0.0162	0.00506	0.00394	0.00832
	(0.0453)	(0.0463)	(0.0468)	(0.0172)	(0.0173)	(0.0175)	(0.0169)	(0.0170)	(0.0171)
Father's mother col.	-0.0861	-0.0908	-0.0857	0.00466	0.00695	0.00670	-0.00743	-0.00574	-0.00485
	(0.0771)	(0.0805)	(0.0819)	(0.0224)	(0.0227)	(0.0227)	(0.0226)	(0.0228)	(0.0228)
Father's father HS	-0.0358	-0.0263	-0.0369	-0.0220	-0.0196	-0.0243	-0.0133	-0.0111	-0.0153
	(0.0426)	(0.0438)	(0.0442)	(0.0165)	(0.0166)	(0.0168)	(0.0162)	(0.0162)	(0.0164)
Father's father col.	0.0146	0.0270	0.0328	-0.0147	-0.0154	-0.0139	-0.00704	-0.00662	-0.00576
	(0.0701)	(0.0724)	(0.0743)	(0.0229)	(0.0232)	(0.0232)	(0.0227)	(0.0229)	(0.0229)
Father's brothers	-0.00250	0.000598	-0.00420	-0.0110	-0.0119	-0.0120	-0.00634	-0.00662	-0.00600
	(0.0195)	(0.0200)	(0.0201)	(0.00920)	(0.00924)	(0.00927)	(0.00878)	(0.00882)	(0.00885)
Father's sisters	0.0201	0.0240	0.0285	-0.0140	-0.0140	-0.0139	-0.00949	-0.00911	-0.00840
	(0.0238)	(0.0246)	(0.0250)	(0.00984)	(0.00989)	(0.00994)	(0.00957)	(0.00961)	(0.00964)
Father's half-sibs	-0.000936	0.00364	-0.00338	0.0141*	0.0134*	0.0139*	0.0113	0.0105	0.0104
	(0.0202)	(0.0207)	(0.0208)	(0.00742)	(0.00748)	(0.00752)	(0.00726)	(0.00731)	(0.00734)
Mother high school		0.0198	0.0263		-0.00426	-0.00595		0.00441	0.00380
		(0.0449)	(0.0455)		(0.0198)	(0.0202)		(0.0187)	(0.0191)
Mother college		0.0528	0.0558		-0.00430	-0.00318		0.00782	0.0113
		(0.0626)	(0.0650)		(0.0248)	(0.0257)		(0.0237)	(0.0246)
Mother's mother HS		0.0855*	0.102**		-0.0120	-0.0107		-0.00221	-0.000296
		(0.0448)	(0.0452)		(0.0167)	(0.0168)		(0.0165)	(0.0166)
Mother's mother col.		0.0307	0.0129		0.0199	0.0214		0.0174	0.0195
		(0.0819)	(0.0832)		(0.0242)	(0.0243)		(0.0242)	(0.0242)
Mother's father HS		-0.0154	-0.0106		-0.00782	-0.00663		-0.0134	-0.0128
		(0.0410)	(0.0410)		(0.0161)	(0.0162)		(0.0158)	(0.0158)
Mother's father col.		-0.0496	-0.0126		-0.0386	-0.0395*		-0.0423*	-0.0418*
		(0.0633)	(0.0648)		(0.0236)	(0.0238)		(0.0233)	(0.0234)
Mother's brothers		-0.00641	-0.00914		-0.00794	-0.00863		-0.00990	-0.0107
		(0.0218)	(0.0220)		(0.00938)	(0.00941)		(0.00909)	(0.00912)
Mother's sisters		0.0140	0.00687		-0.00781	-0.00796		-0.00567	-0.00571
		(0.0233)	(0.0240)		(0.00906)	(0.00912)		(0.00889)	(0.00893)
Mother's half-sibs		0.0190	0.0108		0.000907	0.00123		0.00249	0.00260
		(0.0276)	(0.0278)		(0.00807)	(0.00813)		(0.00804)	(0.00810)
Child male			-0.0655*			0.00731			-0.00308
			(0.0374)			(0.0146)			(0.0142)
Income at 15			-0.00521			-0.000512			-0.00175
			(0.00406)			(0.00138)			(0.00136)
Child's brothers			0.00904			0.00700			0.00279
			(0.0454)			(0.0139)			(0.0143)
Child's sisters			-0.0130			-0.000376			-0.0106
			(0.0493)			(0.0155)			(0.0164)
Child's half-sibs			0.0478			-0.0103			-0.00946
			(0.0473)			(0.0137)			(0.0139)
F-Statistic	0.580	0.606	0.842	0.909	0.749	0.728	0.520	0.541	0.651
F-Stat p-value	0.813	0.893	0.689	0.517	0.761	0.838	0.861	0.940	0.910
Partial-R^2	0.0233	0.0494	0.0978	0.00722	0.0119	0.0168	0.00379	0.00790	0.0138
Observations	302	302	302	1,238	1,238	1,238	1,346	1,346	1,346

NOTE.—The sample contains fathers as described in the note to Table 4. Columns of the table present coefficients from different OLS regressions. The dependent variable in columns 7-9 is an indicator taking the value one if the father was exposed to a non-combat event, conditional on never being exposed to a combat event, and taking the value zero otherwise. The dependent variable in columns 1-3 is an indicator variable taking the value one if the father was exposed to a non-combat event before the child in question was tested, conditional on never being exposed to a combat event, and taking the value zero otherwise. The dependent variable in columns 4-6 is an indicator variable taking the value one if the father was a non-combat event after the child in question was tested, conditional on never being exposed to a combat event, and taking the value zero otherwise. Additional controls included but not shown are dummies for mission, rank (private, sergeant, officer, other), unit type (combat, support, staff, other), year of birth of father, mother (in columns 2, 3, 5 and 6), and child (in columns 3 and 6). For these regressions, each father has one observation and we choose the first child born in the cohort range together with the mother. Standard errors in parentheses.* p <0.10, ** p <0.05, *** p <0.01.

Table A.5: Deployment and child mental health outcomes.

	(1) Psychiatric Hospitalization	(2) Substance Abuse Diagnosis	(3) PTSD Diagnosis	(4) Psychologist Contact	(5) Psychiatrist Contact	(6) Suicide Attempt	(7) Psychotropic Medication
deployed	0.00811	0.000107	0.0000675	-0.00351	-0.0369***	0.00255	-0.00903
	(0.00742)	(0.00136)	(0.00116)	(0.00280)	(0.00753)	(0.00472)	(0.00589)
R^2	0.00000103	5.43e-09	2.93e-09	0.00000136	0.0000209	0.000000253	0.00000204
Mean of dep var	0.157	0.00445	0.00325	0.0193	0.163	0.0236	0.0919
Observations	1,153,739	1,153,739	1,153,739	1,153,739	1,153,739	1,153,739	1,153,739

NOTE.— The sample includes all children born 1986-2004 who are resident in Denmark every 1 January until turning 16. Each column presents estimates from separate OLS regressions. Each column has a different dependent variable which is an indicator taking the value one if the mental health outcomes is registered after 2002. Deployed is an indicator variable taking the value one if the father was deployed in Afghanistan or Iraq 2003-2012, and taking the value zero otherwise. Substance abuse diagnosis includes alcohol abuse and dependence (F10.1, F10.2 and F10.3), and drug abuse and dependence (F11.2, F11.2, F13.1, F13.2 and F14.2). Standard errors clustered by father in parentheses.* p <0.10, ** p <0.05, *** p <0.01.

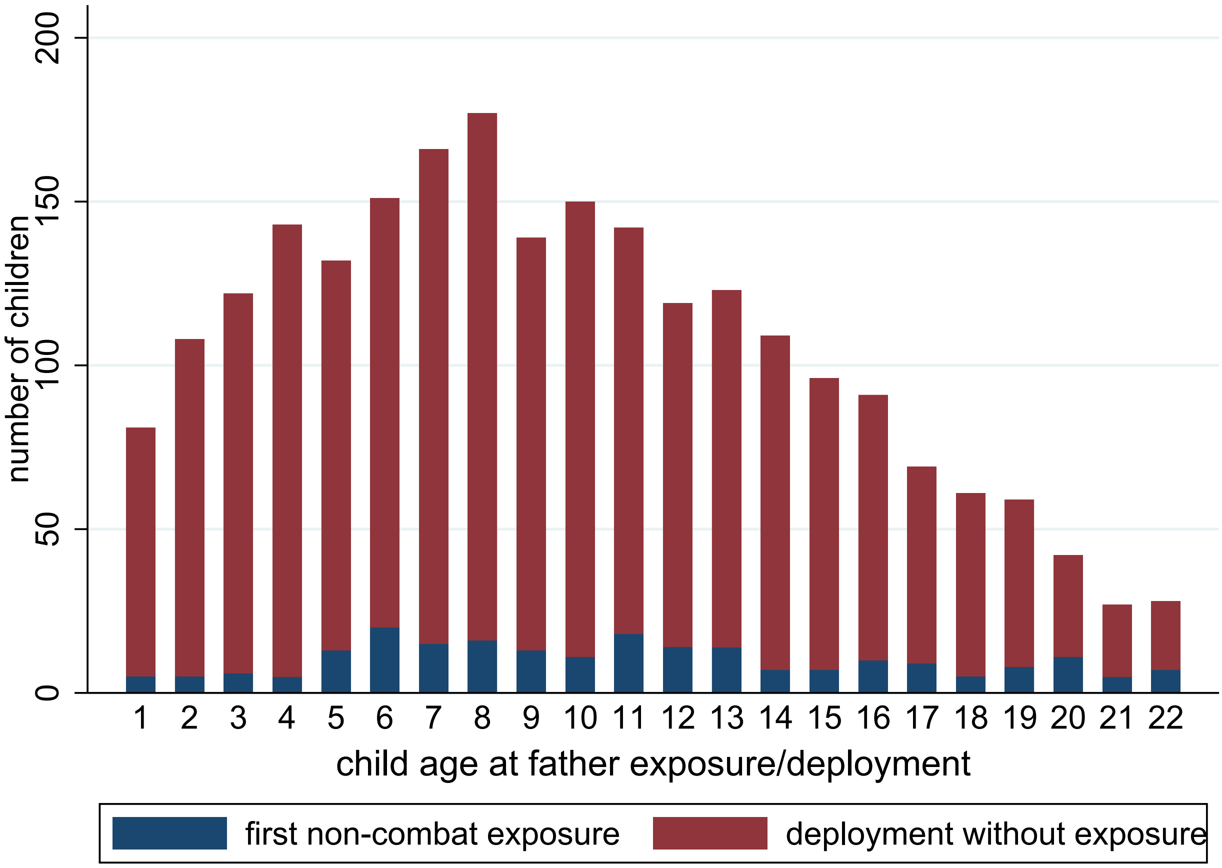
Table A.6: Deployment and child medication (psychotropic and opioids).

	(1) Antipsychotics	(2) Anxiolytics	(3) Sedatives	(4) Antidepressants	(5) Psychostimulants	(6) Opioids
deployed	-0.00184	-0.00509**	0.00168	-0.0118**	-0.00202	-0.000321
	(0.00393)	(0.00238)	(0.00344)	(0.00464)	(0.00356)	(0.00210)
R^2	0.000000190	0.00000398	0.000000205	0.00000559	0.000000280	2.04e-08
Mean of dep var	0.0387	0.0138	0.0294	0.0549	0.0315	0.0107
Observations	1,153,739	1,153,739	1,153,739	1,153,739	1,153,739	1,153,739

NOTE.—The sample includes all children born 1986-2004 who are resident in Denmark every 1 January until turning 16. Each column presents estimates from separate OLS regressions. Each column has a different dependent variable which is an indicator taking the value one if the medication is purchased after 2002. ATC codes: N05A (Antipsychotics), N05B (Anxiolytics), N05C (Hypnotics and sedatives), N06A (Antidepressants), N06B (Psychostimulants), N02A (Opioids). Standard errors clustered by father in parentheses.* * p <0.10, ** p <0.05, *** p <0.01.

A.2 Figures

Figure A.1: Father First Non-Combat Event / First Deployment by Child Age



NOTE.— The sample includes children born 1986-2004 and resident in Denmark on January 1 through age 16, with both parents born after 1954 and fathers deployed to Afghanistan or Iraq in 2003-2012. Blue bars represent number of children of a given age with a father experiencing a first non-combat event, conditional on never being exposed to a combat event. Red bars represent number of children of a given age with a father first deployed, conditional on neither experiencing a combat event or a non-combat event during the 21 missions.

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