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The Local Impact of Armed Conflict on Children's Nutrition and Health Outcomes: Evidence from Chad

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Abstract: This study examines the local and indirect impacts of the 2005-2010 armed conflict on under- five years' old children's nutrition and health outcomes in Chad. We exploit spatial variation of the number of attacks at the district level and assess the indirect impacts of mother's exposure to the conflict on their less than five years old children's anthropometrics. We use unique dataset from the 2014/2015 Demographic and Health Survey (DHS-MICS) with GPS location of households' clusters combined with the 2005-2010 ACLED geo-localised data on armed conflict in Chad. Our empirical analysis establishes a negative and significant impact of armed conflict on children's anthropometric Z scores as well as their likelihood of stunting, underweight, and wasting. We also find that mothers exposed to the conflict are more likely to have children with lower weight and size at birth. Our results are robust after purging the conflict-induced migration effects. Key mechanisms include mother's access and utilisation of healthcare facilities and services. We found that mothers who were exposed to the conflict were neither likely to deliver their children in hospital, nor likely to take iron pills or Vitamin A during and after pregnancy. It is therefore crucial for the Chadian government and the international humanitarian community to implement genuine health policy interventions directed to mothers at childbearing age (15-49) in order to sustain their access and provision of health care facilities and services during and shortly after the end of conflict.

Keywords: Armed conflict, Children's nutrition and health outcomes, Conflict-induced migration, Chad.

JEL Codes: I12, J13, O12.

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1. Introduction

Over the past decades, there has been an upsurge of violent conflicts in Sub Saharan Africa and tensions have recently increased in the Central Africa sub region.[1] Seminal work undertaken by economists have attempted to understand the causes and spread of armed conflicts (Collier & Hoeffler 1998). Recently, there has been a growing body of evidence on the socio-economic consequences of violent conflict with a focus on human capital, mainly in terms of health and education for households and children who were hit hardest by attacks. (Collier 1999; Abadie & Gardeazabal 2003; (Miguel et al. 2004; Guidolin & La Ferrara 2007, Bellows & Miguel 2009; Davis & Weinstein 2002, Shemyakina, 2011, Swee 2009, Akresh, 2011). So far, little is still known on the nutritional and health impacts of violent conflict exposure on children who were born shortly after the end of casualties. Yet, there is an emerging concern among economists and practitioners that shocks experienced early in life may have persistent and long-term effects on socioeconomic performance of individuals and countries (Stein et al. 1975; Glewwe et al. 2001; Maluccio et al. 2009). It is largely recognised that investing in children's health and nutrition today will help shaping the world of tomorrow by preserving the human potential of the future generation. Such an awareness is emphasized by the fact that women and their children are usually the most affected victims of armed conflicts because of their vulnerability in the society. Armed conflict could therefore have lasting consequences on children's health but identifying such effects can be empirically challenging. Although some studies attempted to address this issue, a crude tendency emerging from the literature is that few of them were focused on Sub-Saharan Africa.

Armed conflict has affected three-fourths of all sub-Saharan African countries since World War II (Gleditsch et al. 2002). Chad is one of those countries which has experienced a succession of wars since its independence in 1960[2]. The latest Chadian armed conflict took place between December 2005 and January 2010 and was one of the most disastrous with about 7,000 people killed and wounded with roughly 200,000 Internally Displaced (IDPs) (Human Rights Watch 2007a, b; De Waal 2011). Several Chadian families were also forced to flee and became refugees in neighbouring peaceful countries. (Coulibaly et al., 2011). Despite the massive

[1] In many instances, the conflicts are started or are exacerbated by ethnic and religious struggles, territorial disputes, or the fight for political leadership and power.

[2] In addition to internal armed conflict, Chad has experienced frontier conflict with neighbouring countries such as Libya (1987) and Nigeria (1983). Also, Chad has been involved in conflicts in Democratic Republic of the Congo (1998-1999), Republic of Congo (1998-1999); Sudan (2003, 2006-2010), and Central African Republic (2013), etc. According to the UCDP/PRIO data on the armed conflicts, Chad registered 31 years of armed conflicts over a period of 43 years from 1972 to 2014.

disruption of health services induced by the second Chadian civil war, its nutrition and health consequences on women and children have been empirically understudied.

In recent years, number of policymakers, aid and humanitarian organisations became increasingly concerned with the issue of health in early childhood. This interest is mainly driven by findings revealing that poorer health outcomes and malnutrition in early childhood can have lifelong consequences, especially in terms of educational attainment, labour supply and productivity in adulthood (Kang & Meernik, 2005; Alderman et al., 2006). The awareness of these permanent adverse effects which sack the efforts to improve economic performances led to the adoption in September 2000 of the Millennium Development Goals (MDGs) with specific targets devoted to children's nutrition and health. For instance, the international community has committed to halve mortality rate and the percentage of under-five years old children moderately and severely underweight between 1990 and 2015.

Although noticeable progress have been made over the last decades in improving maternal and child health[3], Chad did not achieve its Millennium Development Goals (MDGs) in 2015 and mainly its targets related to under-five years old children's nutrition and health outcomes. Under five years old mortality rate remains high at 133 deaths per 1,000 live births with a noticeable decrease between 2004 and 2015, Besides, children's anthropometric outcomes have not significantly improved in the same period and higher percentages of children being stunted, wasted and underweighted persist.

Table 1. Some under five years old children's nutrition and health outcomes in Chad

Outcomes	DHS-MICS II (2004)		DHS-MICS III (2014-2015)	
	Moderate	Severe	Moderate	Severe
Height-for-age (%)	40.9	23.2	40.0	22.0
Weight-for-height (%)	13.5	3.1	13.0	4.0
Weight-for-age (%)	36.7	14.0	29.0	11.0
Under-5 mortality (per 1,000 live births)	191		133	

Source: 2004 and 2014/2015 Chad DHS-MICS.

In addition to the poor levels and evolution of children's nutrition and health outcomes, a major stylized fact is their unequal spatial distribution throughout the country. Indeed, there is an important gap across localities with some regions/districts having a higher percentage of

[3] Since 2000, Chad has undertaken health sector reforms aiming to ensure affordable access to a better healthcare quality for the majority of the population, especially poor and vulnerable groups. Some of these reforms are the National Health Policy Document (NHPD), the National Health Development Plan (NHDP) or the Medium Term Expenditure Framework (MTEF) implemented by the Ministry of Public Health. In the same vein, the gratuity of medical care policy targeting pregnant women and children under 5 years old, has been put in place in 2007. The geographical coverage of this policy was extended from main hospitals to the district health centres in 2014. The gratuity of medical care budget represented 4.8% of this Ministry's budget or 0.4% of global budget, on average between 2011 and 2015 (Ministry of Public Health, 2015).

stunting as compared to others.[4] For instance, 27% of under-five years old children are affected by stunting in the *Moyen Chari* region, while the proportion is 64% in the *Kanem* region. Besides, under-five mortality rate per 1,000 live births is 99 in *Ouaddaï*, while the rate is *230* in Oriental Logone[5]. The trends of these indicators between 2004 and 2014-2015 also reveals that regions located in the southern part of the country recorded better improvement of under-five health and nutrition indicators as compared to regions located in the northern part.

However, little is still known on the underlying factors explaining the spatial differences of children's nutrition and health status in Chad between 2004 and 2014-2015. It is worth mentioning that conflicts delayed the achievement of MDGs in Sub-Saharan Africa (Gates et al., 2012). In chad, the major political shock experienced by the country between 2005 and 2010 has considerably affected Chadian's institutions and the provision of main public goods such as health, water and sanitation likely to exacerbate the challenges of improving children's health and nutrition across the country.

This paper provides an empirical assessment of the local impacts of the 2005-2010 Chadian armed conflict on under five years old children's nutrition and health anthropometric outcomes. Much specifically, the study : *(i)* analyses the local impact of the Chadian armed conflict on under-five years old anthropometric outcomes born some years after the end of attacks; *(ii)* provides a better understanding of the mechanisms and channels by which mothers' exposure to violent conflict affect their children's nutrition and health; and *(iii)* draws policy recommendations to support the Chadian government and the international community in designing adequate policy responses to protect children from the negative and lasting effects of conflicts.

To the best of our knowledge, there is no prior empirical work assessing the local impact of conflict exposure on Children's health status in Chad, especially the recent 2005-2010 Chadian armed conflict. By attempting to fill this knowledge gap in the literature, the study intends to make three important contributions to the literature. First, it contributes to the growing empirical body of evidence on the effects of conflicts on children's nutrition and health outcomes in Sub-Saharan Africa. Second, the paper proposes an empirical analysis which purges the bias-effect of conflict-induced migration in estimating the local impact of armed conflict in the short run. The latter is being considered as an important limitation of several

[4] In some regions, the level of stunting is sometimes more than twice as much as the one recorded in other regions.
[5] Those figures emanate from the 2014-2015 DHS-MICS report

previous studies. Last but not least, getting a better understanding of the local impacts of armed conflict in a fragile country such as Chad could serve as policy lessons for neighbouring fragile countries in the Central Africa Sub region currently at the brink of a civil war. This is also crucial for the smooth achievement of child-related Sustainable Development Goals (SDGs).

The remainder of the paper is organized into five sections. Section 2 depicts the context of political fragility and armed conflicts in Chad. Section 3 presents the literature review. The methodology is exposed in section 4, while section 5 provides empirical results. Section 6 concludes the paper and devises key policy implications.

2. Political fragility and armed conflicts in Chad

Since its independence in 1960, Chad has been swamped by successive armed conflicts, which mainly derived from ethnic and religious struggles, territorial disputes, or the fight for political leadership and power (De Bruijn & Van Dijk 2007). Chad has undergone a major political instability in 1965 with rebellion groups being supported financially and militarily by neighbouring countries (especially Sudan and Libya). The first rebel movement was organised in the Guera region with riots and insurgency against the authoritarian regime of the Chadian president at the time François Tombalbaye. This tax revolt has catalysed frustrations due to ethnic and religious marginalisation felt by Muslim from Northern and Eastern regions against the southern-led government. Thus, the rebels were fighting to control natural resources in the north and conquer the central power in the southern part of the country. Such a conflicting environment is generally identified as the main cause of the 1979-1982 civil war characterized by important political, economic and humanitarian disasters (Magrin, 2008)[6].

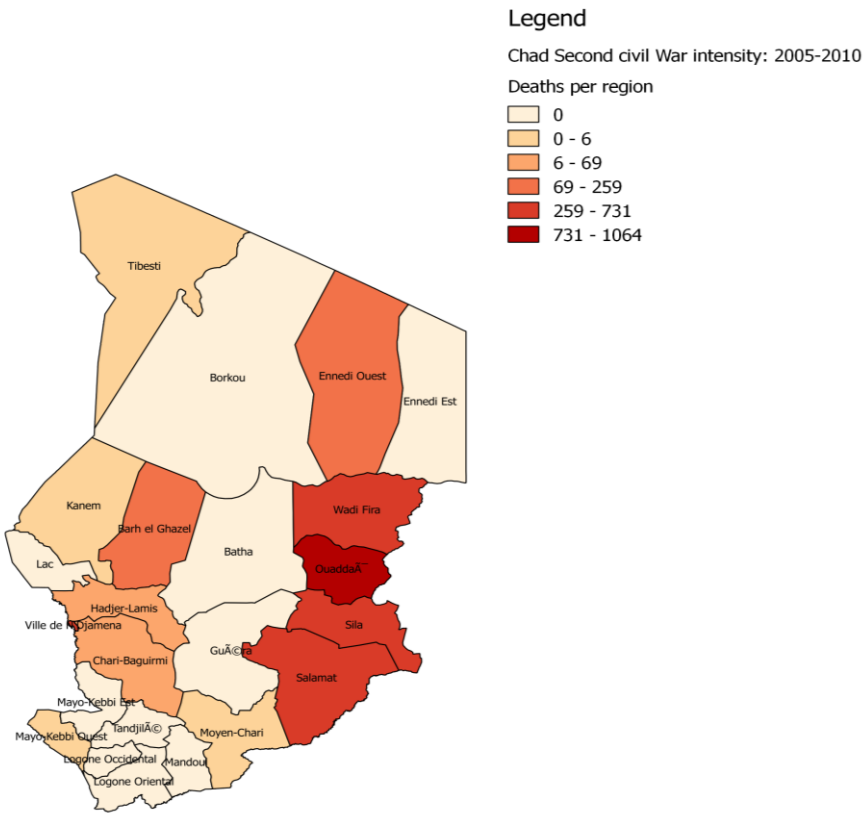
Even after 1982, under the regime of Hissein Habré, there was an armed confrontation between Chad and Libya because of the territorial disputes in the Aouzou locality. This confrontation between the two countries was followed by the internal armed conflict in 1989 leading to the overthrow of the Hissein Habré regime and the coming into power of the current regime of Idriss Deby Itno since December 1990.

After this long period of political instability (1979-1990), a "National conference of Peace" was organized in January 1993. This had led to a somewhat stabilized period during the mid-1990s. In 1996, Idriss Deby Itno, a native of the northern part of the country won the first presidential

[6] Youssouf Togoimi was killed in September 24th, 2002 in the region of Tibesti.

election with the involvement of more than one political party. In 1997, the new government signed peace deals with some armed and rebels groups such as the Armed Forces for a Federal Republic, the National Front of Chad, and the Movement for Social Justice and Democracy. Despite these political agreements, an armed rebellion led by Youssouf Togoimi, the president Deby's former general of armed forces, began in the North in 1998. A Libyan peace deal in 2002 put an end to this first sequence of Chadian armed conflict (1998-2002) under the regime of the president Idriss Deby Itno.

Figure 1. Violence in Chad by regions



Source: ACLED.

The Libyan peace deal to diminish religious and ethnic frustrations was not sufficient to hide the rebellion's willingness to fight for political leadership and power. Therefore, another sequence of armed conflict occurred over the period 2005-2010. Marchal (2008) argues that in addition to internal causes related to the failure of the Libyan peace deal, this Chadian armed conflict was to some extent the continuation of the conflict in the neighbouring Darfur region in Sudan which then spread across the border in Chad by 2003. The 2005-2010 armed conflict involved Chadian government forces and several rebel groups including the United Forces for Development and Democracy, the United Front for Democratic Change and the coalition of *Forces for Change*. This period was characterised by two destructive attacks in the capital city

in April 2006 and February 2008. The fightings were therefore spread spatially across localities such as N'Djamena, Abeche, Mongo, and Chad-Sudan border (Am Timan, Adré, Borota, Adé) as depicted in figure 1.

Although most casualties occurred among soldiers during fighting, thousands of civilians were also killed, wounded and displaced. By the end of 2007, estimates suggest that approximately 150,000 Chadians have been internally displaced, and thousands of others went abroad to neighbouring countries as refugees, mainly in Sudan and the Central African Republic (Human Rights Watch 2007a, b). This war generated significant physical loss, destroying and jeopardising the livelihoods of households who stayed behind and who have encountered a significant reduction in accessing water, food and health infrastructure. Last but not least, the 2005-2010 armed conflict in Chad has diverted a fair amount of financial resources into funding the army and factions which could have been devoted to investments in social sectors such as health and education.

3. Literature review

A considerable number of studies on the microeconomic consequences of violent conflict have established a negative relationship between armed conflict's exposure and children's health outcomes. The seminal work by Yuksel-Akbulut (2009) estimates the long-term effects of World War II in Germany. He found that individuals affected by allied bombing are shorter and have poorer health outcomes than their peers. Similar studies based on more recent wars have also provided evidence of a negative link between armed conflict and children health. (See for e.g, Verwimp (2012) in Burundi; Mansour and Rees (2012) in Palestine; Parlow (2012) in Kasmir; Minoiu and Shemyakina (2014) in Côte d'Ivoire). Guerrero-Serdan (2009) estimated the regional variation in children's Height for Age Z-scores in Iraq after US-invasion and showed that children living in war-affected regions are shorter. Similarly, Akresh et al. (2012) examined the consequences of the Eritrean-Ethiopian conflict on the height of young children in Eritrea and found that children exposed to the war are shorter by 0.42 standard deviations than the reference population. Akresh et al.(2011) also went further by investigating the long-term impacts of the Nigerian Biafra civil war on adult height and found that exposed individuals suffered from a reduced stature. Apart from studies which have empirically assessed the direct effects of exposure to conflict on children's anthropometric health outcomes, another strand of the literature on the consequences of conflict also unravel potential mechanisms through which

conflict would affect children's health outcomes (Strauss and Thomas, 2008; Akresh, Lucchetti and Thirumurthy, 2012; Minoiu and Shemyakina, 2014). Indeed, it has been widely acknowledged that armed conflicts accentuate and exacerbate a number of factors which result in the deterioration of children's nutrition and health status even in peacetime. The list of these mechanisms include psychological stress, poor health care and environmental sanitation, low household food security, poor diet, insufficient health services, and inadequate maternal and child care practices (Akresh, Lucchetti and Thirumurthy, 2012).

Besides, the psychological stress of mothers exposed to conflicts during pregnancy is able to affect babies in utero. Camacho (2008) found a significant effect of land mine explosions in Colombia on stress during pregnancy which affects birth weight and gestation. They established that babies born between 1998 and 2003 corresponding to the period of conflict are more likely to be born prematurely and suffer a reduction in birth weight of 8.7 grams. In a similar study, Eskenazi et al. (2007) found that psychological stress of mothers in their early stages of pregnancy as a result of September 11th terrorist attack in New York led to a lower weight at birth of their children.

Household food insecurity also appears as an important mechanism through which conflict would affect children's nutrition and health outcomes, especially in developing countries where people in conflict affected regions mainly work on farms. This causal mechanism can be explained theoretically in several manners (Jeanty and Hitzhusen, 2006). Armed conflicts can reduce the ability of farmers to produce. Indeed, farmers may find their land overgrown after conflicts which reduced the area that could be used for planting during the first season. In the same vein, because of violence, farmers may be more cautious and adopt restrictive planting strategies (they grow specific cultures and avoid to plant closer to conflict affected villages fearing of being attacked).In addition, conflict might result in a large destruction of agricultural infrastructures such as flood control and irrigation systems, roads, markets, but also food processing, storage and distribution systems (Messer and Cohen, 2004). Farmers also suffer from displacements, lack of food necessary to provide adequate dietary energy for work, and may ever face death. Conflicts may also lead to a collapse of agricultural inputs and extension services offered by stakeholders such as governmental and non-governmental agencies (lack of funding support, absence of platforms of discussion and collaboration, etc.). Consequently, food scarcity might lead to the loss of income and inflation but also poorer nutrition and health outcomes of children. The latter might lack access to a diversified diet containing adequate

levels of energy, proteins, vitamins and minerals to properly grow in their early years (Jeanty and Hitzhusen, 2006; Messer and Cohen, 2004).

Some empirical works shed light on the causal mechanism of household food security to explain the effects of conflicts on children's health status. The Food and Agriculture Organization (FAO) contributed to this effort by assessing the impact of armed conflicts on the nutritional status of children (FAO, 1996). Their findings attributed poor children's health to the broad causes of malnutrition that resulted from inadequate household food security which itself is a result from disruption of agricultural production and food distribution systems during conflicts. Similarly, Akresh et al. (2011) used cohorts of children born between 1987 and 1991 in Rwanda and found that those exposed in 1994 to the genocide in the North, as well as to the crop failure in the South, suffered of stunting because of these two external shocks.

Tranchant et al. (2014) have also analysed the combined impact of political violence and adverse climatic shocks on child nutrition in India. Based on longitudinal data, they found that drought has adverse effects on child nutrition in conflict-affected communities. In addition, their work revealed that political violence has large negative effects on child nutrition through a reduction of the ability of households to cope with drought. The recent work of Bageant et al. (2016) attempted to understand how conflict in Nepal mitigates the agriculture-nutrition nexus which impacts on children's health. They found a robust relationship between anthropometric outcomes and milk consumption. Their study also established that households owning few livestock are significantly more affected by conflict as compared to larger holders which subsequent impacts on child nutrition. In the following section, we attempt to provide an empirical analysis of the potential indirect health and nutritional impacts of armed conflict exposure on children born some few years after the end of hostilities in Chad.

4. Methodology

4.1. Data

Our data come from two main sources. First, we use a sample of 18,463 children under the age of five from the latest 2014/2015 Demographic and Health Survey/ Multiple Indicators and Cluster Survey (DHS-MICS) from Chad. This two-stage clustered random survey enables us to accurately measure health and nutritional outcomes of children and mothers. We consider three Z-scores anthropometric indicators of children, each of which depicts specific nutrition and health status of the child: Height-for-Age Z score (HAZ) for the probability of stunting, Weight-

for-Age Z score (WAZ) for the probability of being underweight; Weight-for-Height Z score (WHZ) for the probability of wasting. We also consider the Body Mass Index of the child as well as the size and weight at birth. The DHS-MICS survey also provides us with several socio-economic characteristics at the household level for both mothers and fathers. It also informs us on self-reported mothers' nutritional and health behaviour during and after pregnancy. The second source of data allows us to capture the intensity of armed conflict events and fatalities by using geocoded data from the Armed Conflict Location & Event Data Project (ACLED) in Chad over the period 2005-2010. However, as no district information is made available in the 2014/2015 DHS-MICS survey[7]; we matched the 2015 Global Positioning System (GPS) cluster data from ACLED-Chad source with the latest Geographic Information System (GIS) shape file available of the country. This has enabled us to identity districts where each of our 626 household clusters belong to. Figure A in appendix A shows the map of DHS clusters matched with the 53 existing districts in Chad. We finally obtain a dataset with clusters already identified by the name of districts where conflict events are clearly identified and localized.

4.2. Empirical strategy

To empirically assess the local impact of armed conflict on children's nutrition and health outcomes, we consider an identification strategy where we assume the random nature of violent attacks within and between geographical districts (Shemyakina, 2011; Akresh et al. 2012). In addition, given that the time variation is almost non-existing in our dataset as most children were born after the end of violence in 2009-2010, we estimate the following Ordinary Least Squares (OLS) regression:

$$Y_{ij} = \beta_0 + \beta_1.\left(Attacks_j\right) + \delta.X_{ij} + \varepsilon_{ij} \qquad [1]$$

Where Y_{ij} measures under-five years old children anthropometric outcomes for a child i in district j. β_0 is a constant, $Attacks_j$ is a variable measuring the presence of conflict in a district j. It is equivalent to 1 if the best estimate of the total number of deaths at the district level is strictly positive and 0 otherwise[8]. X_{ij} are a set of household level characteristics used as controls including the gender of the child, its birth order and mother's level of education, as well as the standard of living of its current household. ε_{ij} is the idiosyncratic error term. The set of variables used in equation [1] is defined in appendix B. If exposure to conflict (that is residing in the

[7] The possible explanation is the privacy purpose which is a crucial issue within the DHS-MICS survey worldwide.
[8] We checked that at least one death was registered in all districts where a conflict event (attack) appeared.

districts that had at least one conflict event) is detrimental to under-five children's health and nutritional outcomes, then the estimated coefficient β_1 measuring the average impact of maternal conflict exposure on children's anthropometrics is expected to be negative.

However, we have to consider the fact that households, especially mothers might have move between the start/ end of the conflict and the start of the DHS-MICS survey. Assessing the impact of the 2005-2010 armed conflict using household dataset collected four years later in 2014/2015 might be subject to some bias. For instance, it is plausible to think that a family living in a conflict-affected locality, migrated to a safer locality during the conflict (between 2005 and 2010), and then came back home at the end of the conflict (between 2010 and 2014/2015). Considering that setting, the conflict-induced migration effects might bias our estimates. Therefore, if not accounting for migration, a child *i* living in a conflict-affected district *j* could be better-off (good nutrition and health outcomes) because he/she was just not living in this locality during the conflict because of the displacement of his/her household. The awareness of conflict-induced displacement in estimating the impact of armed conflict was already mentioned in the literature. Akresh et al. (2012) highlighted this issue and proposed a proxy of war's intensity taking into account the number of internally displaced persons in the local area of study. Their approach is used for children birth cohorts' analysis and seems to be unsuitable for our study.

In order to purge the conflict-induced migration effects likely to bias our estimation of the local impacts of armed conflict on children's nutrition and health outcomes, we consider an empirical analysis by constructing a *migration correction coefficient.* We rely on the number of returnees in each locality to construct the *migration correction coefficients*. The underlying idea is that the number of returnees helps to proxy the intensity of the conflict and the extent to which children – households – escaped the adverse effects of exposure to conflict events. Indeed, children living in an area (whether conflict or non-conflict affected) with a high level of returnees recorded are likely to be better-off as they were not exposed to the conflict due to the migration of their families. The returnees' data[9] are obtained from the United Nations Office for the Coordination of Humanitarian Affairs (UNOCHA) in Chad. They provide the number of returnees clustered by department in 2014, as well as the estimated population size of each department for the same year.

[9] The returnee's data are only available at an aggregate level for each department rather than each district. The migration correction coefficient is constructed at the department level. However, for econometric analyses, the value of the migration correction coefficient of a specific department is affected to all districts which belong to the department.

The migration correction coefficient is defined as follow:

$$Coef_d = \left[1 - \left(\frac{Returnees_d}{Population_d}\right)\right] \quad [3]$$

Where $Returnees_d$ indicates the number of returnees recorded in district *d*, $Population_d$ gives the total population in district *d*, and $Coef_d$ represents the *migration correction coefficient* of district *d*. We use the *migration correction coefficient* in our econometric analysis to adjust and account for migration in our different proxies of conflict intensity and exposure. The values computed are summarized in table A8 of appendix D. We can observe two main situations regarding the level of returnees in a specific district. When the number of returnees in a district *d* is high, the *migration correction coefficient* will be closer to 0 leading to a null impact of armed conflict on children's nutrition and health outcomes because households were not really exposed to the conflict as they have migrated. On the contrary, in the case of a low level of returnees in a district *d*, the *migration correction coefficient* will tend to be equal 1. That would suggest that households would not have massively migrated outside out their area of residence during the conflict. In the following section, we present the results of our descriptive statistics before describing the outputs of our econometric analysis. It is worth mentioning that here we are also making the assumption that any forms of displacement which might have happened as a result of the conflict outbreak in 2005-2010 in Chad took place within the same district.

5. Empirical results

5.1. Descriptive statistics

The main variables used in our analysis are described in Table 2 below. The mean value of the Height-for-Age Z score is -1.57 showing that on average 43% of children are stunted. Also, the mean value of the Weight-For-Age Z score is -1.39 corresponding to 33% of children being underweight. In addition, 15% of children are wasted given the mean value of the weight-for-age Z score of -0.64 and the mean value of the Body Mass Index is low (-0.44). Regarding the Size of children at Birth, 44% of children born are either smaller than average or very small. The representative child in our sample is born with a weight of 3,590 grams and a height of 821 centimetres from a household which belongs to the middle class with an average wealth index of 2.99.

Descriptive statistics of the different proxies of armed conflict's intensity are consistent with information provided in figure 1 which depicted the spatial distribution of violent attacks across

the country. On Average 32% of districts (3 out of 10 districts) have experienced an attack between the 2005 and 2010 period with approximately 68 fatalities, ranging from 1 to 803. Figure B in appendix A shows the percentage of children stunted in each region covered by the 2014/2015 DHS. We could already infer that the vast majority of regions heavily affected by the conflict tend to have a higher percentage of children stunting. For instance, in Wadi-Fira which is among the regions hit hardest by rebel attacks, 50% of children are stunted. However, this geographical pattern of conflict and stunting is not strongly consistent, as some of the regions where the level of attacks is lower also tend to have a higher percentage of children stunted as this is the case of the Kamen region.

Table 2. Descriptive Statistics

Variables	N(Obs.)	Mean	Std. Dev.	Min	Max
Children characteristics					
HAZ	10,182	-1.57	2.01	-6	5.95
WAZ	10,409	-1.39	1.50	-5.99	4.9
WHZ	10,213	-0.64	1.37	-4.99	4.99
BMIZ	10,223	-0.44	1.40	-5	4.89
Stunting	10,182	0.43	0.49	0	1
Underweight	10,409	0.33	0.47	0	1
Wasting	10,213	0.15	0.35	0	1
Size at birth	18,463	0.44	0.50	0	1
Weight at birth	1,969	3590.15	872.54	500	6900
Child Height	10,413	821.84	138.85	360	1340
Male	18,463	0.51	0.50	0	1
Age	10,621	29.56	17.75	0	59
Birth order	18,463	4.37	2.65	1	16
Household characteristics					
Wealth Index	18,463	2.99	1.37	1	5
Mother education	18,440	1.53	2.99	0	20
Armed conflict variables					
Fatalities	53	67.96	157.28	0	803
Log Fatalities	53	1.36	2.33	0	6.69
Attack	53	0.32	0.47	0	1

Source: 2014/2015 Chad DHS and ACLED.

Those inconclusive preliminary findings lead us to proceed with further statistical investigation to check whether anthropometrics Z score of children living in conflict affected districts are statistically different from those living in non-conflict affected zones. Table 3 shows that for the majority of children's health characteristics we have considered, those living in non-conflict affected districts tend to be better off. That is, children living in districts heavily affected by the 2005-2010 armed conflict have on average a lower HAZ, WAZ and WHZ scores and therefore a higher probability of stunting, wasting and underweight. For instance, the average weight-for-age Z score of children living in districts non-affected by violent attacks is higher by 0.207 units as compared to those living in districts where at least one attack has been recorded. This is consistent with results on the proportion of children who are underweighted in non-conflict

affected districts (31.2%) and conflict affected districts (36.7%). Our results also establish that children in districts non-affected by conflict also have higher size and weight at birth.

Table 3. Difference in mean of children's anthropometric Attack Vs No Attack districts

Variables	No attack	Attack	Overall	Diff (1) vs. (2)
HAZ	-1.535 (0.025)	-1.627 (0.032)	-1.571 (0.020)	0.093** (0.041)
WAZ	-1.305 (0.019)	-1.513 (0.023)	-1.387 (0.015)	0.207*** (0.030)
WHZ	-0.576 (0.018)	-0.744 (0.021)	-0.642 (0.014)	0.169*** (0.028)
BMIZ	-0.397 (0.018)	-0.532 (0.023)	-0.449 (0.014)	0.135*** (0.029)
Stunting	0.416 (0.006)	0.445 (0.008)	0.427 (0.005)	-0.029*** (0.010)
Underweight	0.312 (0.006)	0.367 (0.008)	0.333 (0.005)	-0.055*** (0.010)
Wasting	0.139 (0.004)	0.158 (0.006)	0.146 (0.003)	-0.019*** (0.007)
Size at birth	0.466 (0.005)	0.396 (0.006)	0.439 (0.004)	0.071*** (0.007)
Weight at birth	3631.449 (26.381)	3542.586 (29.382)	3590.154 (19.663)	88.863** (39.487)
Child Height	823.386 (1.731)	819.443 (2.201)	821.836 (1.361)	3.943 (2.799)
Male	0.506 (0.005)	0.513 (0.006)	0.509 (0.004)	-0.007 (0.008)
Age	29.480 (0.222)	29.689 (0.273)	29.563 (0.172)	-0.208 (0.352)
Birth order	4.418 (0.025)	4.295 (0.031)	4.370 (0.019)	0.123*** (0.040)
N (Obs.)	11261	7202	18463	18463

Source: 2014/2015 Chad DHS and ACLED. $^{*}p < 0.10$, $^{**}p < 0.05$, $^{***}p < 0.01$. Standard errors in brackets.

5.2. The impact of conflict on children's nutrition and health outcomes

Table 4 below presents the econometric results for our main equation (1) after purging for the conflict-induced migration bias. We control for the gender of the child, birth order and the different wealth index category of household as well as the number of years of education of the mother. We found that the presence of children in districts that have experienced at least one attack during the 2005-2010 armed conflict have had a significant and negative impact on their health and nutritional outcomes which is consistent with our descriptive statistics above. Indeed, holding everything else constant, we found that the probability of a child to have a

larger size at birth is 0.25 times lower for those who were living in conflict affected districts. In the same vein, the weight at birth of children living in war affected districts is 70.07 grams lower than those living in non-conflict affected districts but not significant. We also find that the WAZ, WHZ and BMIZ score of children living in district affected by the armed conflict are lower than their peers.

Table 4. Impact of armed conflict on children's anthropometric outcomes using conflict-related migration correction coefficients (1)

Variables	Size at birth	Weight at Birth	HAZ	WAZ	WHZ	BMIZ
Attack	-0.255***	-70.07	-0.116***	-0.199***	-0.140***	-0.111***
	(0.0206)	(43.02)	(0.0418)	(0.0302)	(0.0283)	(0.0292)
Male	0.121***	162.8***	-0.0908**	-0.100***	-0.0714***	-0.00387
	(0.0195)	(39.61)	(0.0397)	(0.0291)	(0.0272)	(0.0278)
Birth order	0.00854**	5.087	0.0259***	0.0181***	0.00773	0.00718
	(0.00383)	(7.864)	(0.00775)	(0.00570)	(0.00531)	(0.00540)
Mother Education	0.0655***	19.35***	0.0607***	0.0729***	0.0485***	0.0413***
	(0.00341)	(4.598)	(0.00688)	(0.00508)	(0.00475)	(0.00484)
N (Obs.)	18106	1937	10079	10306	10111	10121
Adj. R^2	0.035	0.016	0.017	0.031	0.015	0.010

Source: 2014/2015 Chad DHS and ACLED. $^{*}p < 0.10$, $^{**}p < 0.05$, $^{***}p < 0.01$. Standard errors in brackets.

The statistical relevance of our chosen control variables is consistent with the expected signs for almost all of them. Surprisingly, we found that children from richer families are more likely to have lower anthropometric Z score than their peers. We expect those results to be linked with the plausible multicollinearity between mothers' years of education and wealth index. Indeed, the returns to education (wage or wealth) tend to be higher for highly educated mothers. In the meantime, a better educated mother is likely to have children with better anthropometric outcomes. Results from Table 5 below also suggest that children living in conflict-affected districts few years after the end of hostilities are 3.26 percentage points more likely to be stunted than their peers living in non-conflict affected districts. The same results hold for the probability of children being wasted or underweighted which are respectively 0.0169 and 0.0541 times higher for those living in war-affected districts. Taking a gender perspective, we also found that the male child tends to have lower anthropometric Z scores (HAZ, WAZ, WHZ, BMIZ) than the girl child. However, the male child tends to be better off at birth with a higher size and weight than the girl child. In order to identity the mechanisms leading to the significant health impacts of conflict on less than 5 years old children born few years after the end of attacks, we focus on mother's health outcomes. In the following section, we investigate the impact of armed conflict on mothers' access to healthcare services during and after pregnancy.

Table 5. Impact of armed conflict on children's anthropometric outcomes using conflict-related migration correction coefficient (2)

Variables	Probability of Stunting	Probability of Wasting	Probability of Underweight
Attack	0.0326***	0.0169**	0.0541***
	(0.0103)	(0.00749)	(0.00977)
Male	0.0215**	0.0276***	0.0320***
	(0.00978)	(0.00703)	(0.00918)
Birth order	-0.00464**	-0.00189	-0.00618***
	(0.00192)	(0.00137)	(0.00179)
Mother Education	-0.0159***	-0.00771***	-0.0207***
	(0.00165)	(0.00116)	(0.00148)
N (Obs.)	10079	10111	10306
Adj. R^2	0.017	0.005	0.025

Source: 2014/2015 Chad DHS and ACLED. $^{*}p < 0.10$, $^{**}p < 0.05$, $^{***}p < 0.01$. Standard errors in brackets.

5.3. Some plausible mechanisms of propagation

For effective and sound policy interventions to mitigate the adverse impacts of conflict on children's health, there is a necessity to unravel the key channels of the main impacts we found on children. As already highlighted in the literature (Iqbal, 2006; Havard et al., 2009; Barre & Domingues, 2012), previous results shed light on the plausible role of mothers in channelling the impact of conflict on children's nutrition and health. We intend to identify those mechanisms by considering various maternal outcomes related to access and utilisation of healthcare facilities and services. Our rationale is that a negative impact found on mothers' access to key health services should be translated into poorer health outcomes for their children. In general, it is legitimate to attribute worse children's health and nutrition outcomes in conflict affected districts to a lack of mother's access to health services before and during pregnancy in those localities hit hardest by conflict. (See Thomas et al., 1996; Miguel et al., 2004; Asadul et al., 2014). Tables 6 and 7 below present the results of our analysis.

Results reported in table 6 below reveal that mothers who were living in conflict affected districts are 5.83 percentage points less likely to have been assisted by skilled birth attendant during delivery. Besides, mothers living in high conflict affected settings are 5.49 percentage points more likely to give birth with a traditional birth attendant as compared to their peers living in low conflict affected settings.

Table 6. Plausible armed conflict impacts mechanisms (1)

Variables	Mother Visited Health Facility in the last 12 months	Mother Birth assisted by a skilled/ trained health practitioner	Mother Birth assisted by a traditional health practitioner	Mother Received Vitamin A Dose in the first 2 months after delivery
Attack	-0.0629***	-0.0583***	0.0549***	-0.0363***
	(0.00731)	(0.00372)	(0.00739)	(0.00762)
Wealth index	-0.00303	0.00452	0.00205	0.00518
	(0.00705)	(0.00403)	(0.00705)	(0.00748)
Male	0.00881***	0.000524	-0.00574***	0.00991***
	(0.00137)	(0.000779)	(0.00138)	(0.00142)
Birth order	0.0309***	0.00317***	-0.0340***	0.0222***
	(0.00127)	(0.000726)	(0.00113)	(0.00154)
Mother Education	0.467***	0.0785***	0.351***	0.246***
	(0.0133)	(0.00709)	(0.0130)	(0.0153)
N (Obs.)	18175	18121	18121	10729
Adj. R^2	0.063	0.013	0.099	0.063

Source: 2014/2015 Chad DHS and ACLED. $^{*}p < 0.10$, $^{**}p < 0.05$, $^{***}p < 0.01$. Standard errors in brackets.

Our empirical findings from Table 7 below reveal that mothers of children living in conflict affected districts were 1.85 percentage points less likely to take iron pill during pregnancy and 6.51 percentage points less likely to provide Vitamin A (known as a key source of nutritional growth) to their children over the past 6 months preceding the survey (5 years after the end of the war). Similarly, mothers in conflict affected districts were 5.29 percentage points less likely to provide plain water the first three days after their child birth although they were 1.25 times more likely to give sugar/glucose to their child. In general, our results highlight that the 2005-2010 rebel attacks have created significant shocks in the supply of key health care facilities preventing mothers to properly take care and feed their offspring.

Table 7. Plausible armed conflict impact mechanisms (2)

Variables	Mother takes iron pills, sprinkles during pregnancy	Child given plain water the first three days	Child given sugar/ glucose the first three days	Child was given Vitamin A during the last 6 months
Attack	-0.0185***	-0.0529***	0.0125*	-0.0651***
	(0.00541)	(0.00808)	(0.00744)	(0.00771)
Male	-0.00164	-0.00112	0.00752	-0.00718
	(0.00525)	(0.00755)	(0.00696)	(0.00743)
Birth order	0.00280***	0.00204	0.000222	0.0123***
	(0.00102)	(0.00143)	(0.00131)	(0.00145)
Mother Education	0.00965***	0.00128	-0.00287**	0.0298***
	(0.00109)	(0.00137)	(0.00136)	(0.00142)
N (Obs.)	16129	10303	10303	16099
Adj. R^2	0.014	0.015	0.034	0.045

Source: 2014/2015 Chad DHS and ACLED. $^{*}p < 0.10$, $^{**}p < 0.05$, $^{***}p < 0.01$. Standard errors in brackets.

However, we are still not able to conclude at this stage that the lack of access of those mothers to health care facilities is indeed the key mechanisms driving the main impacts on children's health. We still have to re-run the main regression and check whether the statistically significance of conflict exposure change or disappear when controlling for those potential mechanisms. Tables A2 and A3 in Appendix C present the results of these new regressions. We find that the mechanisms above seems to be only relevant in explaining the main impacts on the Body Mass Index of children and their likelihood of wasting giving that the level of statistical significance is changing after controlling for those potential channels. Therefore, we could only conclude that only the negative impacts of conflict on children's Body Mass Index and their probability of wasting seem to work through the lack of mothers' access to basic healthcare facilities during and after pregnancy in localities hit hardest by conflict. Future research still needs to shed a light on mechanisms through which political shocks on mothers translate into poorer health outcomes on their children.

5.4. Robustness checks

We use an alternative measure of conflict exposure to check whether our findings still hold. First, we consider an alternative continuous measure of violence to assess the genuine intensity of conflict rather than the presence or existence of violent attacks in a given district. We use the natural logarithm of the total number of fatalities per districts within the regression framework presented in equation [2] below. The use of the Log is justified here to significantly narrow the higher variability[10] of the number of fatalities across districts. This approach is consistent with several other studies (Ghobarah et al., 2004; Bundervoet et al., 2009; Shemyakina, 2011; Minoiu and Shemyakina, 2014).

$$Y_{ij} = \beta_0 + \beta_1.\left(Log\_fatalities_j\right) + \delta.X_{ij} + \varepsilon_{ij} \qquad [2]$$

Tables A4 and A5 in appendix C suggest that when considering this continuous measure of attacks at the district level, the magnitude and significance of our results still hold for almost all of our outcomes of interest, except for the HAZ score and the probability of stunting. For the latter, the sign remains the same although the coefficient becomes statistically non-significant. We also carried out robustness check using this continuous measure of conflict on potential mechanisms. Results reported in tables A6 and A7 in Appendix C establish the existence of a statistically significant negative impacts of fatalities on access to healthcare

[10] With a standard deviation of 157.28 and a higher coefficient of variation of 2.31

services for mothers living in highly affected districts. Therefore, the impact of armed conflict on under-five years old children's nutrition and health outcomes is negative, statistically significant and robust when considering either the discrete proxy or a continuous indicator of armed conflict exposure. In addition, even if the vast majority of children were born some years after the end of attacks, that is after 2009-2010, we found that the magnitude of impacts tends to be higher for children exclusively born during the conflict.

However, the reported findings should be interpreted with cautious, mostly because we only make use of the geographical variation. This is mainly because the survey was conducted over the period 2014-2015 implying that the oldest kids were born either in 2009 or 2010, corresponding to almost the end of the armed conflict. If the DHS-MICS data collection was conducted a little bit earlier than 2014, we would have been able to also consider and introduce a time variation based on children's year of birth. This should certainly have provided us with better insights as our econometric estimation framework would have been different with the use of a difference-in-difference approach. Last but not least, by using our migration correction coefficients to purge the bias induced by forced displacement, we assume that those who stayed behind during the conflict are likely to have poorer socio-economic outcomes than those who have left and become refugees abroad as well as IDPs within the country. This assumption is disputable considering the growing body of empirical evidence that children and women in forcibly displaced situations are equally likely to suffer in terms of health and education.

6. Conclusion

This paper empirically examined the local impact of the 2005-2010 Chadian armed conflict on a set of under-five years old children's health and nutritional outcomes exposed few years after the end of the conflict. We exploit a spatial variation on the number of attacks at the district level and assess the indirect impact on children's health and nutrition. We found a negative and statistically significant impact of armed conflict on children's nutritional Z scores (HAZ, WAZ, WHZ, BMIZ, stunting, underweight, wasting), as well as their weight and size at birth. After purging for the conflict-induced migration bias, we find that armed conflict worsens health and nutritional status of children born and still living in districts heavily affected by violent attacks some years after the end of casualties. Results are gender sensitive as the male child tends to have lower anthropometric Z scores than the girl child. Most importantly, we found that such short-term and indirect negative impacts are driven by mother's lower accessibility of vital health care services during and after pregnancy. Our results are consistent with similar studies investigating the impacts of other forms of violent conflict (civil war, genocide, terrorism) on

children and adults' health outcomes. Our findings easily translate into key policy recommendations for the Chadian government and other fragile states in Sub Saharan Africa. Hence, in order to prevent the adverse effects of conflict on the next generation born some years after the end of attacks, the government should implement targeted health policy interventions for mothers in conflict affected areas during and shortly after the end of conflict. Programs should aim at improving access to healthcare facilities for mothers in childbearing age (15-49) of conflict affected areas. This should sustain their access and provision of health facilities and services despite eventual destructions of infrastructure and disruption in the provision of health services which might have occurred during and after the conflict.

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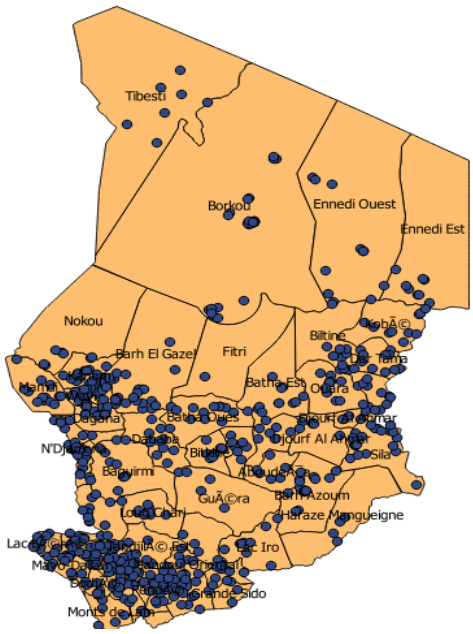
Appendices

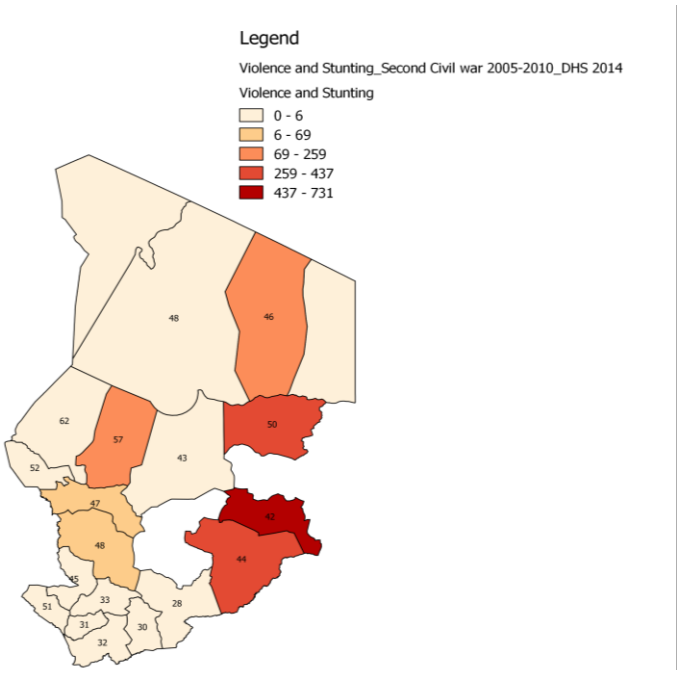
Appendix A: Spatial descriptive statistics

Figure A. DHS districts and clusters in Chad



Source: 2014/2015 Chad DHS and ACLED.

Figure B. Violence and Stunting in Chad by region



Source: 2014/2015 Chad DHS and ACLED.

Appendix B: Definition of variables

Table A1. Definition of variables

Variables	Definition
Children characteristics (Source: 2014/2015 DHS-MICS)	
HAZ	Height for Age Z score of under five years old children computed using the 2006 WHO new standards
WAZ	Weight for Age Z score of under five years old children computed using the 2006 WHO new standards
WHZ	Weight for Height Z score of under five years old children computed using the 2006 WHO new standards
BMIZ	Body Mass Index Z score of under five years old children computed using the 2006 WHO new standards
Stunting	1 if HAZ is less than -2 SD (Standard Deviation); 0 otherwise
Underweight	1 if WHZ less than -2 SD (Standard Deviation); 0 otherwise
Wasting	1 if WAZ less than -2 SD (Standard Deviation); 0 otherwise
Size at birth	1 if the child size at birth is very large, larger than average, or average; 0 otherwise (smaller than average or very small)
Weight at birth	Weight at birth of the child (in grams)
Child Height	Height of the child (in centimetres, 1 decimal)
Male	Sex of child (1. Male 0. Female)
Age	Age of the child in months
Birth order	Birth order of the child
Household characteristics (Source: 2014/2015 DHS-MICS)	
Wealth Index	Household's wealth index (1. Poorest; 2. Poorer; 3. Middle; 4. Richer; 5. Richest)
Mother education	Number of years of completed education
Armed conflict variables (Source: ACLED)	
Fatalities	Best estimates of the total number of deaths in the district
Log Fatalities	Natural Log of the total number of deaths in the district
Attack	1 if Fatalities > 0 ; 0 Otherwise

Source: Authors

Appendix C: Additional empirical results

Table A2: Impacts of conflict on children's health when controlling for potential mechanisms (1)

Variables	Size child birth	Weight Birth	Haz06	Waz06	Whz06	Bmiz06
Attack	-0.0785***	-137.3**	-0.144**	-0.180***	-0.0721*	-0.0399
	(0.0105)	(58.26)	(0.0580)	(0.0419)	(0.0382)	(0.0394)
Male	0.0281***	207.1***	-0.0300	-0.104***	-0.0994***	-0.0644*
	(0.00722)	(52.90)	(0.0542)	(0.0399)	(0.0363)	(0.0371)
Birth order	0.00513***	6.671	0.0103	0.00570	0.00433	0.00570
	(0.00140)	(10.35)	(0.0103)	(0.00755)	(0.00689)	(0.00695)
Mother Education	0.0237***	16.73***	0.0763***	0.0700***	0.0286***	0.0224***
	(0.00126)	(6.130)	(0.00970)	(0.00744)	(0.00656)	(0.00666)
N (Obs.)	18440	1086	5846	6024	5898	5901
Adj. R2	0.025	0.036	0.028	0.035	0.013	0.010

Source: 2014/2015 Chad DHS and ACLED. $^{*}p < 0.10$, $^{**}p < 0.05$, $^{***}p < 0.01$. Standard errors in brackets.

Table A3: Impacts of conflict on children's health when controlling for potential mechanisms (2)

Variables	Probability of Stunting	Probability of Wasting	Probability of Underweight
Attack	0.0410***	0.00619	0.0484***
	(0.0135)	(0.0104)	(0.0129)
Male	-0.00342	0.0325***	0.0285**
	(0.0127)	(0.00976)	(0.0120)
Birth order	-0.00107	-0.00215	-0.00210
	(0.00243)	(0.00182)	(0.00228)
Mother Education	-0.0167***	-0.00598***	-0.0166***
	(0.00218)	(0.00170)	(0.00202)
N (Obs.)	5846	5898	6024
Adj. R2	0.026	0.006	0.027

Source: 2014/2015 Chad DHS and ACLED. $^{*}p < 0.10$, $^{**}p < 0.05$, $^{***}p < 0.01$. Standard errors in brackets.

Table A4. Robustness checks using alternative proxy of violence (1)

Variables	Size child birth	Weight Birth	Haz06	Waz06	Whz06	Bmiz06
Log Fatalities	-0.0140***	-19.98**	-0.00433	-0.0364***	-0.0404***	-0.0361***
	(0.00149)	(8.067)	(0.00839)	(0.00607)	(0.00558)	(0.00580)
Male	0.0266***	163.9***	-0.0912**	-0.101***	-0.0726***	-0.00474
	(0.00725)	(39.59)	(0.0397)	(0.0291)	(0.0271)	(0.0278)
Birth order	0.00501***	4.461	0.0265***	0.0180***	0.00724	0.00667
	(0.00140)	(7.852)	(0.00776)	(0.00571)	(0.00531)	(0.00539)
Mother Education	0.0222***	18.90***	0.0619***	0.0718***	0.0461***	0.0390***
	(0.00132)	(4.599)	(0.00691)	(0.00511)	(0.00474)	(0.00484)
N (Obs.)	18261	1937	10079	10306	10111	10121
Adj. R2	0.026	0.018	0.016	0.030	0.017	0.012

Source: 2014/2015 Chad DHS and ACLED. $^{*}p < 0.10$, $^{**}p < 0.05$, $^{***}p < 0.01$. Standard errors in brackets.

Table A5. Robustness checks using alternative proxy of violence (2)

Variables	Probability of Stunting	Probability of Wasting	Probability of Underweight
Log Fatalities	0.00322	0.00522***	0.0116***
	(0.00203)	(0.00151)	(0.00194)
Male	0.0216**	0.0277***	0.0324***
	(0.00978)	(0.00702)	(0.00918)
Birth order	-0.00473**	-0.00182	-0.00610***
	(0.00192)	(0.00137)	(0.00179)
Mother Education	-0.0161***	-0.00738***	-0.0202***
	(0.00166)	(0.00117)	(0.00148)
N (Obs.)	10079	10111	10306
Adj. R^2	0.016	0.006	0.025

Source: 2014/2015 Chad DHS and ACLED. $^{*}p < 0.10$, $^{**}p < 0.05$, $^{***}p < 0.01$. Standard errors in brackets.

Table A6. Robustness checks for plausible armed conflict impact mechanisms (1)

Variables	Mother Visited Health Facility the last 12 months	Mother Birth assisted by a skilled/ trained health practitioner	Mother Birth assisted by a traditional health practitioner	Mother Received Vitamin A Dose in the first 2 months after delivery
Log Fatalities	-0.0151***	-0.0106***	0.00980***	-0.00784***
	(0.00142)	(0.000741)	(0.00143)	(0.00148)
Male	-0.00339	0.00420	0.00235	0.00513
	(0.00704)	(0.00404)	(0.00706)	(0.00748)
Birth order	0.00864***	0.000490	-0.00572***	0.00984***
	(0.00136)	(0.000779)	(0.00138)	(0.00142)
Mother Education	0.0301***	0.00287***	-0.0338***	0.0219***
	(0.00128)	(0.000727)	(0.00113)	(0.00155)
N (Obs.)	18175	18121	18121	10729
Adj. R^2	0.064	0.011	0.098	0.063

Source: 2014/2015 Chad DHS and ACLED. $^{*}p < 0.10$, $^{**}p < 0.05$, $^{***}p < 0.01$. Standard errors in brackets.

Table A7. Robustness checks for plausible armed conflict impact mechanisms (2)

Variables	Mother takes taking iron Pills, Sprinkles during pregnancy	Child given plain water the first three days	Child given sugar/ glucose the first three days	The Child was given Vitamin A over the past 6 months
Log Fatalities	-0.00724***	-0.0175***	0.00484***	-0.0187***
	(0.00100)	(0.00166)	(0.00152)	(0.00149)
Male	-0.00176	-0.00119	0.00752	-0.00750
	(0.00525)	(0.00752)	(0.00695)	(0.00741)
Birth order	0.00266***	0.00174	0.000317	0.0120***
	(0.00102)	(0.00142)	(0.00131)	(0.00145)
Mother Education	0.00907***	0.000128	-0.00252*	0.0286***
	(0.00109)	(0.00137)	(0.00137)	(0.00142)
N (Obs.)	16129	10303	10303	16099
Adj. R^2	0.016	0.023	0.035	0.050

Source: 2014/2015 Chad DHS and ACLED. $^{*}p < 0.10$, $^{**}p < 0.05$, $^{***}p < 0.01$. Standard errors in brackets.

Appendix D: Migration correction coefficients

Table A8. Computation of migration correction coefficients

Regions	Departments	Population	Returnees	Migration correction coefficients
Lac	Fouli	72,791	2,358	0.96761
	Kaya	50,485	7,775	0.84599
	Mamdi	143,254	690	0.99518
	Wayi	252,171	1,658	0.99343
Logone Occidental	Dodjé	127,182	0	1.00000
	Guéni	110,025	0	1.00000
	Lac Wey	396,384	1,621	0.99591
	Ngourkosso	190,329	0	1.00000
Logone Oriental	Kouh Est	121,188	0	1.00000
	Kouh Ouest	59,207	0	1.00000
	La Nya	168,528	0	1.00000
	La Nya Pendé	129,248	12,964	0.89970
	La Pendé	191,864	0	1.00000
	Monts de Lam	261,853	12,018	0.95410
Mandoul	Barh-Sara	259,776	5,853	0.97747
	Mandoul Occidental	184,979	0	1.00000
	Mandoul Oriental	306,249	0	1.00000
Mayo-Kebbi Est	Kabbia	273,627	0	1.00000
	Mayo-Boneye	282,157	0	1.00000
	Mayo-Lemié	98,112	0	1.00000
	Mont Illi	272,544	0	1.00000
Mayo-Kebbi Ouest	Lac Léré	65,647	0	1.00000
	Mayo-Binder	209,044	0	1.00000
	Mayo-Dallah	400,269	0	1.00000
Moyen-Chari	Bahr-Koh	366,824	0	1.00000
	Grande Sido	127,990	36,705	0.71322
	Lac Iro	208,292	0	1.00000
N'Djamena	N'Djaména	1,137,651	5,259	0.99538
Ouaddai	Abdi	127,802	0	1.00000
	Assoungha	341,549	0	1.00000
	Ouara	392,977	0	1.00000
Salamat	Aboudéia	77,339	0	1.00000
	Bahr-Azoum	217,873	0	1.00000
	Haraze-Mangueigne	66,262	0	1.00000
Sila	Djourf Al Ahmar	97,486	0	1.00000
	Kimiti	365,817	0	1.00000
Tandjile	Tandjilé Centre	381,757	0	1.00000
	Tandjilé Est	304,478	0	1.00000
	Tandjilé Ouest	105,234	0	1.00000
Tibesti	Tibesti Est	17,203	0	1.00000
	Tibesti Ouest	13,268	0	1.00000
Wadi Fira	Biltine	202,140	0	1.00000
	Dar-Tama	214,492	0	1.00000
	Kobé	166,841	0	1.00000
	Mégri	24,422	0	1.00000

Source: From INSEED and UNOCHA databases.