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ABSTRACT

This study examines the long-term effects of prenatal exposure to war violence on cognitive and developmental outcomes, focusing on children in Afghanistan, a country deeply affected by prolonged violent conflict. Using data from the 2022 Afghanistan Multiple Indicator Cluster Surveys and geo-referenced information on violent incidents, we estimate the effects of prenatal exposure to civilian casualties on educational attainment, math performance, and functional and disciplinary outcomes. Our findings reveal significant gender disparities, with girls exposed in utero demonstrating substantially worse cognitive and developmental outcomes compared to boys, including lower school attendance, reduced math performance, and increased functional difficulties. These adverse effects appear to be driven by disruptions in foundational cognitive skills during critical developmental periods. Post-birth exposure, while negatively affecting both genders, has less pronounced and consistent effects. These results highlight the intergenerational consequences of war conflict, emphasizing the need for interventions that address the unique vulnerabilities of children in conflict-affected regions.

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1. Introduction

War and violent conflict bring immediate and visible consequences, such as the destruction of physical infrastructure, disruption of economic activities, forced displacement of populations, and substantial human casualties. However, their impact extends far beyond these effects, reaching deeper and often less visible costs that are frequently inadequately measured. These hidden repercussions of war and violent conflict disproportionately affect the most vulnerable members of society, particularly women and children, manifesting as heightened health risks, mental trauma, disrupted education, and distorted labor market outcomes (Akbulut-Yuksel, 2014; Akbulut-Yuksel, Tekin, and Turan, 2022; Brück, Di Maio, and Miaari, 2019; Verwimp, Justino, and Brück, 2019). Among those most at risk and often overlooked are unborn children, whose development during the critical prenatal period is especially susceptible to various stressors. During this period, maternal stress, poor nutrition, or harmful environmental exposures can disrupt fetal growth, leading to adverse birth outcomes such as low birthweight and prematurity (Black et al., 2019; Almond and Mazumder, 2011; Currie and Walker, 2011; Currie et al., 2023). These outcomes are not merely short-term concerns as poor health at birth is widely recognized to be strongly associated with impaired cognitive development, lower educational attainment, and reduced socioeconomic outcomes later in life (Currie and Moretti, 2007; Currie, 2011; Black, Devereux, and Salvanes, 2007). Despite the growing recognition of the long-term impacts of prenatal exposure to adverse conditions on children, the full extent of these effects in war and violent conflict settings remain underexplored.[1] This paper investigates the impact of in utero exposure to war violence on children's cognitive and developmental outcomes, using data from Afghanistan—a country severely affected by decades of conflict.

Understanding the cognitive and developmental effects of prenatal exposure to war conflict on children is important for several reasons. First, these outcomes are not only key predictors of individual success and well-being, but they play a foundational role in shaping societal recovery and stability in post-conflict settings (Barakat et al., 2013; Milton, 2017). Poor cognitive development in early life can hinder educational attainment, limit economic opportunities and impair labor market productivity, and perpetuate cycles of poverty and instability (Cunha et al., 2006; Grantham-McGregor et al., 2007; Heckman, 2006; Walker et al., 2007). Second, the urgency of this question is amplified by the increasing prevalence of violent conflicts worldwide, such as the ongoing war in Ukraine,

[1]The research consistently demonstrates that early-life exposure to adverse conditions, such as malnutrition, extreme weather, disease, income shocks, maltreatment, and maternal stress, has enduring effects on various outcomes, including educational attainment, labor market productivity, and physical and mental health. Several examples include Almond and Mazumder (2011) for malnutrition, Almond (2006) and Bleakley (2007) for disease environment, Bozzoli and Quintana-Domeque (2014) for income, Black, Devereux, and Salvanes (2016) for maternal bereavement and stress, Black et al. (2019) for radiation, and Currie et al. (2023) for firearm violence.

violence in Gaza, and conflicts in regions like Syria and Sudan. These conflicts place an increasing number of children in unstable and perilous conditions associated with armed conflict. In 2022 alone, approximately 468 million children—nearly 19% of the global child population—were living in conflict zones, with millions residing perilously close to areas of active fighting (Østby, Rustad, and Tollefsen, 2023). These conditions impose a particularly severe toll on infants and young children, as disruptions to essential services like healthcare, nutrition, and clean water significantly heighten developmental risks. Additionally, the stress and trauma faced by women and caregivers in these settings may compromise their ability to provide nurturing care, further jeopardizing the developmental potential of children both in utero and after birth. By focusing on Afghanistan, this paper provides fresh insights into the intergenerational effects of war conflicts. A deeper understanding of how early exposure to war violence influences development can guide more effective policies for conflict prevention, humanitarian aid, and post-conflict recovery.

Broadly, our study contributes to the newly emerging subfield of the microeconomics of violent conflict within empirical development economics, which examines how individuals and communities in conflict-affected areas adapt, cope, and are impacted, focusing on micro-level dynamics, long-term human capital effects, and the efficacy of interventions using innovative, interdisciplinary approaches (Verwimp, Justino, and Brück, 2019). More specifically, within this subfield, our paper enhances to the growing body of research on the effects of war conflict on the human capital development of children. This literature can be categorized into two strands: one examining the human capital outcomes of school-age children living in war zones, and the other focusing on the prenatal period and its long-term implications for human capital development. The former is more extensively studied, with findings showing that exposure to armed conflict reduces educational attainment and disrupts developmental trajectories across various contexts. For instance, Shemyakina (2011) finds that girls in Tajikistan were less likely to complete mandatory schooling due to conflict exposure, while Ichino and Winter-Ebmer (2004) document significant educational losses among Austrian and German children during World War II. Similarly, Akresh and de Walque (2008) shows that children exposed to the Rwandan genocide experienced an 18% decline in average years of education. In Guatemala, Chamarbagwala and Morán (2011) find that the country's civil war disproportionately impacted schooling for rural and indigenous populations. Moreover, Brück, Di Maio, and Miaari (2019) show that during the Second Intifada in the West Bank, conflict significantly reduced the probability of passing high school exams and total test scores, highlighting the detrimental impact of violence on academic achievement.

Our study primarily contributes to the relatively smaller body of literature that examines the effects of prenatal exposure to war on children's human capital development. Several studies have documented the detrimental impacts of war exposure during critical

developmental periods. For instance, Akbulut-Yuksel (2014) shows that in utero and early childhood exposure to World War II bombings in Germany led to reduced educational attainment and lower earnings in adulthood. Similarly, Lee (2014) finds that in utero exposure to the Korean War negatively affected health and socioeconomic outcomes later in life. These studies highlight how war disrupts developmental trajectories, often through mechanisms such as maternal stress, reduced access to healthcare, and destruction of social infrastructure. More recently, Sardoschau (2024) explores the effects of prenatal exposure to violence in Iraq, finding significant declines in child health and cognitive outcomes due to stress-induced disruptions during pregnancy. In Vietnam and Cambodia, studies by Le and Nguyen (2020) and Saing and Kazianga (2020) highlight the long-term effects of aerial bombings on educational attainment and earnings. The present study builds on these findings by focusing on Afghanistan, which provides a unique context for examining these effects. Unlike previous studies, Afghanistan represents a much recent, decades-long conflict characterized by recurrent cycles of violence, foreign interventions, and internal turmoil. Combined with persistent challenges such as widespread poverty, weak governance, limited access to education and healthcare, and pronounced gender inequalities, Afghanistan presents a unique case for examining the intergenerational effects of war.

While our primary focus is on the impact of prenatal exposure to violent conflict on children's human capital outcomes, in our empirical analysis, we also consider the effects of subsequent war exposure during childhood. This dual perspective enables us to disentangle the distinct impacts of violence experienced in utero from those encountered in early childhood. This approach not only strengthens the relevance of our findings for understanding the intergenerational consequences of war but also provides insights for designing targeted interventions that address the unique vulnerabilities of children exposed to conflict at different stages of development.

Aside from these contributions, our paper is also tied to the "fetal origins" literature in economics, which underscores how conditions during pregnancy can have lasting effects on health and human capital outcomes (Almond and Currie, 2011). Specifically, research has shown that adverse prenatal exposures—such as maternal stress, inadequate nutrition, or environmental shocks—are strongly associated with outcomes like low birthweight and preterm delivery. As mentioned earlier, these early disadvantages often lead to poorer cognitive development, lower educational attainment, and diminished socioeconomic opportunities later in life. Building on this body of work, our study focuses on the relatively underexplored context of war violence, providing evidence on how traumatic shocks during pregnancy influence cognitive and developmental trajectories. While many early-life adversities, such as malnutrition, disease, and income shocks, share common mechanisms of long-term impact—such as stress and deprivation—warfare presents distinct challenges. Violent conflicts are often marked by unpredictability, severity,

and extensive physical and psychological trauma, which interact with early childhood development in distinct and complex ways. In this context, our study contributes to the fetal origins literature by providing evidence on the lasting consequences of conflict-related early-life adversity.

The mechanisms underlying the relationship between prenatal exposure to war conflict and later cognitive outcomes are multifaceted. Stress-induced maternal cortisol levels during pregnancy have been identified as a critical pathway affecting fetal brain development, potentially leading to long-term cognitive deficits (Beydoun and Saftlas, 2008; Glynn et al., 2001). Maternal stress can also disrupt health-seeking behaviors and access to prenatal care, compounding the direct physiological effects of stress on the fetus (Mansour and Rees, 2012). Despite these advances, the literature often focuses on specific health outcomes such as birth weight or mortality, leaving a gap in understanding cognitive development outcomes in prolonged conflicts with fluctuating intensity, like those in Afghanistan. Moreover, many studies rely on broad measures of exposure, such as distance from conflict zones, without fully exploiting the rich temporal and spatial data available. This paper addresses these gaps by focusing on the context of Afghanistan and leveraging granular data to provide estimates of the impact of prenatal exposure to civilian casualties on child cognitive outcomes later in life.

In our analysis, we use data from the 2022 Afghanistan Multiple Indicator Cluster Surveys and geo-referenced information from the Uppsala Conflict Data Program to examine the impact of prenatal exposure to violent conflict on human capital outcomes for children aged 7–12. We assess human capital development using multiple indicators of educational attainment, performance in math, and discipline and functioning problems. War exposure is measured as a binary variable indicating whether an individual was exposed to an explosive violent incident resulting in civilian casualties, as detailed further in Section 2. Our research design leverages spatial and temporal variations in conflict intensity to identify causal effects. Specifically, we compare the long-term outcomes of children of the same age and socio-economic background within the same Afghan province, where one child was in utero during a violent incident involving civilian casualties in their district, while another child's mother lived in a district within the same province that experienced no such incident. Our findings reveal a striking gender disparity: in utero exposure to civilian casualties significantly reduces cognitive outcomes for girls, with negligible effects observed for boys. Specifically, girls exposed to deadly conflict in utero demonstrate lower math performance and reduced foundational learning skills compared to their unexposed counterparts.

The fact that our study finds female-specific effects is consistent with the findings of Shemyakina (2011) and Le and Nguyen (2020), who explore the long-term impacts of violent conflict in the contexts of Tajikistan and Vietnam, respectively. In both studies, the adverse effects of conflict exposure were disproportionately borne by females,

highlighting the gendered nature of the impacts in resource-limited and conflict-affected settings. This pattern aligns with the broader literature on gender-based intrahousehold resource allocation in resource-constrained contexts. Studies in this literature have documented how economic constraints and socio-cultural norms drive households in developing countries to favor boys in the allocation of resources. For instance, Rose (2000) and Alderman and King (1998) show that in contexts of poverty and resource scarcity, investments in health, education, and nutrition disproportionately benefit boys due to their perceived higher economic returns or cultural significance as future providers. Barcellos, Carvalho, and Lleras-Muney (2014) and Kaul (2018) further illustrate how son preference in male-dominated societies leads to unequal treatment, with boys receiving more care and attention compared to girls, particularly in their early years. These disparities are especially pronounced in Afghanistan, where deeply rooted patriarchal norms and prolonged conflict have severely impacted the education system, leaving 3.7 million children out of school, with girls accounting for 60% of this figure (UNICEF et al., 2018). These systemic challenges are exacerbated by adverse shocks, as highlighted in Oster (2009), where limited resources prompt parents to prioritize boys even more heavily. Such disparities in resource allocation can have long-term effects on cognitive development and human capital, as shown by Attanasio, Meghir, and Nix (2020). Our findings contribute to this literature by demonstrating how conflict-related shocks in Afghanistan exacerbate existing disparities, disproportionately affecting girls and highlighting the urgent need for policies that tackle gender-specific inequalities in resource allocation.

A supplementary analysis suggests that the effects are partly driven by the unequal allocation of household resources under economic constraints exacerbated by the war conflict. Specifically, households with exposed children tend to have lower overall asset levels, which likely disproportionately affect investments in girls' education and well-being due to prevailing patriarchal norms in Afghanistan.

The remainder of the paper is structured as follows. Section 2 details the datasets used in the analysis, while Section 3 outlines the empirical strategy. Section 4 presents and discusses the results, and Section 5 concludes with a summary and implications of the findings.

2. Data

We combine data from two primary sources to assess the impact of in utero exposure to civilian casualties on human capital outcomes of primary-school-aged children. Below, we detail our data sources and analytical sample.

2.1. Child Outcomes

Our data source for the child outcome measures is the 2022 Afghanistan Multiple Indicator Cluster Surveys (MICS), conducted jointly by UNICEF Afghanistan and the National Statistics and Information Authority (NSIA) during the fall and winter of the 1401 Afghan calendar year, corresponding to September 2022 through February 2023. The 2022 MICS provides a nationally representative sample of 23,338 households designed to deliver high-quality data on the conditions of households, women, and children in the country. Specifically, the data include information on the household members' roster, their education levels, household assets, and hygiene practices; a section on women's marital and fertility backgrounds; details on maternal and newborn health; and informational panels covering children under five years old, as well as one child per household aged 5–17 years. Importantly, district identifiers are not publicly available in the MICS dataset. However, we obtained these identifiers under restricted use from the NSIA.

We focus on primary-school-aged children, aged 7 to 12 years old at the time of survey, corresponding to births between November 2009 and February 2016. This focus allows us to examine changes in outcomes for children who have not yet advanced to secondary education, which typically begins in grade 7 at age 13.[2] To accurately identify children exposed to civilian fatalities in utero, we further limit our sample to households that have resided in the same district for at least the past 12 years, increasing confidence in accurately identifying exposure at the child level.

The MICS informational panel for children aged 5–17 includes details on birth history, educational attainment, child labor, child discipline, child functioning, and foundational learning skills (only for those aged 7–14) in math and reading. Our primary outcomes are children's educational attainment, math performance, discipline, and functional difficulties, which we detail below. Given the learning poverty crisis in developing countries, examining factors that contribute to foundational learning poverty is vital for recovery and support efforts.[3]

Although foundational learning skills are one of our main outcomes, participation rates in reading quizzes are very low, with significantly more children participating in math activities. Therefore, in terms of foundational skills, our focus is primarily on math scores, as we have sufficient power for identification. We consider math performance as a cognitive outcome because it reflects mental processing abilities, such as problem-solving,

[2]Notably, this restriction also alleviates potential concerns regarding the impact of the de facto authority's current ban on girls' education beyond primary school.

[3]Learning poverty, a concept developed by the World Bank and the UNESCO Institute for Statistics, describes the inability of children to read and comprehend a simple text by age 10. It integrates two key factors: the percentage of children who have not reached minimum reading proficiency and the proportion of primary-aged children who are out of school, emphasizing gaps in both educational access and foundational learning. See the World Bank's brief (www.bit.ly/3DRLCql) for more details.

logical reasoning, and numerical comprehension.

The data categorize math activities into four types: number identification, identifying the larger number, addition, and pattern recognition. To attain a comparable sample while minimizing unobservable factors that might correlate with children's willingness to participate in math tests or household factors that might influence a mother's evaluation of her child's development, we restrict the analytical sample to children who participated in all math-related questions.[4]

We examine five major outcomes: (i) an indicator for ever-attending school (including formal Islamic education), (ii) current grade, (iii) a math composite index, (iv) a children's functional difficulty index, and (v) an index measuring the use of physical punishment for disciplining children in the household within the past 30 days. Except for the first two outcomes, all other outcomes are standardized and should be interpreted in terms of standard deviations. The "current grade" measure is conditional on the child having ever attended school.[5] Since we control for age in the regressions, this outcome indicates whether a child exposed to war violence in utero is at a lower grade compared to another child of the same age who was not exposed to such violence. The math composite index is derived from four sub-indices: number identification (6 items), identification of large numbers (5 items), addition (5 items), and number sequencing (5 items), compromising a total of 21 individual items.

The children's functional difficulty index includes 16 items, covering physical difficulties (6 items) and cognitive difficulties (10 items), as reported by the child's mother. Additionally, the physical punishment index is based on seven items, assessing whether someone in the household has recently shaken, shouted at, hit the child on the bottom, struck them with a belt or stick, slapped them in the face, hit them on the hand or arm, or otherwise beaten them in the past 30 days. We present a detailed list of survey items categorized by index type in Table A.3.

A potential increase in physical abuse resulting from exposure to civilian fatalities could adversely affect both the physical and cognitive development of a child. For instance, research indicates children who experience abuse often perform worse on cognitive tasks, experience difficulties with reading comprehension, and face challenges in math and abstract reasoning compared to their non-abused peers (Ammerman et al.,

[4]This restriction aims to avoid potential overestimation. Specifically, this conservative approach helps prevent the selection of children who might be less likely to perform well due to the availability of various resources in the first place. Although the included children might have better parental education and access to public services, a potential positive selection, if anything, reduces the likelihood of detecting persistent effects from in-utero shocks.

[5]The survey records the highest grade each child has attended, but we observed several inconsistencies. For example, some 7-year-old children were reported in 4th grade, which is unrealistic because the school starting age is 7 years. To address this issue, we limit the grades for each child based on their age, allowing a maximum of one grade above the expected level. For instance, a 7-year-old can only be in first or second grade. If a 7-year-old is reported in a grade higher than second, we mark those cases as missing.

1986; De Bellis et al., 2009; Ryan et al., 2018). Abuse often results in attention difficulties, hyperactivity, and impulsivity, which can further impair cognitive functioning and academic performance (Capusan et al., 2016; Slade and Wissow, 2007)

2.2. Violent Incidents

Our data source for violent war incidents is the Uppsala Conflict Data Program (UCDP), which provides geo-referenced data on violent conflicts in Afghanistan at the incident level. The dataset covers incidents in Afghanistan from 1989 to the present, focusing on lethal violence involving the use of armed force in state-based, non-state, and one-sided violence. It emphasizes dyadic conflicts, which involve two opposing parties. The UCDP applies a threshold of 25 deaths for dyadic conflicts; therefore, it records only violent incidents that have crossed this threshold at least in one of the years.

The violent conflicts data include information on the number of associated fatalities and the timing of the incidents. We exclude incidents not precisely identified at the district or weekly levels, focusing only on data with geographic and temporal detail. For the period from 2001 to 2021, the total number of violent incidents is 31,011.[6]

Using incident narratives from the source article provided in the UCDP dataset, we identify incidents involving civilian fatalities and injuries. We specifically focus on exposure to civilian fatalities, which allows us to isolate and leverage the random nature of such events compared to other forms of armed conflict exposure. In contexts where the majority of people are exposed to widespread violence, it becomes challenging to disentangle the effects of traumatic incidents. By focusing on a particular aspect of exposure, we aim to overcome this challenge. Furthermore, civilian fatalities are significantly more likely to spark public discourse and attract broader media coverage than general armed conflicts or fatalities in situations of chronic violence affecting most of the population. This is especially relevant in contexts where social interactions are heavily localized, making exposure to civilian fatalities within the district of origin a highly pertinent measure for isolating the long-term effects of in utero exposure to armed conflict. We identify 1,901 such incidents. Of these incidences, 274 occurred at a time that coincided with the in-utero period of at least one child.[7] Our analysis shows that the leading causes of civilian casualties are explosive events (e.g., explosions, roadside bombings, blasts), aerial attacks, and unpredicted attacks/clashes.[8] Importantly, as we

[6]Following the political events of summer 2021, the conflict levels in Afghanistan have significantly decreased, and the reporting of violent incidents has been inconsistent.

[7]A total of 417 incidents of this nature were reported during the period corresponding to the in-utero phase of the children in our analytical sample (January 2009 to March 2016). Of these, 274 include specific information on civilian fatalities in the source text, while the remaining incidents either document only civilian injuries, are duplicates, or consist of broader statements concerning civilian safety and overall tolls in the Afghan war.

[8]Among the 274 incidents with specific information on civilian fatalities, the leading causes are distributed as follows: explosive events account for 57%, aerial attacks for 7%, clashes or large-scale

demonstrate later, the variation in civilian casualties appears plausibly random, unlike the overall violent conflict, which underpins our empirical approach.

Using the incident coordinates, we spatially merge the violent conflict data with the district shapefile, allowing us to associate each incident with its corresponding district.[9] Next, we aggregate the number of civilian fatalities by calendar month for each district and create a panel dataset of civilian fatalities at the district-calendar month level.

2.3. Construction of In-Utero Exposure to Violent Conflicts

We have children's birth month and year recorded in Afghan calendar, which we convert to the commonly used Gregorian calendar.[10] We use the converted year and month to determine the date of birth in year-month format for further analysis. Next, we use each child's date of birth in year-month format and count back nine months to define the in utero period, creating a child-calendar month panel that covers the period from potential conception to the child's age in months at the time of the survey.[11] We then use district-unique codes and year-month identifiers to match district-level violent conflict (civilian fatalities) records for each child from conception through December 2021.

We consider a child exposed if any civilian casualties occurred in their district at any point during the nine months of gestation.

2.4. Descriptive Statistics

We begin by presenting the variation in violent conflicts, in utero exposure, and primary-school-aged children for whom cognitive outcomes are available. Figure 1 illustrates the spatial coverage of the analytical sample and the distribution of monthly

attacks for 17%, and other incidents—comprising military operations by government or international forces, gunman attacks, targeted killings, ethnic clashes, direct fires, or unspecified events—make up the remaining 19%.

[9]There are 400 official districts in Afghanistan. Of these, 181 districts experienced at least one incident of war violence with civilian casualties during the analysis period.

[10]In the Afghan calendar, the year 1401 began on March 21, 2022, and ended on March 20, 2023. Under this system, January 1, 2023, corresponds to the 11th day of the 10th month of 1401. We convert the year by adding 621 to the Afghan year. For Afghan months 10 through 12, we add an additional year to account for the overlap with the following Gregorian year. To adjust the month, we add 2 to the Afghan month and use a modulo operation (`mod`) to keep it within the 12-month cycle. Specifically, Afghan month 10 becomes Gregorian month 1 (January), month 11 becomes month 2 (February), and month 12 becomes month 3 (March). This method simplifies the conversion but does not account for a 10-day overlap between the two calendars.

[11]This approach assumes a standard gestation length of nine months, though some children may be born prematurely, leading to discrepancies in the actual duration of their in utero exposure. However, such cases, where in utero exposure to civilian fatalities occurs with shorter gestation lengths, could make it harder to detect any effects. In robustness analysis, we assigned our treatment indicator based on eight months of gestation as well as ten months of gestation length for all pregnant women. The estimates based on eight months of gestation are nearly identical to those reported in the paper, while the results for ten months of gestation are qualitatively consistent but less precisely estimated. This reduced precision is expected due to the increased measurement error introduced by extending the treatment variable.

violent conflicts by district from 2009 to 2016, focusing on incidents involving civilian fatalities and whether children were exposed to them. Blue circle markers represent the number of children aged 7–12 years, with respondent counts varying by district. Kabul, the capital, has the highest count with 57 children, while the lowest is one per district. Some districts are not represented in the study sample. Red markers indicate districts with reported civilian casualties, while purple stars denote districts where at least one child was exposed to civilian fatalities in utero. In some districts with reported civilian casualties, children in the study sample were not exposed in utero, as fatalities occurred outside the months corresponding to the prenatal period. An important insight is that, although violent conflicts are concentrated in certain areas (marked by yellow stars), civilian casualties are dispersed across the map, occurring even in districts without substantial clusters of violent conflict, highlighting the randomness of their distribution.

Table 1 provides the descriptive statistics for the study sample, including the pooled sample and gender-specific subsamples. Approximately 12.4% of the children were exposed to civilian fatalities in utero, while 44.7% experienced post-birth exposure to seven or more civilian casualties. The majority of children have living parents, with about 98% of mothers and 94% of fathers alive. A significant proportion of mothers (85%) have no formal schooling, though females are more likely than males to have mothers with higher educational attainment, particularly at the high school level (4.9% vs. 2.3%). Urban residence is more common among females (18%) compared to males (14%), which is with higher average district luminosity observed for female children. There are no statistically significant differences in the likelihood of in-utero or post-birth exposure to civilian fatalities between males and females, suggesting exposure is not systematically related to gender. These statistics provide a foundational understanding of the sample's demographic characteristics and highlight key differences that will be examined further in the empirical analysis

Table 2 presents the descriptive statistics for the outcome variables and highlights key differences between children exposed to civilian fatalities in utero and those who were not. In the pooled sample (Panel A), children exposed in utero are significantly less likely to have ever attended school (67.1% compared to 80.2%). Current grade levels are similar between exposed and unexposed children, with no statistically significant difference between the two groups. Math performance shows a slight, but not statistically significant disadvantage for exposed children. However, functional difficulties are substantially higher for the exposed group, and physical punishment is more prevalent. Gender-specific panels shown in Panels B and C reveal further insights. For females (Panel B), in utero exposure corresponds to a significantly lower likelihood of school attendance (59.2% vs. 78.6%) and elevated functional difficulty. We observe similar trends in physical punishment. Males (Panel C) exposed in utero also show significantly reduced school attendance (71.8% vs. 81.3%), higher functional difficulty, and greater physical

punishment. These unadjusted differences are supportive of the notion that there might be harmful human capital effects of in utero exposure to war violence. These differences in raw, unadjusted outcomes set the stage for the empirical strategy described in the next section.

Next, in line with the spirit of balance tests, we regress indicators of in-utero exposure and post-birth exposure, respectively, on our demographic variables, as shown in Table A.1. While we observe a negative correlation with mother's education, which we control for in our empirical model, this correlation does not appear for post-birth exposure. Importantly, in Table A.2, conditioning on age and province fixed effects and estimating each regressor separately suggest a weaker relationship with respect to mother's education. Consistent with our earlier findings, neither specification reveals any significant correlation with respect to gender, nor does the presence of the mother or father appear to be correlated. Conditional on demographic variables, in-utero exposure to civilian fatalities is orthogonal to district-level characteristics such as luminosity, temperature, and urban status.

3. Empirical Approach

We use the regression model in Equation (1) to examine the long-term impact of in utero exposure to civilian casualties on children's educational, cognitive, and developmental outcomes. Specifically, this approach allows us to disentangle the effects of in utero exposure to traumatic events on children's outcomes as they reach primary school, while controlling for individual and district-level characteristics. The regression model is specified as follows:

$$Y_{ia(t)dp} = \alpha + \textit{In-Utero}_{ia(t-a-1)dp} + \textit{Post-Birth}^{a(t)}_{ia(t-a)dp} + X_{iadp} + \gamma_p + \delta_a + \epsilon_{iadp}, \qquad (1)$$

where $Y_{ia(t)dp}$ is the outcome of interest for child i, aged a, in the Afghan year (t) 1401 (equivalent to 2022), residing in district d of province p. The term $\textit{In-Utero}_{ia(t-a-1)dp}$ represents the key variable of interest, capturing the effect of in utero exposure to civilian casualties. It takes the value of 1 for child i of age a if any civilian casualties occurred in district d of province p during their gestation period, defined as $(t-a-1)$ — one period prior, corresponding to the nine months before birth, measured in calendar months. $\textit{Post-Birth}^{a(t)}_{ia(t-a)dp}$ is a binary indicator equal to 1 if child i, aged a, in district d of province p, was exposed to *at least* seven or more civilian casualties (the median value) in their district from the month of birth to December 2021. The model includes X_{iadp}, which controls for individual-level variables, such as the child's gender, parental survival status, and the mother's level of education, as well as district-level

characteristics, including an indicator for urban districts, historical average monthly district luminosity, and temperature (°C). The variables γ and δ represent province and age fixed effects, respectively. Standard errors are clustered at the province level, and all models incorporate child sampling weights from the MICS dataset.

We exploit variations across districts within province p and age categories to estimate the effects of in utero exposure to civilian fatalities on children's outcomes. By comparing children of the same age across districts in province p, where one child in district d was exposed to civilian casualties in utero while another of the same age was not, we isolate the effect of such exposure. We account for cultural and economic variations across provinces, which arise from government development and security planning, as budgets are allocated at the provincial level rather than the district level. Thus, after controlling for province fixed effects, in utero exposure to civilian fatalities can be considered plausibly random. In other words, conditional on fixed effects and additional controls, any differences in children's educational, cognitive, and developmental outcomes can be interpreted as the causal effects of in utero exposure to civilian casualties.[12]

Given the pervasive gender disparities in education, economic opportunities, and social norms that disadvantage girls in Afghanistan, examining gender-specific effects may be particularly important. To capture these differential impacts, we include an interaction term, $\textit{In-Utero}_{ia(t-a-1)dp} \times \textit{Female}_{iadp}$ in Equation (1), which captures the interaction between exposure and a gender indicator set to 1 for females.[13] This approach allows us to investigate whether female children are disproportionately affected by such exposure. Additionally, we explore the impacts of in utero exposure within gender-specific subsamples.

To assess the robustness of our inference, we conduct randomization inference exercises for the pooled, female, and male samples, respectively. Specifically, we randomly assign exposure to approximately 12.4% of the sample each time and run the simulation 5,000 times for each outcome based on our main specification in Equation (1). We then plot the effects from all iterations to illustrate the distribution of effects in comparison to our main findings. This exercise helps evaluate whether the observed effects could arise purely by chance, thereby providing a benchmark to assess the statistical significance and robustness of our estimated impacts.

To further investigate whether changes in child outcomes are solely attributable to in

[12]We considered a version of our model that included trimester-specific indicators to gain insights into the timing of prenatal exposure that might matter most. However, performing an analysis that considers trimester-specific effects requires a sufficiently large number of exposed children, particularly when accounting for gender-specific impacts. In our sample, only 277 children (12.4%) were exposed to war violence in utero, of whom only 103 are female. These numbers appear insufficient to produce precisely estimated results that consistently identify a clear pattern. Consequently, we chose to conduct our analysis using overall in utero exposure rather than focusing on trimester-specific effects.

[13]Note that in this specification, the coefficient on the *In-Utero* indicator captures the impact of prenatal exposure to war violence among males, while the estimate on the *Female* indicator reflects the gender difference in the outcome variables for children with no war-related exposure.

utero exposure to civilian fatalities, we modify our benchmark specification by introducing pre-birth exposure indicators in Equation (2). Specifically, this specification extends the pre-birth period to 36 months before the birth month for all children, partitioning it into four nine-month intervals. This creates four in-utero periods for each child: one actual and three placebo (pre-birth) periods, as illustrated in Figure A.1. We then construct exposure indicators for mothers across all periods, assigning a value of 1 if the mother was exposed to civilian casualties and 0 otherwise. Exposure to civilian fatalities in the different in utero periods is denoted by $\sum_{n=1}^{4} \textit{In-Utero}_{ia(t-a-n)dp}$, and we estimate it using the following specification:

$$Y_{ia(t)dp} = \alpha + \sum_{n=1}^{4} \textit{In-Utero}_{ia(t-a-n)dp} + \textit{Post-Birth}^{a(t)}_{ia(t-a)dp} + X_{iadp} + \gamma_p + \delta_a + \epsilon_{iadp} \quad (2)$$

In this specification, the pre-birth periods serve as "placebo periods" because, while mothers may be exposed to civilian casualties during these times, the child is not yet conceived. Hence, any observed effect on child outcomes should not be attributable to in utero exposure. This approach tests the validity of the assumption that the observed effects are specifically due to in utero exposure.[14]

4. Results

In this section, we present our primary findings on the impact of in utero exposure to civilian casualties. We then evaluate the robustness of these findings using placebo specifications and randomization inference, and explore the potential mechanisms underlying the observed effects.

4.1. Main Results

We report our main findings on the long-term effects of in utero exposure to civilian fatalities on children's educational, cognitive, and developmental outcomes in Table 3. Panel A presents results for the pooled sample. Panel B reports gender-specific effects, captured through the interaction between the in utero exposure variable and a gender indicator. Panel C extends this specification by incorporating the interaction between post-birth exposure and a gender indicator.

In Table 3, all outcomes, except the first and second—representing the likelihood of ever attending school (formal general education) and current grade—are standardized,

[14]This approach does not require omitting a pre-period because the exposure during these periods is not relative to a single event date but rather represents specific windows of potential treatment.

with the estimates expressed in standard deviations. The outcomes in columns (3) through (5) are composite indices, where a negative estimate in math and a positive estimate for functional difficulty and physical punishment indicate worsened outcomes for exposed children.

Panel A of Table 3 reports the effects of in utero and post-birth exposure to civilian casualties on educational and developmental outcomes for the pooled sample. The omitted category in these regressions is no-exposure to war violence. In utero exposure is associated with a statistically significant 6.7 percentage point, corresponding to an 8.48%, decrease in the likelihood of ever attending school. However, there is no evidence of a significant impact on current grade or math performance, with small and statistically insignificant coefficients. Functional difficulties, which measure physical and cognitive challenges, show a positive but not statistically significant association with in utero exposure. Similarly, the estimate for physical punishment, an index of disciplinary practices, is positive but not statistically significant. For post-birth exposure, children who were exposed to war violence after birth up to the time of assessment are 7 percentage points less likely to have ever attended school. Interestingly, this effect size is nearly identical to that of in utero exposure. Additionally, post-birth exposure is associated with a 0.11 standard deviation decline in math performance. However, the effects on current grade, functional difficulty, and physical punishment are not statistically significant.

Panel B of Table 3 examines the differential impact of in utero exposure to civilian fatalities by gender. The estimates in the first row indicate that in utero exposure to war violence has no statistically significant effect on males. Interestingly, this pattern is in contrast to the unadjusted, raw differences shown in Table 2. The estimates in the second row indicate that, among children unexposed to any war violence, females perform worse than males in terms of current grade progression, lagging behind by 0.11 grades. They also score 0.16 standard deviations lower in math. However, unexposed females experience 0.14 standard deviations fewer functional difficulties and face less physical punishment compared to their male counterparts.

The estimates for the interaction term reveal strikingly worse effects of in utero exposure to incidents of war violence on females relative to males. Specifically, females exposed in utero are significantly worse off across all outcomes except the current grade. They are 11.5 percentage points less likely to attend school, representing a 14.5% reduction relative to the mean, and score 0.16 standard deviations lower in math compared to males. The decline in math scores appears to be driven primarily by poorer performance in the number recognition and addition sub-indices, as highlighted in Table A.4.[15] Number identification and addition often rely on foundational numerical

[15]The coefficient on the interaction terms, *In-Utero* × *Female*, in Table A.4 is negative and sizable for both number recognition and addition. While the effect on number recognition is statistically significant (p <0.05), the effect on addition is borderline insignificant at conventional levels (p =0.11).

processing skills (Corso, Corso, and de Salles, 2024), which may be particularly sensitive to disruptions during critical developmental stages in utero. These findings suggest that certain cognitive skills may be more sensitive to early developmental disruptions.

Furthermore, females with exposure to war violence in utero experience a 0.36 standard deviation increase in functional difficulties compared to male counterparts. The results from the sub-indices analysis shown in Table A.4 suggest that the increase in functional difficulties experienced by females is primarily by cognitive impairments. This is consistent with the notion that potential disruptions in cognitive skills can adversely affect academic performance in fundamental functional tasks.

Next, the interaction term in the last column shows that females who were exposed to war violence in utero face a 0.23 standard deviation increase in physical punishment compared to males. Finally, females also appear slightly behind in grade progression compared to males, though the estimate is not statistically significant. However, this effect should be interpreted with caution as these children are still in the early years of their education window. Therefore, it could still be too early for any negative educational effect to manifest itself in significant lagging in grade progression. According to the estimates in the fourth row, there is a 7 percentage point reduction in school attendance and a 0.11 standard deviation decline in math performance associated with post-birth exposure for both males and females. However, there are no statistically significant effects on functional difficulty or physical punishment.

Note that the specification in Panel B imposes post-birth exposure to have the same effect on males and females. In Panel C, we relax this assumption by including an interaction term between the indicators of post-birth exposure to war violence and female. Controlling for this interaction does not influence the effects obtained in Panel B. The estimates on the first four rows remain robust. Focusing on the estimates in the last two rows suggests that post-birth exposure to war violence reduces the likelihood of attending school by 8.1 percentage points among males. Furthermore, the interaction term for post-birth exposure and female is small and insignificant, suggesting that post-birth exposure negatively affects both genders with respect to school attendance. For functional difficulties, post-birth exposure appears to increase females' functional difficulties by 0.20 standard deviations relative to males. With respect to grade progression, math performance, and physical punishment there appears to be no gender-specific effects associated with exposure to post-birth war violence.

Taken together, the results in Table 3 highlight the substantial and disproportionate impact of in utero exposure to civilian casualties on females. In utero exposure significantly exacerbates gender disparities, with females showing worse outcomes in school attendance, math performance, and developmental measures compared to males. Post-birth exposure, while negatively affecting both genders, has less pronounced and consistent effects, with some evidence of increased functional difficulties for females

relative to males.

As a robustness check, we estimate flexible models using gender-specific subsamples. The results, shown in Table A.5, consistently indicate that female children exposed to civilian casualties in utero have a lower likelihood of attending formal schooling and higher levels of functional difficulties.

4.2. Validity of Identification and Inference

In this section, we conduct various empirical exercises to assess: (i) whether other potential factors influence child outcomes that happen to coincide with in-utero exposure; and (ii) the sensitivity of our inference. The purpose of these exercises is to evaluate whether the observed effects are driven solely by in utero exposure to civilian fatalities or by other factors, including random variation.

For the first exercise, we use placebo exposure periods outside the actual in-utero window (as shown in Figure A.1) and apply the model specification in Equation (2) to test whether any placebo exposure is associated with child outcomes. The results, reported in Table 4, use our benchmark specifications for pooled and gender-specific effects. To ensure consistency with our main findings in Table 3, we present the results of the placebo analysis in three panels.

We find two key results. First, in all three Panels A, B, and C, we do not observe any statistically significant changes in child outcomes during placebo exposure periods. Since the child is not yet conceived during these periods, this provides reassurance that other factors driving outcomes are unlikely to be at play. Second, we find qualitatively similar effects of in-utero exposure when conditioning on placebo period exposure.

Our findings remain consistent with our benchmark analysis when we stratify the results by gender subsamples in Table A.6. These results confirm that none of the placebo exposures are associated with the main outcomes of interest.

Next, we examine whether independence between in-utero exposure and child outcomes is achieved after conditioning on individual and district-level variables. While our earlier balance test indicated this is not the case, we nonetheless assess the robustness of our estimates by excluding these variables, as shown in Table A.7. Using a flexible approach, we present how estimates vary not only across specifications but also across subsamples. Overall, our findings regarding the adverse effects of in-utero exposure on female children remain qualitatively similar, regardless of the exclusion of control variables.

Additionally, we conduct a leave-one-out analysis, excluding one major province at a time to demonstrate that in-utero exposure to war violence is randomly distributed across districts and not driven by a specific province. If this is true, excluding a province should not meaningfully impact our point estimates. Figure A.2 reports the estimates for the

interaction term, showing the differential impact of in-utero exposure on human capital outcomes between females and males. For comparison, we also include our benchmark estimates from Panel B of Table 3. We specifically exclude Kabul, Nangarhar, Kandahar, Balkh, and Herat individually, and further assess the sensitivity of our estimates by excluding all these provinces simultaneously.[16]

An interesting pattern emerges from our leave-one-out analysis in Figure A.2. While dropping the most populous provinces reduces statistical significance in some cases, the point estimates remain quantitatively similar and closely aligned across the board. The key takeaway is that girls are consistently more likely than boys to experience adverse human capital outcomes due to exposure to armed fatal conflicts, regardless of the province they live in.

Our final exercise focuses on the sensitivity of our inference. Specifically, we conduct randomization inference by randomly assigning the exposure treatment to 12.4% of the sample.[17] This process is repeated 5,000 times, applying our main specification with the random treatment assignment as the primary variable of interest for each outcome. This allows us to evaluate the likelihood of observing our main findings under random assignment.

The distribution of the estimated coefficients across different specifications and subsamples is shown in Figures A.3 through A.6. Each figure includes the Fisher p-value, indicating the proportion of times (out of 5,000) that the estimated coefficient exceeds (in absolute terms) our benchmark coefficient, represented by the dashed vertical line. For instance, when the estimated coefficients exceed the benchmark threshold derived from the actual treatment assignment fewer than 250 times, the corresponding p-value falls below 0.05.

Figure A.3 presents findings from the pooled sample, while Figure A.4 shows the distribution of estimated coefficients from our preferred interaction model, which evaluates the differential impact of in utero exposure on females versus males. Figures A.5 and A.6 further display results for the female and male subsamples, respectively. This randomization exercise provides further confidence in our primary findings, demonstrating that in utero exposure to civilian fatalities is *significantly* associated with worsened human capital outcomes for female children. These results align with our benchmark analysis, which shows statistically significant reductions in schooling and increased functional difficulties, particularly among the female subsample. These patterns once again highlight the gendered vulnerability to early-life shocks.

[16]These provinces are major in Afghanistan due to their population density, historical, cultural, political, and economic significance: Kabul is the political and administrative capital; Nangarhar is the economic hub in the east with vast agricultural productivity; Kandahar, a key province shaping the country's political and economic landscape; Balkh, a major economic center in the north; and Herat, a major economic center in the west. The Afghanistan ring road network, which connects major border crossing points, forms the primary road network through these provinces.

[17]As shown in Table 1, 12.4% of the sample experienced in-utero exposure to civilian fatalities.

4.3. Mechanisms

To understand the pathways through which in utero exposure to civilian fatalities affects children's human capital outcomes, we explore potential mechanisms related to household economic constraints and preferential investment in boys, a common practice in low- and middle-income countries. In resource-scarce environments, households often face challenging decisions about allocating limited resources, such as food, healthcare, and education. Evidence from the literature suggests that under such constraints, boys frequently receive preferential investment over girls due to cultural norms and perceptions of higher returns on investments in sons compared to daughters (Rose, 2000; Oster, 2009; Jayachandran and Kuziemko, 2011; Barcellos, Carvalho, and Lleras-Muney, 2014; Kaul, 2018; Attanasio, Meghir, and Nix, 2020). This gendered allocation of resources may exacerbate disparities in educational, cognitive, and developmental outcomes between boys and girls, particularly in contexts of economic hardship triggered by external shocks such as violence or conflict.

To investigate these mechanisms, we use the 2015 Demographic and Health Surveys (DHS) for Afghanistan and apply a similar empirical approach outlined in Section 3, which we detail below. Specifically, we examine whether households with childbirth in the five years preceding the survey differ significantly in their household asset index as well as in women's and men's employment and ownership indices. We use the DHS dataset to shed light on household economic conditions during the early life period of our analytical sample cohorts, providing more relevant information on how a household's economic status may have shaped spending patterns and contributed to the persistent effects of in-utero exposure to armed conflict and civilian fatalities. In contrast, the MICS 2022 dataset reports household assets but lacks gender-disaggregated data on work status and ownership. It primarily reflects household asset conditions in late 2022, shaped by recent events, which may mask differences and fail to represent households' economic status during a child's early life.[18]

Although we cannot directly identify households with exposed children in the DHS 2015 dataset using the MICS 2022 data, we use birth history and birth month information from the DHS 2015 to identify households with live births in the past five years. For these households, we determine whether civilian casualties occurred in the mother's district of residence from the potential conception month to the child's birth month. We classify households as treated if the mother experienced exposure to civilian casualties during the in-utero period.

The household asset index is a composite measure comprising twenty-nine individual items, standardized by province. We further divide this index into four sub-indices

[18]Note that the country's real GDP contracted by 26 percent (World Bank, 2024) during the 2021 and 2022 fiscal years due to the COVID-19 pandemic and political changes.

based on the economic value or importance of the assets. The "high asset" category includes ownership of agricultural land, a car/truck, tractor, rickshaw, or motorcycle. The "medium" category includes items such as a bicycle, computer, generator, cattle, cows, horses/donkeys, goats, sheep, camels, chickens, ducks, or an animal-drawn cart. The "medium-low" includes items such as a refrigerator, electricity, television, radio, mobile phone, stand fan, or sewing machine. The "low" category includes furniture items such as a table, chair, sofa, bed, cupboard, or watch.

Additionally, we construct province-standardized employment and ownership indices for women and men separately, each based on three binary survey items. The women's index includes indicators for whether women work, own a house (alone or jointly), and own land (alone or jointly). The men's index includes indicators for whether men work year-round, own a house (alone or jointly), and own land (alone or jointly).

We regress the household asset index, along with the women's and men's employment and ownership indices, on in-utero exposure to civilian fatalities. We present the estimates in Tables 5 and 6, respectively. Our analysis shows that households with a child exposed to civilian fatalities in utero have an overall asset index 0.07 standard deviations lower, driven primarily by lower scores in the high economic importance asset category. However, we find no evidence that adult women or men in exposed households differ in employment, house ownership, or land ownership compared to those in non-exposed households.

Taken together, this analysis provides suggestive evidence that households with children exposed to traumatic civilian fatalities in utero face economic constraints, as reflected in reduced household assets. These constraints may lead to preferential investment in boys' human capital over girls' during early childhood, potentially buffering the negative impacts of exposure on boys while exacerbating the long-term effects of in-utero shocks on girls' educational, cognitive, and developmental outcomes.

5. Conclusion

This paper contributes to the growing body of literature on the long-term effects of prenatal exposure to adverse conditions, with a specific emphasis on war and conflict. By exploring the cognitive and developmental consequences of in utero exposure to civilian casualties, it adds to our understanding of how early-life stressors influence human capital formation. Specifically, the study provides empirical evidence on the long-term cognitive and developmental impacts of in utero exposure to civilian casualties, focusing on children in Afghanistan. The Afghan context offers a particularly compelling case due to its prolonged conflict, deeply rooted patriarchal norms, and systemic challenges such as limited access to education and healthcare. These factors, coupled with high poverty levels and weak institutional capacity, create a unique setting for understanding how prenatal exposure to violence shapes long-term human capital outcomes, offering valuable

insights for conflict-affected regions globally.

Our empirical strategy leverages spatial and temporal variations in exposure to war conflict in utero to isolate the causal impact of in utero exposure to civilian casualties on children's human capital outcomes. The findings reveal striking gender disparities. Girls exposed to violent conflict in utero experience significant reductions in school attendance, math performance, and foundational cognitive skills, while boys appear largely unaffected. These results align with existing literature on intrahousehold resource allocation in resource-constrained settings, where socio-cultural norms and economic priorities heavily influence parental investment decisions.

Our mechanism analysis provides further evidence that these gender-specific impacts are, at least in part, driven by economic constraints that exacerbate the unequal allocation of household resources. Specifically, families with children exposed to violence in utero tend to experience significant asset depletion, which likely disproportionately affects investments in girls' education and well-being due to prevailing patriarchal norms.

The implications of these findings are particularly pressing given the increasing prevalence of armed conflicts worldwide. In recent years, the number of children living in conflict zones has grown significantly, with millions exposed to conditions that severely compromise their developmental potential. The global rise in violent conflicts, such as those in Ukraine, Syria, and Sudan, highlights the urgency of addressing the developmental and gender-specific consequences of prenatal exposure to violence. Understanding these impacts is crucial not only for mitigating immediate harms but also for informing policy interventions that can break cycles of intergenerational disadvantage and foster resilience in conflict-affected populations.

References

Akbulut-Yuksel, Mevlude. 2014. "Children of War: The Long-run Effects of Large-scale Physical Destruction and Warfare on Children." *Journal of Human Resources* 49 (3):634–662.

Akbulut-Yuksel, Mevlude, Erdal Tekin, and Belgi Turan. 2022. "World War II Blues: The Long–lasting Mental Health Effect of Childhood Trauma." Working Paper 30284, NBER.

Akresh, Richard and Damien de Walque. 2008. "Armed Conflict and Schooling: Evidence from the 1994 Rwandan Genocide." Working Paper 3516, IZA.

Alderman, Harold and Elizabeth M. King. 1998. "Gender Differences in Parental Investment in Education." *Structural Change and Economic Dynamics* 9 (4):453–468.

Almond, Douglas. 2006. "Is the 1918 Influenza Pandemic Over? Long-Term Effects of In Utero Influenza Exposure in the Post-1940 U.S. Population." *Journal of Political Economy* 114 (4):672–712.

Almond, Douglas and Janet Currie. 2011. "Killing Me Softly: The Fetal Origins Hypothesis." *Journal of Economic Perspectives* 25 (3):153–172.

Almond, Douglas and Bhashkar Mazumder. 2011. "Health Capital and the Prenatal Environment: The Effect of Ramadan Observance during Pregnancy." *American Economic Journal: Applied Economics* 3 (4):56–85.

Ammerman, Robert T, Jeffrey E Cassisi, Michel Hersen, and Vincent B Van Hasselt. 1986. "Consequences of Physical Abuse and Neglect in Children." *Clinical Psychology Review* 6 (4):291–310.

Attanasio, Orazio, Costas Meghir, and Emily Nix. 2020. "Human Capital Development and Parental Investment in India." *Review of Economic Studies* 87 (6):2511–2541.

Barakat, Sultan, David Connolly, Frank Hardman, and Vanita Sundaram. 2013. "The Role of Basic Education in Post-Conflict Recovery." *Comparative Education* 49 (2):124–142.

Barcellos, Silvia Helena, Leandro S. Carvalho, and Adriana Lleras-Muney. 2014. "Child Gender and Parental Investments in India: Are Boys and Girls Treated Differently?" *American Economic Journal: Applied Economics* 6 (1):157–89.

Beydoun, Hind and Audrey F. Saftlas. 2008. "Physical and Mental Health Outcomes of Prenatal Maternal Stress in Human and Animal Studies: A Review of Recent Evidence." *Paediatric and Perinatal Epidemiology* 22 (5):438–466.

Black, Sandra E, Aline Bütikofer, Paul J Devereux, and Kjell G Salvanes. 2019. "This Is Only a Test? Long-Run and Intergenerational Impacts of Prenatal Exposure to Radioactive Fallout." *Review of Economics and Statistics* 101 (3):531–546.

Black, Sandra E, Paul J Devereux, and Kjell G Salvanes. 2007. "From the Cradle to the Labor Market? The Effect of Birth Weight on Adult Outcomes." *Quarterly Journal of Economics* 122 (1):409–439.

———. 2016. "Does Grief Transfer Across Generations? Bereavements During Pregnancy and Child Outcomes." *American Economic Journal: Applied Economics* 8 (1):193–223.

Bleakley, Hoyt. 2007. "Disease and Development: Evidence from Hookworm Eradication in the American South." *Quarterly Journal of Economics* 122 (1):73–117.

Bozzoli, Carlos and Climent Quintana-Domeque. 2014. "The Weight of the Crisis: Evidence From Newborns in Argentina." *Review of Economics and Statistics* 96 (3):550–562.

Brück, Tilman, Michele Di Maio, and Sami H Miaari. 2019. "Learning the Hard Way: The Effect of Violent Conflict on Student Academic Achievement." *Journal of the European Economic Association* 17 (5):1502–1537.

Capusan, Andrea Johansson, Ralf Kuja-Halkola, Preben Bendtsen, E Viding, E McCrory, Ina Marteinsdottir, and Henrik Larsson. 2016. "Childhood Maltreatment and Attention Deficit Hyperactivity Disorder Symptoms in Adults: A Large Twin Study." *Psychological Medicine* 46 (12):2637–2646.

Chamarbagwala, Rubiana and Hilcías E Morán. 2011. "The Human Capital Consequences of Civil War: Evidence from Guatemala." *Journal of Development Economics* 94 (1):41–61.

Corso, Luciana Vellinho, Helena Vellinho Corso, and Jerusa Fumagalli de Salles. 2024. "Intervention in Mathematical Skills: Number Sense." In *Neuropsychological Interventions for Children-Volume 1: From Early-Preventive Stimulation to Rehabilitation*. Springer, 169–180.

Cunha, Flavio, James J Heckman, Lance Lochner, and Dimitriy V Masterov. 2006. "Interpreting the Evidence on Life Cycle Skill Formation." *Handbook of the Economics of Education* 1:697–812.

Currie, Janet. 2011. "Inequality at Birth: Some Causes and Consequences." *American Economic Review* 101 (3):1–22.

Currie, Janet, Bahadir Dursun, Michael Hatch, and Erdal Tekin. 2023. "The Hidden Cost of Firearm Violence on Infants in Utero." Working Paper 31774, NBER.

Currie, Janet and Enrico Moretti. 2007. "Biology as Destiny? Short- and Long-Run Determinants of Intergenerational Transmission of Birth Weight." *Journal of Labor Economics* 25 (2):231–264.

Currie, Janet and Reed Walker. 2011. "Traffic Congestion and Infant Health: Evidence from E-ZPass." *American Economic Journal: Applied Economics* 3 (1):65–90.

De Bellis, Michael D, Stephen R Hooper, Eve G Spratt, and Donald P Woolley. 2009. "Neuropsychological Findings in Childhood Neglect and their Relationships to Pediatric PTSD." *Journal of the International Neuropsychological Society* 15 (6):868–878.

Glynn, Laura M., Pathik D. Wadhwa, Christine Dunkel-Schetter, Aleksandra Chicz-DeMet, and Curt A. Sandman. 2001. "When Stress Happens Matters: Effects of Earthquake Timing on Stress Responsivity in Pregnancy." *American Journal of Obstetrics & Gynecology* 184 (4):637–642.

Grantham-McGregor, Sally, Yin Bun Cheung, Santiago Cueto, Paul Glewwe, Linda Richter, and Barbara Strupp. 2007. "Developmental Potential in the First 5 Years for Children in Developing Countries." *The Lancet* 369 (9555):60–70.

Heckman, James J. 2006. "Skill Formation and the Economics of Investing in Disadvantaged Children." *Science* 312 (5782):1900–1902.

Ichino, Andrea and Rudolf Winter-Ebmer. 2004. "The Long-run Educational Cost of World War II." *Journal of Labor Economics* 22 (1):57–87.

Jayachandran, Seema and Ilyana Kuziemko. 2011. "Why Do Mothers Breastfeed Girls Less than Boys? Evidence and Implications for Child Health in India." *Quarterly Journal of Economics* 126 (3):1485–1538.

Kaul, Tara. 2018. "Intra-Household Allocation of Educational Expenses: Gender Discrimination and Investing in the Future." *World Development* 104:336–343.

Le, Kien and My Nguyen. 2020. "Aerial Bombardment and Educational Attainment." *International Review of Applied Economics* 34 (3):361–383.

Lee, Chulhee. 2014. "In Utero Exposure to the Korean War and Its Long-Term Effects on Socioeconomic and Health Outcomes." *Journal of Health Economics* 33:76–93.

Mansour, Hani and Daniel I Rees. 2012. "Armed Conflict and Birth Weight: Evidence from the al-Aqsa Intifada." *Journal of Development Economics* 99 (1):190–199.

Milton, Sansom. 2017. *Higher Education and Post-Conflict Recovery.* Springer.

Østby, Gudrun, Siri Aas Rustad, and AF Tollefsen. 2023. "Children Affected by Armed Conflict, 1990–2022." *Peace Research Institute Oslo* .

Oster, Emily. 2009. "Does Increased Access Increase Equality? Gender and Child Health Investments in India." *Journal of Development Economics* 89 (1):62–76.

Rose, Elaina. 2000. "Gender Bias, Credit Constraints and Time Allocation in Rural India." *Economic Journal* 110 (465):738–758.

Ryan, Joseph P, Brian A Jacob, Max Gross, Brian E Perron, Andrew Moore, and Sharlyn Ferguson. 2018. "Early Exposure to Child Maltreatment and Academic Outcomes." *Child Maltreatment* 23 (4):365–375.

Saing, Chan Hang and Harounan Kazianga. 2020. "The Long-Term Impacts of Violent Conflicts on Human Capital: US Bombing and Education, Earnings, Health, Fertility and Marriage in Cambodia." *Journal of Development Studies* 56 (5):874–889.

Sardoschau, Sulin. 2024. "In utero exposure to violence and child health in Iraq." *Journal of Population Economics* 37 (2):40.

Shemyakina, Olga. 2011. "The Effect of Armed Conflict on Accumulation of Schooling: Results from Tajikistan." *Journal of Development Economics* 95 (2):186–200.

Slade, Eric P and Lawrence S Wissow. 2007. "The Influence of Childhood Maltreatment on Adolescents' Academic Performance." *Economics of Education Review* 26 (5):604–614.

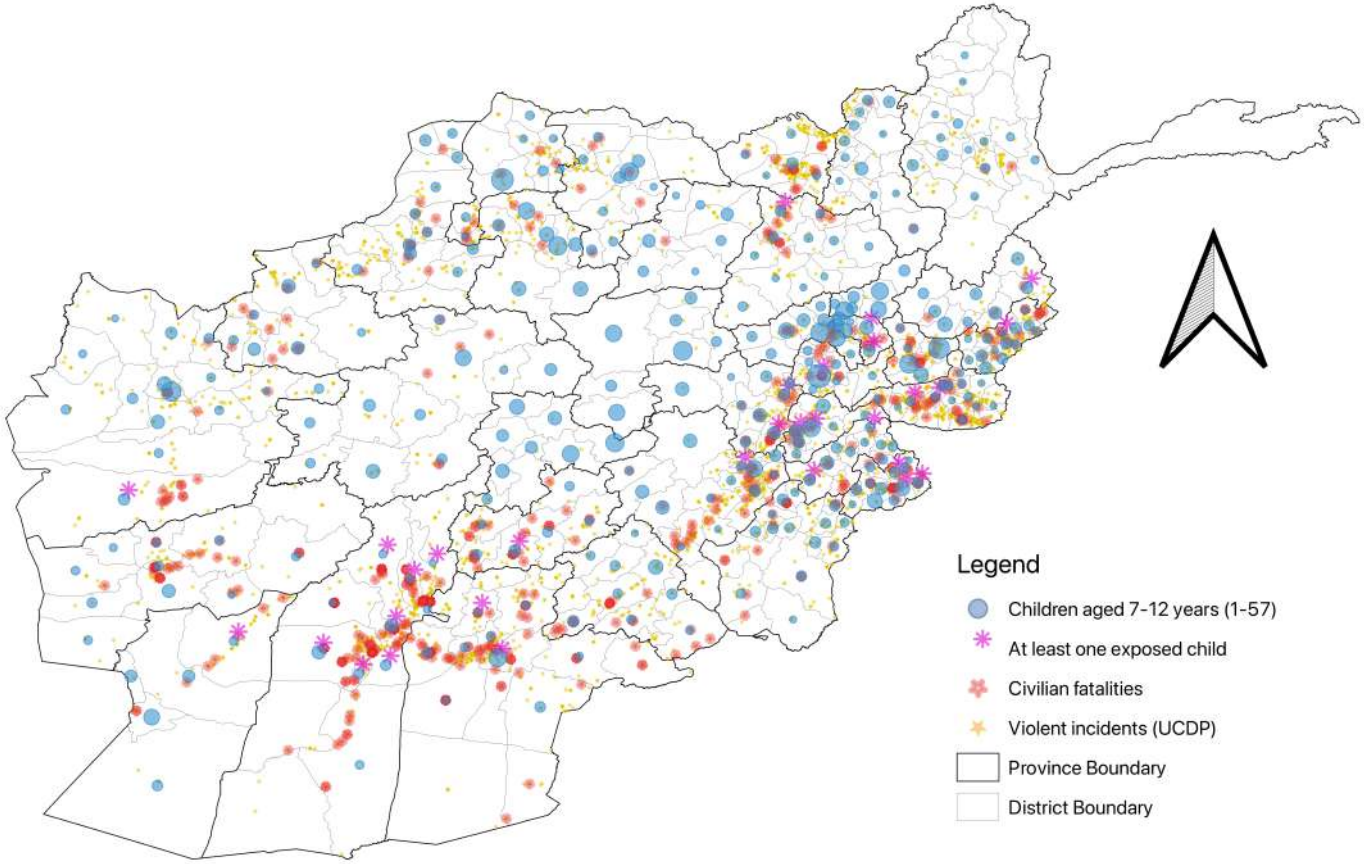
UNICEF et al. 2018. "All Children in School and Learning Global Initiative on Out-of-School Children Afghanistan Country Study." *Ministry of Education* .

Verwimp, Philip, Patricia Justino, and Tilman Brück. 2019. "The Microeconomics of Violent Conflict." *Journal of Development Economics* 141:102297.

Walker, Susan P, Theodore D Wachs, Julie Meeks Gardner, Betsy Lozoff, Gail A Wasserman, Ernesto Pollitt, and Julie A Carter. 2007. "Child Development: Risk Factors for Adverse Outcomes in Developing Countries." *The Lancet* 369 (9556):145–157.

World Bank. 2024. "Afghanistan Development Update – Navigating Challenges and Confronting Economic Recession and Deflation." Tech. rep., World Bank, Washington, DC.

Figure 1. Spatial Distribution of the Analytical Sample, Violent Incidents, and Civilian Casualties (2009–2016)



Note: This map shows the spatial coverage of the analytical sample, violent incidents, and civilian casualties by district in Afghanistan from 2009 to 2016. Blue circles represent the number of surveyed children in the analytical sample aged 7–12 years, red markers indicate districts with reported civilian casualties, purple stars denote districts where children were exposed to fatalities in utero, and yellow stars mark violent incidents. The map is constructed by the authors based on data from the Multiple Indicator Cluster Survey (MICS)–Afghanistan and the Uppsala Conflict Data Program.

Table 1. Descriptive Statistics for the Study Sample

	Pooled	Male	Female	p-value
	(1)	(2)	(3)	(2 = 3)
Female	0.394			
	(0.489)			
In-Utero Exposure	0.124	0.129	0.117	0.411
	(0.330)	(0.335)	(0.322)	
Post-Birth Exposure	0.447	0.442	0.456	0.522
	(0.497)	(0.497)	(0.498)	
Mother Alive	0.981	0.979	0.985	0.256
	(0.136)	(0.145)	(0.121)	
Father Alive	0.935	0.932	0.939	0.534
	(0.247)	(0.252)	(0.240)	
Mother's Education				
No schooling	0.854	0.870	0.828	0.006
	(0.353)	(0.336)	(0.377)	
Less than high school	0.089	0.083	0.099	0.196
	(0.285)	(0.276)	(0.299)	
High school	0.033	0.023	0.049	0.001
	(0.179)	(0.150)	(0.216)	
Any tertiary	0.023	0.022	0.024	0.798
	(0.149)	(0.147)	(0.153)	
Urban	0.159	0.144	0.182	0.018
	(0.366)	(0.352)	(0.386)	
Average District Temperature (°C)	10.566	10.673	10.402	0.338
	(6.506)	(6.528)	(6.472)	
Average District Luminosity	0.719	0.641	0.838	0.006
	(1.667)	(1.527)	(1.856)	

Note: This table presents the descriptive statistics for the analytical sample, including the pooled sample, including both male and female children, and gender-specific subsamples. The variables include individual-level characteristics for each child in the survey, such as parental survival status, mother's educational attainment, and whether the child lives in an urban area. We also report district-level measures, including average district temperature and luminosity. Post-birth exposure refers to exposure to the median number of post-birth civilian casualties, which is seven; therefore, we define it as exposure to seven or more post-birth casualties. The last column reports the p-value for the difference in means between columns (3) and (2).

Table 2. Unadjusted Descriptive Statistics for Outcome Variables

	Sample (1)	In Utero = 1 (2)	In Utero = 0 (3)	p-value (2 = 3)
Panel A: Pooled				
Ever school	0.786	0.671	0.802	0.000
	(0.410)	(0.471)	(0.398)	
Current grade	3.495	3.433	3.502	0.608
	(1.681)	(1.897)	(1.654)	
Math performance	0	-0.074	0.010	0.191
		(0.985)	(1.002)	
Functional difficulty	0	0.201	-0.028	0.000
		(1.042)	(0.991)	
Physical punishment	0	0.177	-0.025	0.002
		(0.954)	(1.004)	
N	2,231	277	1954	
Panel B: Female				
Ever school	0.764	0.592	0.786	0.000
	(0.425)	(0.494)	(0.410)	
Current grade	3.502	3.286	3.523	0.317
	(1.693)	(1.988)	(1.661)	
Math performance	-0.092	-0.187	-0.079	0.330
	(1.052)	(1.022)	(1.055)	
Functional difficulty	-0.065	0.207	-0.101	0.002
	(0.942)	(1.114)	(0.911)	
Physical punishment	-0.124	0.064	-0.149	0.037
	(0.971)	(0.933)	(0.974)	
N	880	103	777	
Panel C: Male				
Ever school	0.801	0.718	0.813	0.003
	(0.399)	0.451)	(0.390)	
Current grade	3.491	3.504	3.489	0.927
	(1.674)	(1.856)	(1.650)	
Math performance	0.060	-0.007	0.070	0.329
	(0.961)	(0.959)	(0.961)	
Functional difficulty	0.042	0.198	0.019	0.035
	(1.034)	(1.000)	(1.038)	
Physical punishment	0.081	0.244	0.056	0.022
	(1.010)	(0.962)	(1.015)	
N	1,351	174	1,177	

Note: This table presents the descriptive statistics for the outcome variable for the full sample, as well as comparisons between children exposed and unexposed to in utero fatalities, including gender-specific subsamples in Panels B and C. The pooled sample includes both male and female children. The last column reports the p-value for the difference in means between columns (3) and (2).

Table 3. Effects of In-Utero Exposure to Civilian Casualties

	Ever school (1)	Current grade (2)	Math performance (3)	Functional difficulty (4)	Physical punishment (5)
Panel A: Pooled					
In-Utero Exposure	-0.067**	0.050	0.024	0.080	0.014
	(0.031)	(0.072)	(0.067)	(0.061)	(0.048)
Post-Birth Exposure	-0.070*	-0.124	-0.110*	-0.087	0.021
	(0.037)	(0.123)	(0.064)	(0.059)	(0.070)
N	2,228	1,599	2,228	2,217	2,215
Panel B: Gender Differences					
In-Utero Exposure	-0.017	0.080	0.092	-0.074	-0.084
	(0.044)	(0.088)	(0.079)	(0.087)	(0.067)
Female	-0.035	-0.108*	-0.158***	-0.135**	-0.136**
	(0.028)	(0.058)	(0.054)	(0.064)	(0.055)
In Utero × Female	-0.115**	-0.074	-0.158**	0.356**	0.227**
	(0.054)	(0.135)	(0.075)	(0.154)	(0.092)
Post-Birth Exposure	-0.071*	-0.125	-0.110*	-0.086	0.022
	(0.036)	(0.123)	(0.063)	(0.058)	(0.069)
N	2,228	1,599	2,228	2,217	2,215
Panel C: Gender Differences with Post × Female Interaction					
In-Utero Exposure	-0.012	0.082	0.101	-0.036	-0.089
	(0.047)	(0.086)	(0.071)	(0.082)	(0.067)
Female	-0.048*	-0.113	-0.182**	-0.237***	-0.124**
	(0.028)	(0.074)	(0.082)	(0.081)	(0.054)
In Utero × Female	-0.126**	-0.078	-0.178*	0.271*	0.237**
	(0.053)	(0.133)	(0.095)	(0.139)	(0.106)
Post-Birth Exposure	-0.081*	-0.129	-0.130	-0.167**	0.032
	(0.044)	(0.137)	(0.085)	(0.070)	(0.078)
Post-Birth × Female	0.025	0.011	0.049	0.204**	-0.024
	(0.044)	(0.137)	(0.160)	(0.090)	(0.088)
N	2,228	1,599	2,228	2,217	2,215
Province FE	✓	✓	✓	✓	✓
Age FE	✓	✓	✓	✓	✓

Note: This table presents the long-term effects of in utero exposure to civilian fatalities. Panel A reports results for the pooled sample, including both male and female children, while Panel B shows gender-specific effects. Panel C accounts for variation in post-birth exposure by gender. The dependent variable mean in the first column is 0.79, and in the second column, it is 3.50. For the remaining columns, the means are zero because the variables are standardized. All models include additional controls for parental and household demographic variables, as well as district-level time-varying variables, reported in Table 1. Standard errors are clustered at the province level. Significance levels: * $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$.

Table 4. Effects of Placebo In-Utero Exposures

	Ever school (1)	Current grade (2)	Math performance (3)	Functional difficulty (4)	Physical punishment (5)
			Panel A: Pooled		
In-Utero Exposure	-0.071**	0.029	0.021	0.085	0.013
	(0.032)	(0.070)	(0.062)	(0.072)	(0.049)
Placebo period #1	-0.054	-0.102	0.110	-0.066	-0.133*
	(0.040)	(0.104)	(0.102)	(0.091)	(0.074)
Placebo period #2	0.040	0.186	0.009	-0.032	-0.058
	(0.035)	(0.145)	(0.133)	(0.109)	(0.074)
Placebo period #3	0.024	0.124	0.029	-0.029	0.067
	(0.034)	(0.160)	(0.078)	(0.061)	(0.067)
Post-Birth Exposure	-0.071*	-0.146	-0.124*	-0.075	0.032
	(0.039)	(0.114)	(0.067)	(0.067)	(0.071)
N	2,228	1,599	2,228	2,217	2,215
			Panel B: Gender Differences		
In-Utero Exposure	-0.019	0.047	0.081	-0.067	-0.083
	(0.043)	(0.087)	(0.072)	(0.084)	(0.065)
Female	-0.034	-0.104*	-0.159***	-0.135**	-0.135**
	(0.027)	(0.056)	(0.053)	(0.064)	(0.055)
In Utero × Female	-0.119**	-0.043	-0.136*	0.345**	0.220**
	(0.050)	(0.149)	(0.071)	(0.136)	(0.089)
Placebo period #1	-0.060	-0.105	0.104	-0.049	-0.122
	(0.041)	(0.107)	(0.099)	(0.082)	(0.076)
Placebo period #2	0.037	0.184	0.006	-0.025	-0.053
	(0.036)	(0.147)	(0.132)	(0.110)	(0.070)
Placebo period #3	0.016	0.121	0.020	-0.007	0.082
	(0.034)	(0.162)	(0.079)	(0.053)	(0.064)
Post-Birth Exposure	-0.069*	-0.145	-0.123*	-0.078	0.030
	(0.039)	(0.115)	(0.066)	(0.064)	(0.070)
N	2,228	1,599	2,228	2,217	2,215

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Table 4. – continued from previous page

	Ever school (1)	Current grade (2)	Math performance (3)	Functional difficulty (4)	Physical punishment (5)
Panel C: Gender Differences with Post × Female Interaction					
In-Utero Exposure	-0.014	0.049	0.089	-0.028	-0.087
	(0.046)	(0.083)	(0.066)	(0.080)	(0.065)
Female	-0.048*	-0.110	-0.181**	-0.238***	-0.127**
	(0.028)	(0.073)	(0.084)	(0.081)	(0.055)
In Utero × Female	-0.131**	-0.049	-0.155	0.258**	0.227**
	(0.048)	(0.139)	(0.101)	(0.122)	(0.102)
Post-Birth Exposure	-0.080*	-0.150	-0.140*	-0.160**	0.037
	(0.046)	(0.135)	(0.080)	(0.073)	(0.079)
Post-Birth × Female	0.028	0.012	0.044	0.206**	-0.017
	(0.043)	(0.132)	(0.167)	(0.090)	(0.088)
Placebo period #1	-0.060	-0.105	0.103	-0.054	-0.122
	(0.041)	(0.105)	(0.102)	(0.083)	(0.077)
Placebo period #2	0.037	0.184	0.006	-0.026	-0.053
	(0.036)	(0.146)	(0.132)	(0.108)	(0.069)
Placebo period #3	0.016	0.121	0.021	-0.005	0.081
	(0.034)	(0.164)	(0.080)	(0.054)	(0.064)
N	2,228	1,599	2,228	2,217	2,215
Province FE	✓	✓	✓	✓	✓
Age FE	✓	✓	✓	✓	✓

Note: This table presents the long-term effects of placebo in utero exposures to civilian fatalities. Panel A reports results for the pooled sample, including both male and female children, while Panel B shows gender-specific effects. Panel C accounts for variation in post-birth exposure by gender. The dependent variable mean in the first column is 0.79, and in the second column, it is 3.50. For the remaining columns, the means are zero because the variables are standardized. All models include additional controls for parental and household demographic variables, as well as district-level time-varying variables, reported in Table 1. Standard errors are clustered at the province level. Significance levels: * $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$.

Table 5. Child Exposure and Household Assets

	Overall index	By economic importance			
		High	Medium	Medium-low	Low
	(1)	(2)	(3)	(4)	(5)
Child exposed	-0.072**	-0.102***	-0.074**	-0.005	-0.020
	(0.031)	(0.032)	(0.033)	(0.025)	(0.030)
N	17,986	18,180	18,076	18,180	18,170

Note: This table presents the relationship between in-utero child exposure to civilian fatalities and household assets. All outcomes are normalized by province, the coefficients are reported in standard deviation and each estimate comes from a separate regression. There are 29 individual items, each taking a value of 1 if the household owns it, and 0 otherwise. The items are grouped by the authors based on the importance of the assets. The "high asset" category includes ownership of agricultural land, a car/truck, tractor, rickshaw, or motorcycle. The "medium" category includes items such as a bicycle, computer, generator, cattle, cows, horses/donkeys, goats, sheep, camels, chickens, ducks, or an animal-drawn cart. The "medium-low" includes items such as a refrigerator, electricity, television, radio, mobile phone, stand fan, or sewing machine. The "low" category includes furniture items such as a table, chair, sofa, bed, cupboard, or watch. We estimate the model using district fixed effects and cluster standard error at the district level. Significance levels: * $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$.

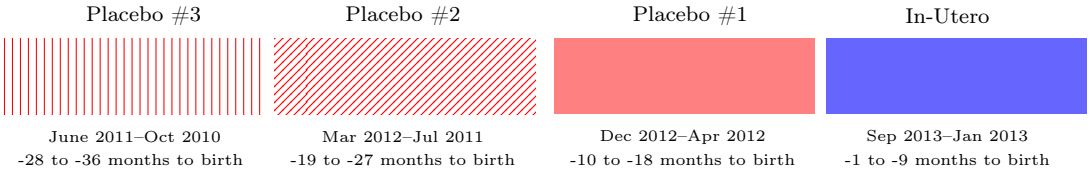
Table 6. Women and Men Employment and Ownership Index

	Women index	Men index
	(1)	(2)
Child exposed	0.007	0.039
	(0.049)	(0.053)
N	18,790	10,361

Note: This table presents the relationship between in-utero child exposure to civilian fatalities and adult employment and ownership indices. All outcomes are normalized by province, the coefficients are reported in standard deviation and each estimate comes from a separate regression. The women's index includes indicators for whether women work, own a house (alone or jointly), and own land (alone or jointly). The men's index includes indicators for whether men work year-round, own a house (alone or jointly), and own land (alone or jointly). We estimate the model using district fixed effects and cluster standard errors at the district level. Significance levels: * $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$.

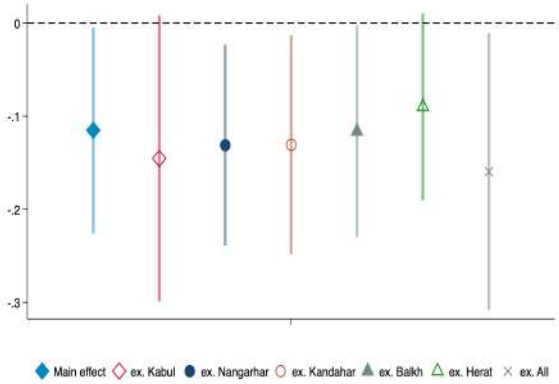
Appendix Figures and Tables

Figure A.1. In-Utero Periods for a Child with an October 2013 Birth-Month

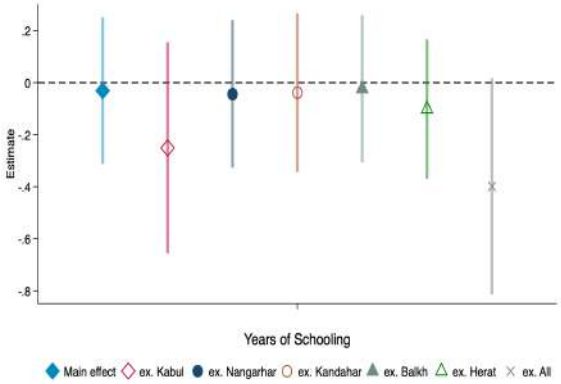


Note: This figure illustrates an example of extending the pre-birth period to 36 months prior to the birth month for a child born in October 2013. The period is divided into four nine-month intervals, resulting in four in-utero periods for the child: one actual period (-9 to -1 months before birth) and three placebo (pre-birth) periods (-10 to -36 months before birth). Exposure indicators are constructed for mothers across all periods, assigning a value of 1 if the mother was exposed to civilian casualties and 0 otherwise.

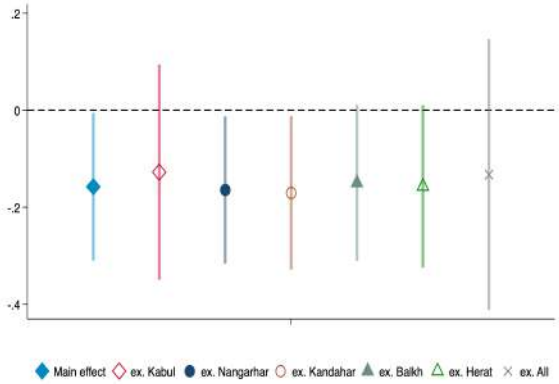
Figure A.2. Leave-one-out analysis for the interaction model



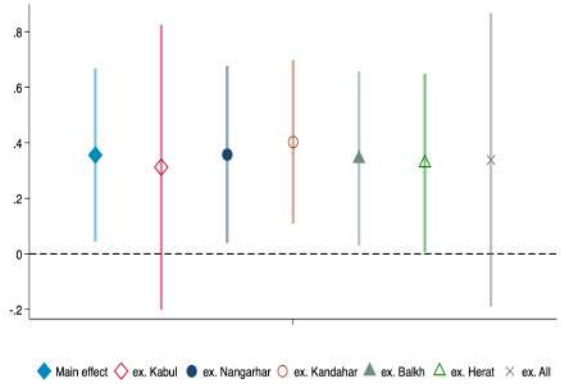
(1) Ever School



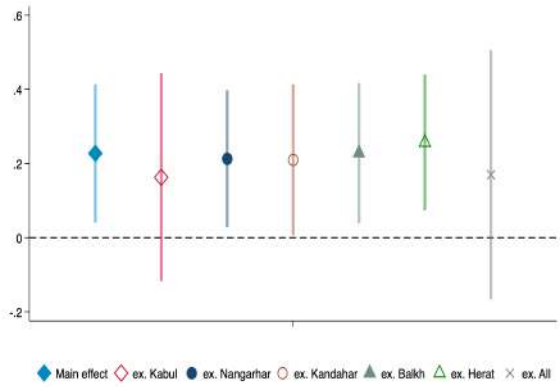
(2) Current Grade



(3) Math Performance



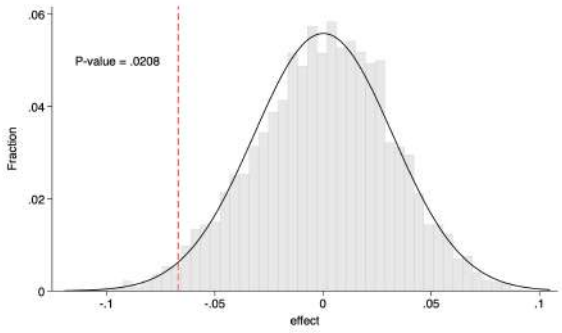
(4) Functional Difficulty



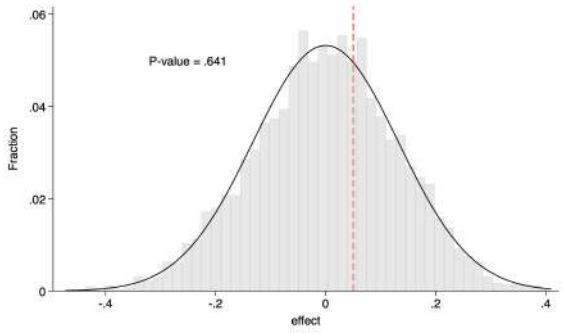
(5) Physical Punishment

Note: Each figure depicts the interaction coefficient (*In-Utero* × *Female*) from separate regressions, where one or all major provinces are excluded. The whiskers indicate 95% confidence intervals.

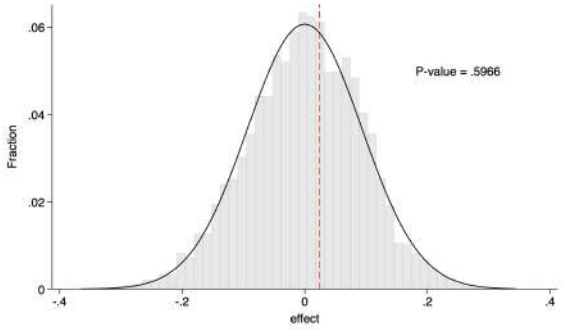
Figure A.3. Distribution of Effects from a Random In-Utero Exposure Assignment - Pooled Sample



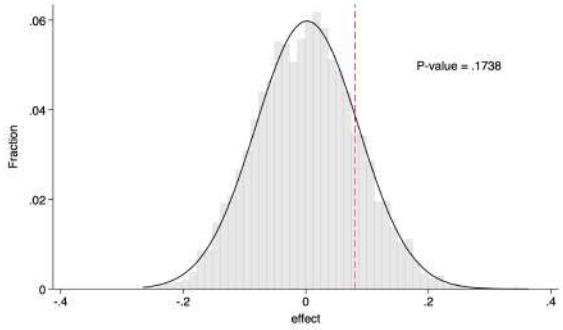
(1) Ever School



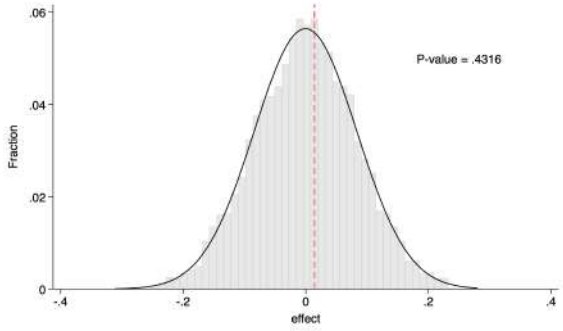
(2) Current Grade



(3) Math Performance



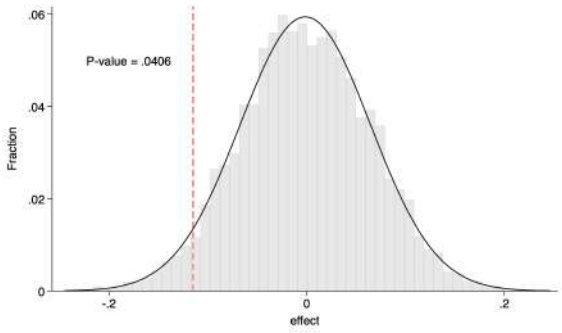
(4) Functional Difficulty



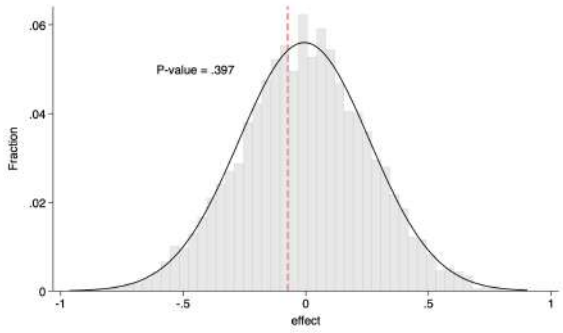
(5) Physical Punishment

Note: Each figure depicts the distribution of in-utero exposure effects derived from 5,000 simulations. For each simulation, in-utero exposure to civilian fatalities is randomly assigned, and the treatment effect is estimated repeatedly using the primary specification in Equation (1). The resulting distributions of these estimates are plotted for the pooled sample to evaluate the robustness of our benchmark inference. The vertical line indicates the benchmark estimates, which correspond to those reported in Panel A of Table 3.

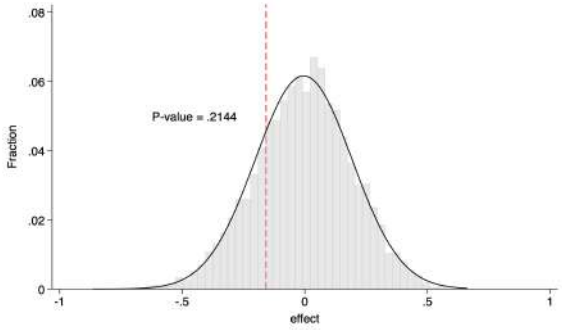
Figure A.4. Distribution of Effects from a Random In-Utero Exposure Assignment - Gender Differences



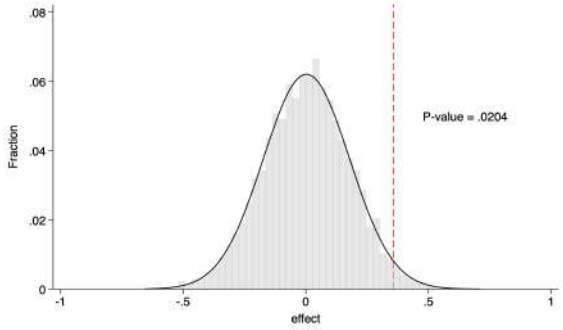
(1) Ever School



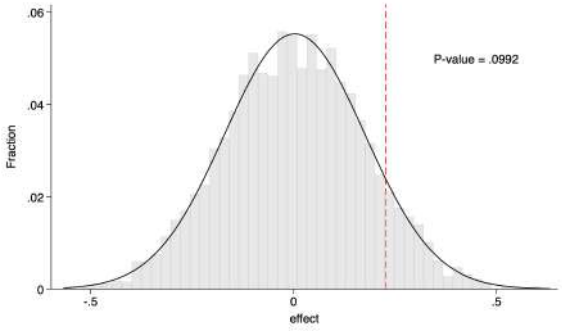
(2) Current Grade



(3) Math Performance



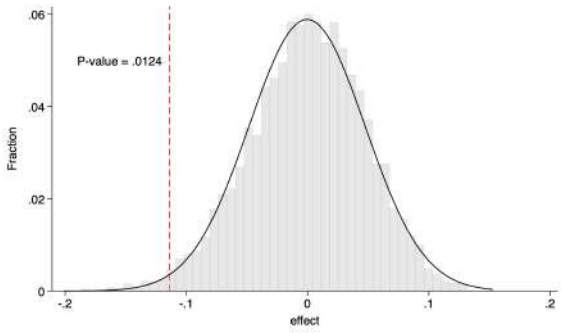
(4) Functional Difficulty



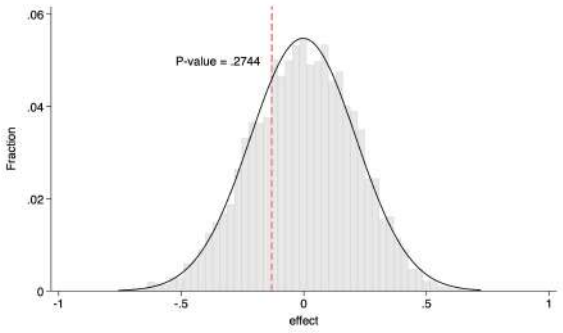
(5) Physical Punishment

Note: Each figure depicts the distribution of in-utero exposure effects derived from 5,000 simulations. For each simulation, in-utero exposure to civilian fatalities is randomly assigned, and the treatment effect is estimated repeatedly using the alternative specification that incorporates the interaction term, *In-Utero* × *Female*, in Equation (1) . The resulting distributions of these estimates are plotted for the gender interaction term to evaluate the robustness of our benchmark inference. The vertical line indicates the benchmark estimates, which correspond to those reported in Panel B of Table 3.

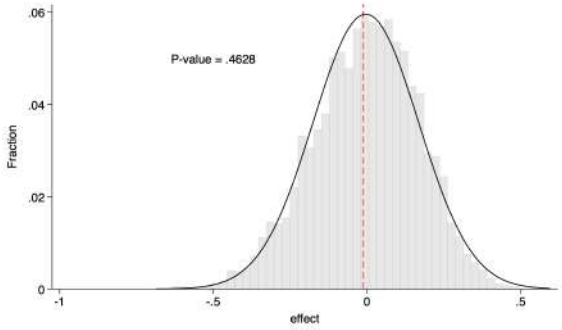
Figure A.5. Distribution of Effects from a Random In-Utero Exposure Assignment - Female Subsample



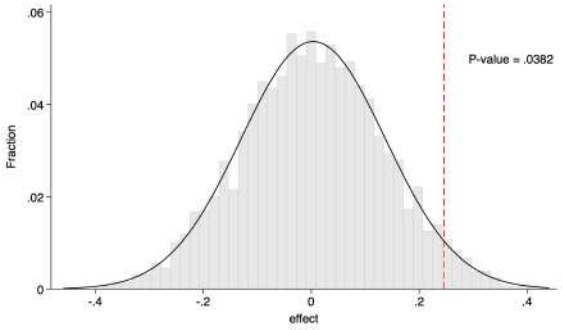
(1) Ever School



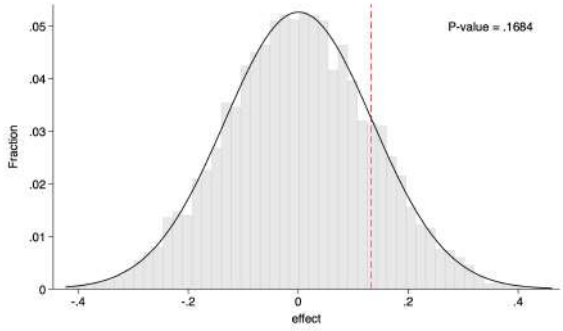
(2) Current Grade



(3) Math Performance



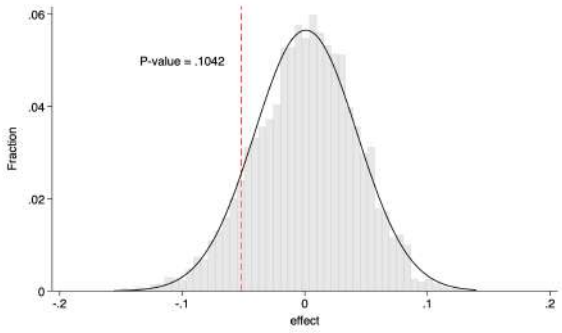
(4) Functional Difficulty



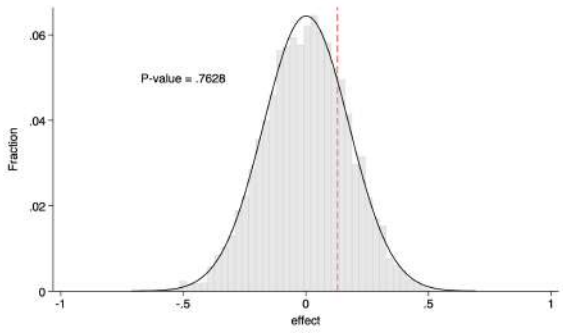
(5) Physical Punishment

Note: Each figure depicts the distribution of in-utero exposure effects derived from 5,000 simulations. For each simulation, in-utero exposure to civilian fatalities is randomly assigned, and the treatment effect is estimated repeatedly using the primary specification in Equation (1). The resulting distributions of these estimates are plotted for the female subsample to evaluate the robustness of our benchmark inference. The vertical line indicates the benchmark estimates, which correspond to those reported in Panel A of Table A.5.

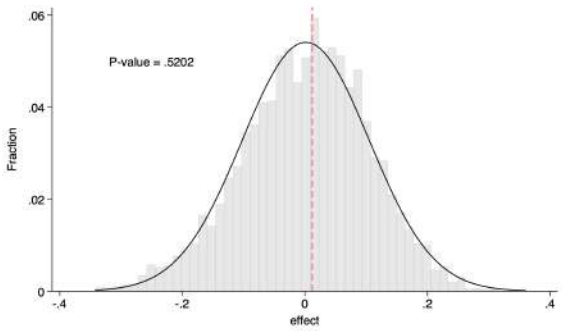
Figure A.6. Distribution of Effects from a Random In-Utero Exposure Assignment - Male Subsample



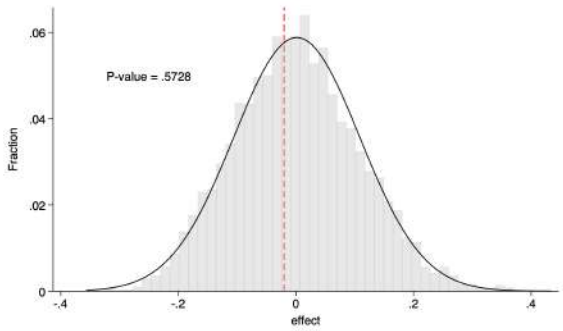
(1) Ever School



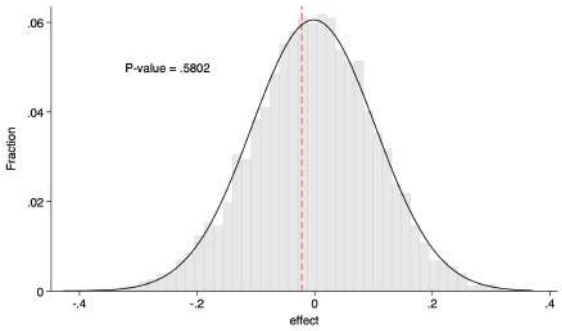
(2) Current Grade



(3) Math Performance



(4) Functional Difficulty



(5) Physical Punishment

Note: Each figure depicts the distribution of in-utero exposure effects derived from 5,000 simulations. For each simulation, in-utero exposure to civilian fatalities is randomly assigned, and the treatment effect is estimated repeatedly using the primary specification in Equation (1). The resulting distributions of these estimates are plotted for the male subsample to evaluate the robustness of our benchmark inference. The vertical line indicates the benchmark estimates, which correspond to those reported in Panel B of Table A.5.

Table A.1. Balance Table for Exposure to Civilian Fatalities - Joint Regressions

	In-Utero Exposure	Post-Birth Exposure
	(1)	(2)
Female	-0.011	-0.005
	(0.016)	(0.021)
Mother Alive	-0.074	-0.065
	(0.090)	(0.064)
Father Alive	0.018	-0.036
	(0.028)	(0.045)
Mother's Education		
Less than high school	-0.035*	-0.017
	(0.017)	(0.047)
High school	-0.133*	0.032
	(0.066)	(0.035)
Any tertiary	-0.072***	-0.014
	(0.024)	(0.049)
Urban	0.059	0.104
	(0.072)	(0.081)
Average District Temperature (°C)	0.007	0.030**
	(0.006)	(0.013)
Average District Luminosity	0.039	0.030
	(0.027)	(0.040)
N	2,228	2,228

Note: This table presents the relationship between child demographic variables and in-utero and post-birth exposures to civilian fatalities. Each column representing a single regression. All models include province and age fixed effects. Standard errors are clustered at the province level. Significance levels: * $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$.

Table A.2. Balance Table for Exposure to Civilian Fatalities - Separate Regressions

	In-Utero Exposure	Post-Birth Exposure
	(1)	(2)
Female	-0.014	0.003
	(0.025)	(0.029)
Mother Alive	-0.102	-0.108
	(0.074)	(0.067)
Father Alive	0.017	-0.023
	(0.032)	(0.043)
Mother's Education		
No schooling	0.032	-0.024
	(0.020)	(0.050)
Less than high school	-0.013	-0.006
	(0.019)	(0.061)
High school	-0.085**	0.076
	(0.031)	(0.062)
Any tertiary	0.002	0.056
	(0.035)	(0.065)
Urban	0.165	0.239*
	(0.102)	(0.123)
Average District Temperature (°C)	0.015*	0.038**
	(0.007)	(0.015)
Average District Luminosity	0.048**	0.058
	(0.023)	(0.036)
N	2,231	2,231

Note: This table presents the relationship between child demographic variables and in-utero and post-birth exposures to civilian fatalities. Each row-column representing a single regression. All models include province and age fixed effects, and standard errors are clustered at the province level. Significance levels are denoted as follows: * $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$.

Table A.3. List of Survey Items Categorized by Indices

Composite Index	Sub-indices	Survey option	Answer
Math	Number identification	9	9
		12	12
		30	30
		48	48
		74	74
		731	731
	Large numbers	7 vs. 5	7
		11 vs. 24	24
		58 vs. 49	58
		65 vs. 67	67
		146 vs. 154	154
	Addition	3 + 2	5
		8 + 6	14
		7 + 3	10
		13 + 6	19
		12 + 24	36
	Number sequence	5, 6, 7, _	8
		14, 15, _ , 17	16
		20, _ , 40, 50	30
		2, 4, 6, _	8
		5, 8, 11, _	14
Functional difficulty	Cognitive Difficulty	Difficulty being understood by household members	Yes/No
		Difficulty being understood by outsiders	Yes/No
		Remembering	Yes/No
		Learning	Yes/No
		Concentrating	Yes/No
		Accepting changes in routine	Yes/No
		Controlling behavior	Yes/No
		Making friends	Yes/No
		Being depressed at all	Yes/No
		Being anxious or worried at all	Yes/No
	Physical Difficulty	Wear glass	Yes/No
		Use hearing aid	Yes/No
		Difficulty hearing	Yes/No
		Difficulty walking	Yes/No
		Difficulty seeing	Yes/No
		Difficulty with feeding or dressing	Yes/No
Physical punishment		Being shook	Yes/No
		Shouted, yelled at or screamed	Yes/No
		Hit or slapped on the bottom	Yes/No
		Hit by belt, hairbrush, stick or other hard object	Yes/No
		Hit or slapped on face/head	Yes/No
		Hit or slapped on arm/hand/leg	Yes/No
		Beat up	Yes/No

Table A.4. Effects of In-Utero Exposure on Math and Functional Difficulty Sub-Indices

	Math Index				Functional Difficulty	
	Number recognition	Large Number	Addition	Pattern	Physical Difficulty	Cognitive Difficulty
	(1)	(2)	(3)	(4)	(5)	(6)
In-Utero Exposure	0.073	0.012	0.044	0.166	-0.136*	-0.046
	(0.061)	(0.077)	(0.089)	(0.099)	(0.071)	(0.091)
Female	-0.162**	-0.198***	-0.052	-0.097*	-0.110***	-0.118
	(0.067)	(0.064)	(0.035)	(0.054)	(0.039)	(0.070)
In Utero × Female	-0.292***	-0.056	-0.189	-0.000	0.174*	0.341**
	(0.093)	(0.094)	(0.116)	(0.090)	(0.096)	(0.150)
Post-Birth Exposure	-0.087*	-0.050	-0.099	-0.123	0.014	-0.099*
	(0.049)	(0.051)	(0.069)	(0.090)	(0.056)	(0.056)
N	2,228	2,228	2,228	2,228	2,220	2,224
Province FE	✓	✓	✓	✓	✓	✓
Age FE	✓	✓	✓	✓	✓	✓

Note: This table presents the long-term effects of in utero exposure to civilian fatalities on sub-indices of math and functional difficulty, highlighting gender-specific effects. The dependent variable means are zero, as the variables are standardized. All models include controls for parental and household demographic characteristics, as well as district-level time-varying variables, as reported in Table 1. Standard errors are clustered at the province level. Significance levels: * $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$. 1.

Table A.5. Effects of In-Utero Exposure to Civilian Casualties by Gender

	Ever school	Current grade	Math performance	Functional difficulty	Physical punishment
	(1)	(2)	(3)	(4)	(5)
			Panel A: Female		
In-Utero Exposure	-0.114***	-0.131	-0.012	0.246***	0.133
	(0.032)	(0.125)	(0.150)	(0.068)	(0.146)
Post-Birth Exposure	-0.047	-0.097	-0.048	0.015	-0.022
	(0.048)	(0.159)	(0.115)	(0.077)	(0.099)
N	879	612	879	874	873
			Panel B: Male		
In-Utero Exposure	-0.052	0.129	0.012	-0.020	-0.022
	(0.050)	(0.110)	(0.078)	(0.116)	(0.084)
Post-Birth Exposure	-0.078*	-0.136	-0.111	-0.200***	0.044
	(0.041)	(0.127)	(0.091)	(0.069)	(0.083)
N	1,349	987	1,349	1,343	1,342
Province FE	✓	✓	✓	✓	✓
Age FE	✓	✓	✓	✓	✓

Note: This table presents the long-term effects of in utero exposure to civilian fatalities by gender sub-sample. Panel A reports results for female, while Panel B shows male-specific effects. The dependent variable mean in the first column is 0.76 and 0.80 for panel A and B; and in the second column is 3.50 and 3.49 for panel A and B, respectively; for the remaining columns, the means are zero, as the variables are standardized. All models include additional controls for parental and household demographic variables, as well as district-level time-varying variables, reported in Table 1. Standard errors are clustered at the province level. Significance levels: * $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$.

Table A.6. Effects of Placebo In-Utero Exposures by Gender Sub-Sample

	Ever school (1)	Current grade (2)	Math performance (3)	Functional difficulty (4)	Physical punishment (5)
			Panel A: Female		
In-Utero Exposure	-0.123***	-0.197	-0.014	0.228***	0.111
	(0.031)	(0.138)	(0.156)	(0.064)	(0.161)
Placebo period #1	-0.080	-0.305	0.015	-0.124	-0.197
	(0.090)	(0.210)	(0.195)	(0.182)	(0.117)
Placebo period #2	-0.022	0.013	0.050	0.017	0.084
	(0.049)	(0.211)	(0.155)	(0.220)	(0.115)
Placebo period #3	-0.007	0.114	-0.039	-0.038	0.102
	(0.053)	(0.347)	(0.206)	(0.124)	(0.082)
Post-Birth Exposure	-0.036	-0.080	-0.050	0.031	-0.018
	(0.051)	(0.143)	(0.128)	(0.082)	(0.102)
N	879	612	879	874	873
			Panel B: Male		
In-Utero Exposure	-0.058	0.080	-0.006	-0.020	-0.031
	(0.052)	(0.113)	(0.077)	(0.115)	(0.083)
Placebo period #1	-0.047	0.056	0.148**	0.029	-0.001
	(0.043)	(0.118)	(0.066)	(0.079)	(0.105)
Placebo period #2	0.064	0.199	-0.052	-0.057	-0.129
	(0.046)	(0.154)	(0.121)	(0.096)	(0.091)
Placebo period #3	0.022	0.095	0.068	0.017	0.126
	(0.030)	(0.142)	(0.082)	(0.122)	(0.090)
Post-Birth Exposure	-0.080*	-0.165	-0.127	-0.201**	0.040
	(0.042)	(0.131)	(0.087)	(0.077)	(0.082)
N	1,349	1,072	1,349	1,343	1,342
Province FE	✓	✓	✓	✓	✓
Age FE	✓	✓	✓	✓	✓

Note: This table presents the long-term effects of placebo in utero exposures to civilian fatalities by gender sub-sample. Panel A reports results for female only, while Panel B shows male-specific effects. The dependent variable mean in the first column is 0.76 and 0.80 for panel A and B; and in the second column is 3.50 and 3.49 for panel A and B, respectively; for the remaining columns, the means are zero, as the variables are standardized. All models include additional controls for parental and household demographic variables, as well as district-level time-varying variables, reported in Table 1. Standard errors are clustered at the province level. Significance levels: * $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$.

Table A.7. Effects of In-Utero Exposure only with Post-Birth Exposure Control

	Ever school	Current grade	Math performance	Functional difficulty	Physical punishment
	(1)	(2)	(3)	(4)	(5)
Panel A: Pooled					
In-Utero Exposure	-0.052	0.094	0.049	0.067	0.006
	(0.033)	(0.073)	(0.080)	(0.047)	(0.065)
Post-Birth Exposure	-0.049	-0.004	-0.016	-0.115	-0.056
	(0.036)	(0.078)	(0.082)	(0.072)	(0.058)
N	2,231	1,600	2,231	2,220	2,217
Panel B: Gender Differences					
In-Utero Exposure	0.002	0.127	0.133	-0.092	-0.114
	(0.043)	(0.097)	(0.093)	(0.081)	(0.074)
Female	-0.022	-0.037	-0.105	-0.138**	-0.172***
	(0.028)	(0.064)	(0.062)	(0.065)	(0.054)
In Utero × Female	-0.126**	-0.093	-0.201**	0.358**	0.264**
	(0.057)	(0.125)	(0.085)	(0.159)	(0.106)
Post-Birth Exposure	-0.049	-0.003	-0.015	-0.114	-0.054
	(0.035)	(0.078)	(0.083)	(0.068)	(0.056)
N	2,231	1,600	2,231	2,220	2,217
Panel C: Female					
In-Utero Exposure	-0.093**	-0.068	-0.059	0.218***	0.103
	(0.043)	(0.108)	(0.155)	(0.068)	(0.151)
Post-Birth Exposure	0.002	0.111	0.073	0.021	-0.117
	(0.044)	(0.109)	(0.163)	(0.090)	(0.071)
N	880	612	880	875	873
Panel D: Male					
In-Utero Exposure	-0.039	0.179*	0.084	-0.058	-0.053
	(0.047)	(0.093)	(0.097)	(0.147)	(0.069)
Post-Birth Exposure	-0.072*	-0.050	-0.051	-0.227**	-0.028
	(0.040)	(0.099)	(0.098)	(0.088)	(0.078)
N	1,351	988	1,351	1,345	1,344
Province FE	✓	✓	✓	✓	✓
Age FE	✓	✓	✓	✓	✓

Note: This table presents the long-term effects of in utero exposure to civilian fatalities. Panel A reports results for the pooled sample, including both male and female children, while Panel B shows gender-specific effects, and Panel C and D shows effect by gender sub-sample. The dependent variable mean in the first column is 0.79, 0.76, and 0.80 for Panels A, C, and D, respectively. The dependent variable mean in the second column is 3.50, 3.50, and 3.49 for Panels A, C, and D, respectively. For the remaining columns, the means are zero, as the variables are standardized. All models include only controls for post-birth exposure. Standard errors are clustered at the province level. Significance levels: * $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$.