The Effects of the War in Iraq on Nutrition and Health: An Analysis Using Anthropometric Outcomes of Children

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Abstract

The war in Iraq initiated in March 2003 triggered a wave of violence and turmoil in the country, exposing households to insecurity and to instability in daily life. The level of violence has varied across provinces, the south and centre areas being the most affected. Using the different intensities of the conflict across areas and the age at exposure to the war among cohorts, I analyze a possible causal effect of the war on nutritional outcomes of children. I use two empirical strategies, leading to very similar results. Estimates indicate that children born in areas affected by high levels of violence are 0.8 cm shorter than children born in low violence provinces. These results are robust to several specifications. Furthermore, the paper also addresses the channels through which the conflict has affected health and nutrition. The results have not only short-term policy implications, but also, given the empirical evidence of the impact of early child malnutrition on later education, labour and productivity outcomes, the results are of great importance for the future.

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1. Introduction

During the past two decades, the health of Iraqi people has substantially deteriorated. The country has been caught up in a continuous wave of wars and conflict causing spread of violence and detrimental effects on people's living standards[1]. The most recent war, initiated by the US-led invasion in 2003, has triggered a new wave of disruption in the country (Cockburn, 2007; Stewart, 2007; Steele, 2008). The conflict has led households to the exposure to violence and killings, to detrimental access to health services, unstable electricity supply, deterioration of drinking water and sewage systems, lack of adequate food and to disruptions of households' daily life (Unicef, June, 2003; UNAMI, 2006). However, the intensity of the violence has varied across provinces and districts in Iraq, the south and centre being the most affected during the first years (Allawi, 2007; Cockburn, 2007)[2]. This variation in insecurity and violence across provinces together with the difference in ages of exposure to the war provide a unique opportunity for a quasi-experimental design, where the war can be thought of as an exogenous shock to the child individual characteristics and household decision making. In this paper, I examine a possible causal effect of the war-related shock, i.e. treatment, on health outcomes of children. In particular, I analyze if the exposure to high levels of violence has had any effect on nutrition status of children. Using difference-in-difference estimators, I use two empirical strategies.

This research relates to various fields in the literature on conflict, development economics, and nutrition. I briefly mention below the key areas in the mentioned subjects that motivate this research. In economics, this paper relates to two areas of the literature that cover health outcomes, shocks and conflicts. First, there is a large body of

[1] Deterioration of living standards decreased during the Iraq-Iran War in the 1980s, but subsequently with the first Gulf War in the 1990s, and with the subsequent sanctions imposed by the UN in 1991.
[2] This paper uses data covering the first three years of the conflict, a period which was relatively less violent than the subsequent years. Violence and insecurity substantially increased in the aftermath of the bombing of the Samarra Al-Asakari Mosque in February 2006.

work studying the relationships between economic conditions and wars, and in particular civil, wars and conflict. The empirical research has extensively been focused on the –macro- causes of wars and conflicts (Collier and Hoeffler, 1998; Collier and Hoeffler, 2004; Miguel et al., 2004; Dube and Vargas, 2006) and on the meso-level implications (Stewart and Valpy, 2001; Barron et al., 2004), with many of the evidence drawn from African countries. But less has been studied at the micro-level on the impacts of conflicts and war on households and individuals. Although empirical work in this area using micro-data is growing (Akresh and Verwimp, 2006; Bundervoet et al., April 2008; Kondylis, 2007; Shemyakina, 2006), it is still very much African-focused[3]. Virtually, no empirical evidence exists for Middle East countries.

Second, within the development economics literature there is a great deal of work analyzing health and its relationship to socio-economic characteristics; its impacts on economic outcomes and linkages with consumption smoothing. Strauss and Thomas (2007) provide an excellent overview of this theoretical and empirical literature, which underlies how health and nutrition positively affect human capital accumulation, productivity as well as people's livings standards. On the one side, there is a unanimous agreement in the literature that health is an important factor for determining economic development and well-being in populations. Behrman and Deolalikar (1988) go beyond this, stating that, "health and nutrition are important as ends in themselves". On the other side, empirical studies have shown that nutrition affects schooling, income, labour force participation and fertility in later life (Alderman et al., 1996; Thomas and Strauss, 1997; Horton, 1999; Alderman et al., 2006; Maluccio et al., 2006).

In the development literature, quantitative research in conflict-affected areas has been modest, not only because of the lack of data, but also because data is not

[3] From all the empirical literature reviewed on the impacts of conflicts, only one has focused in a non-African country (Shemyakina, 2006).

rigorously collected[4], or because of divergence on priorities. This has exacerbated the distance between academic research and practitioners studies. The need for further research has increasingly been demanded (WHO, 2002; USAID, 2006; GAIN, 2008; UNHCR, 2007)[5]. This creates a need to establish closer ties between academic research and policy making in conflict-affected countries.

This paper contributes in several ways to the above mentioned research areas. Firstly, it adds to the economic literature on conflicts by studying the impacts of war and conflict using micro-level data. Secondly, it is relevant to the development economics literature by expanding the research of prenatal and early childhood shocks on nutrition and health. Finally, it contributes to the empirical research on conflict-affected countries and attempts to create linkages between academic-oriented studies and policy making.

The rest of the paper is organized as follows. Section two briefly describes the literature and highlights key results of the research on health and nutrition. Section three provides an overall background to the conflict in Iraq and reviews the main aspects of the 2003 war while exploring some of the implications for health. Section four focuses on the main outcomes used in this paper. Section five describes the data and sample. Section six covers the identification and empirical strategies followed. Section seven and sub-sections present the results for the nutrition indicator, height-for-age. Section eight shows results for the other two indicators, weight-for-height and weight-for-age.

[4] Data from media and humanitarian organizations can provide valuable information despite the fact that, in many instances, it is not collected with a scientific or rigorous methodology.

[5] For example, the WHO acknowledges that research is crucial for assessing the impact of conflicts on health (WHO, 2002). The UNHCR states that studies are important not only to conducting situational assessment but for assessing which interventions are effective and incorporating lessons learnt to programs (UNHCR, December 2007). USAID affirms that studies are needed to do a smooth transition from humanitarian work to development interventions (USAID, 2006). The World Bank took a major step by establishing a full research program on the economics of conflicts in 1999 (World Bank, 2008).

Section nine explores some of the mechanisms in which the war affected health of children. The final section provides a discussion of the results and concludes.

2. Literature

This section reviews the literature and empirical research on the impacts of shocks on health as well as the literature on nutrition and health in early childhood.

2.1 Literature on Shocks

The economics literature on shocks and health draws mainly from the modelling of natural disasters and other phenomena as exogenous shocks to household's decision making. These shocks include changes in weather conditions, such as floods, droughts, earthquakes, fires and rainfall, but also other catastrophes such as famines and hunger. These have provided unique opportunities to explore causalities. Studies of natural disasters have found negative effects on health. For example, Hoddinott and Kinsey (2001) using panel survey data of resettled villages in rural Zimbabwe, analyse the impact of the 1994 drought. They find that younger children lose 1.5-2 cm in the aftermath of the drought, while there is no impact for older cohorts. They also find that these effects are less evident in households who are able to smooth their consumption through holdings of livestock. Also for Zimbabwe, Alderman et al. (2006) use civil war and drought shocks to identify differences in pre-school nutritional status across siblings. They find that children exposed to these shocks are 3.4 cm shorter and complete 0.85 years less schooling. Jayachandran (1995) studies air quality and child mortality in Indonesia. She exploits the massive 1997 wildfires to identify an impact on child survival. She finds that exposure to pollution during the last trimester in-utero has negative effects on survival of babies. Rose (1999) examines whether rainfall shocks in early childhood increase the probability of survival of girls. She finds that a positive

rainfall shock in the first two years of life significantly increases the likelihood that a girl survives relative to boys' survival. More recent work explores health events in early life, including health in-utero and its link to health in adult life and human capital accumulation. Almond (2006) finds that adults who were in-utero during the 1918 influenza pandemic in the US had lower education levels, lower wages and more disabilities than non exposed children. He finds that exposed pregnant women are more vulnerable to influenza and had more still births. On the impacts of conflict, Bundervoet et al. (2008) study the effects of the civil war in rural Burundi. They find that children born in provinces affected by the war had on average 0.5 standard deviations lower height-for-age z-scores than non-exposed children. Akresh and Verwimp (2006) study two types of shocks, crop failure and civil conflict, and find that girls had 0.72 standard deviations lower in their height-for-age z-scores. Generally, the mentioned studies stress not only the importance of health in early childhood for later adult outcomes, but also of health in-utero health and during pregnancy.

2.2 Literature on growth and nutrition

Within the nutritional and epidemiological literatures, studies on nutrition in early childhood are extensive. An important result of this research during the past two decades is that it has helped better understand nutrition patterns and has facilitated the development of international standards for assessing growth of children in developing countries (Martorell, 1996; Li et al., 2003; Stein et al., 2003; Stein et al., 2008). This literature highlights the importance of protein and nutritional intake in early life: infants and young children require considerably more proteins than their older peers

(Scrimshaw et al., 1994; Ziegler, 2006)[6]. In addition, health conditions of the mother during pregnancy are other important determinants of the child's health (Metcoff, 1986).

The initial months of life, in a developing country context, is also of greatest vulnerability and risk and could affect the cognitive development of a child. Research from Martorell and Habicht (1986) and Ruel et al. (2008) has shown that the first two years of the life of a child are crucial for growth, and suggest that it is less likely for children who present slow physical growth during the first 24 months to catch up later in life. If growth is decelerated, it can have possible irreversible and long-term physical consequences (Martorell and Khan, K.L., Schroeder, D, 1994; Martorell et al., 1995; Li et al., 2003). Subsequently, a key conclusion from these various studies is that nutrition in early childhood and during pregnancy determines the physical development of the child and her cognitive development.

3. Background[7]

This section provides some background to the main political and socio-economic factors in Iraq prior to 2003. In addition, it provides an overview of the 2003 war and highlights some of the damages of the conflict relevant for health.

3.1 Pre-2003 situation

Iraq once had some of the highest health and educational indicators in the Middle East, and was one of the most industrialised and developed countries in the region. However,

[6] Children require energy and protein for both growth and for maintenance. For example, an infant of 0-1 month requires 1 gram of protein per kg/day for total growth, a 1-3 month-old .51 grs, while a 3-6 month-old .3 grs and a 2-5 year-old .07 grs of protein per day.

[7] This section draws from books written by ex-government officials and humanitarian personnel as weel as from reports of organizations and companies involved in the reconstruction efforts. It also relies on personal interviews conducted with staff and Iraqi personnel working with several organizations.

living standards substantially deteriorated after the Iraq-Iran war in the 1980s and continued to decline during the Gulf War in 1990-91 and with the 12 years of international sanctions[8]. The deterioration of economic and social conditions led the UN to establish the Oil-For-Food Program (OFFP) in April 1995[9]. Under the terms of the OFFP, the Government of Iraq was allowed to utilise oil revenues to purchase humanitarian goods, including food items[10]. The OFFP started delivering supplies in early 1997, and included twenty sectors, with food being the largest component in financial terms. The program ran until 2003 and was terminated a few months after the 2003 war started. Under the OFFP around 39 billion USD were spent on humanitarian supplies. The independent 2005 inquiry into the impact of the OFFP concluded that the program achieved its humanitarian purposes; mainly through the provision of food, medicines and maintenance supplies to key sectors[11]. The report stated that living conditions of the population improved, in particular the nutrition of children. Rates of malnutrition decreased 2.1 percentage points in the North and 1.9 percentage points in the South and Centre (WG-IIC, 2005).

3.2 The 2003 War[12]

Although several discussions on the invasion started to take place prior to 2003, the initial US plans considered entering the country from the North through Turkey, then moving through towards the Kurdistan region in Iraq and then south to Baghdad. These plans were hampered by Turkey's reluctance to allow US forces to pass through their

[8] With Iraq's invasion of Kuwait in 1990, the UN Security Council passed a resolution SC 661 establishing economic sanctions on Iraq, including a trade embargo. At the end of the Gulf War, sanctions were linked to the removal of weapons of mass destruction in SC 687.
[9] OFFP was created through UN resolution SC 986.
[10] The agreement established that the Government of Iraq would manage the program in the centre and southern provinces (i.e. governorates) and the UN would take the lead in the Northern Governorates.
[11] Nevertheless, there were serious problems in the implementation of the program as well as on the adequate and timely delivery of supplies. For a review on the OFFP see von Sponech (2006) .
[12] Paragraph based on Allawi (2007), Cockburn (2007) and Ricks (2007).

territory. The invasion, known as Operation Iraqi Freedom, therefore, began instead from the south of the country. On March 20 2003, three US and one British Army divisions, a total of 145,000 troops and 247 tanks, entered Iraq from the border with Kuwait and moved across the desert of An Nasiriyah. One of the US divisions moved north along the western bank of the Euphrates River towards Karbala, and other moved towards the southern oil fields and then north towards Nasiriyah, capital of Thi Qar province. The British moved towards Basra. The "shock and awe"[13] period also consisted of aerial bombardment, targeting government buildings and houses owned by the Baath regime[14]. There are reports suggesting that the air campaign also targeted many populated areas[15].

The initial warfare was virtually over within a few weeks. However, despite the fact that the Iraqi army provided little resistance, coalition forces met with several armed groups, militias, and paramilitaries. This created a state of violence and hostility in the south and centre parts of the country. For example, the British military surrounded Basra in the first week, but serious fighting limited them from establishing control. The US forces severely clashed in Nasiriya, and subsequently on their way up to Baghdad were halted by several ambushes and fighting. At the same time, cities were also affected by violence as armed groups from different sides clashed: some were still supporters of Saddam Hussein, while others were from religious militia groups. In Diyala province (i.e. governorate), Badr forces[16] seized Baquba, while other militants linked to political parties, such as the Iraqi National Accords (INA) moved to Anbar,

[13] A military strategy, formulated by Harlan Ullman and James Wade in 1996, is based on "achieving rapid dominance over an adversary by the initial imposition of overwhelming force and firepower". It was used in Iraq in 2003 (Knowles 2006)

[14] The Baath Socialist Party came into power with a *coup d'état* in 1968. Saddam Hussein became president 1979.

[15] According to Landmine Monitor (2003) the coalition use cluster munitions in many populated areas throughout Iraq, including Baghdad, Basra, Hillah, Kirkuk, Mosul, Nasiriyah, and other cities and towns.

[16] Badr forces are a Shiite powerful militia that was formed and trained in Iran during the 1980s and link to the party of the Supreme Islamic Iraqi Council (SIIC)

and the Islamic party of the Supreme Council of the Islamic Revolution of Iraq (SCIR) to Kut in Wasit province[17]. It is said that the Iraqi national military troops did not surrender, but just basically went home. The number of Iraqi army or militia fatalities it is not known, but the coalition forces casualties mounted to 172 by the end of April 2003 (CNN, 2009). US President G.W. Bush declared "Mission Accomplished" in May 1st, after the coalition forces gained control of Baghdad. A Coalition Provisional Authority (CPA), in charge of overseeing overall administration, was set up on the same day.

In contrast with the 1991 war, coalition forces did not purposely target public infrastructure. Although numerous public buildings, private dwellings, and social infrastructure were damaged during the aerial bombings; it is far less than the damage incurred in the previous war in 1991[18]. Nonetheless, damage was done in several ways. A report to US Congress mentioned, already in early April 2003, the state of events:

"*It is widely believed that the current humanitarian situation is worsening due to the war. The war is disrupting critical infrastructure, delivery of basic services, and food distribution*"[19].

During the subsequent months, the war triggered a new wave of violence and destruction that damaged electricity, water supply, sewage networks, food availability and the administrative functioning. Reconstruction efforts were also hampered by armed group activity. The two major contractors in charge of rehabilitation, Abt and Betchel, often reported that insecurity was the major risk in hampering the completion of projects[20]. Personal accounts of Iraqi civil servants, CPA officials, journalists and

[17] Iraqi National Accords (INA) was founded in 1991 by Iyad Allawi who was the interim Iraqi Prime Minister up to election in 2005. The Supreme Council of the Islamic Revolution of Iraq (SCIR) was founded in 1982.

[18] According to Cockburn (2007) in 2003 the US deliberately avoided bombing the Iraqi infrastructure. While in 1991 the US targeted electric power stations, oil refineries, telecommunication centres and essential bridges as a military strategy.

[19] See Margesson and Tarnoff (2003 ; pg.1)

[20] For example, Abt in charge of the reconstruction of the health system acknowledge that security was one of the major factors to delay fielding of staff (Abt, 2004). Bechtel who lead other infrastructure

humanitarian workers show that during the "shock and awe" period there was some damage to infrastructure, but they point to the fact that it was the violence, triggered during the subsequent months, that devastated Iraq infrastructure[21]. The sections below present an overview of the areas relevant to health and nutrition.

[Figure 1: Timeline about here]

3.3 Looting and Robbery

Within a few days of the invasion, the vacuum of an Iraqi authority was visible and eminent, while lack of order and a wave of looting and robbery spread throughout the country. Several public buildings, hospitals, schools, food distribution points and even museums were left unprotected, stimulating theft and burglary. Many looters acted as profiteers and thieves but others as a signal to oppose the coalition forces.

Although there has been no quantification of the damages to public infrastructure, anecdotal evidence and reports from contracting companies, in charge of reconstruction, suggest that a majority of the damage was done through vandalism. The Ministry of Health in Iraq reported that one third of Primary Health Care centres were looted, mainly in urban centres although some in rural areas as well. A Unicef report (Unicef, 2003) provided an overview of the situation in June 2003:

"*500 schools in Baghdad were damaged and equipment and materials had been looted....half of the 1410 water treatment plants in Iraq were no longer functioning and all the sewage treatment plants in Baghdad were out of action. Electricity supplies to nearly forty percent of all water and sewage treatment plants were interrupted. It was further estimated that nearly US$ 50 million worth of spare parts, equipment, water treatment chemicals and service vehicles –were- looted. Some of the hospitals had escaped damage or looting and continued functioning with minimum levels of equipment, but a majority of the primary healthcare facilities had virtually ceased operations. Staff as well as users of such services, particularly women and children, refrained from attending either school or health facilities due to the adverse security environment*".

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projects in water, electricity, airports and port also reported security as a major concern as early as in June 2003. It had later on several personnel abducted and killed (Sawyer, 2006).

[21] See for example Diaz and Garfield (2003), Allawi (2007), Cockburn (2007), Stewart (2007) and Unicef (2003).

3.4 Electricity, Water and Sanitation, and Health Services

One of the main challenges for the CPA, and later for the Government of Iraq, has been the restoration of the electricity network, which until December 2007 had not reached pre-war levels. Moreover, the lack of power severely damaged the water and sanitation infrastructure as well as the provision of health services. Although, public infrastructure was already in a precarious state, and the electricity system was somehow functioning miraculously, the 2003 war triggered an abrupt collapse[22]. Furthermore, the continuous violence hampered restoration efforts. The lack of spare parts combined with poor maintenance made it difficult for the electricity and water systems to be fully operational[23]. Moreover, reconstruction was continuously interrupted by insurgency groups and sabotage. This created an endless cycle of repair - sabotage- repair.

The lack of electricity deteriorated access to safe water and proper sanitation not only because electric power is needed to operate treatment plants, but also, because Iraq is a flat country, in which, except for the North, electricity is needed to pump treated or waste water. During the first years of the war, access to safe water was the major problem in several parts of the country[24]. Similarly, black water was not been properly treated due to malfunctioning treatment plants, or continued to be dumped into rivers or in the desert, which has incremented contamination of air and water born diseases.

[22] Through looting and attacks but also the administration (CPA and subsequently PIG) was full of incompetence, lack of planning, and lack of knowledge of the real situation.

[23] A report commissioned by Unicef stated that the war resulted in almost half of all water and sewage treatment and pumping stations being out of order. The main reasons were power outages, but also looting, general insecurity, as well as collateral damage (Doyle, 2003).

[24] For example, the lack of chlorine and purification tablets exposed households in Basra to water contamination. In Najaf, fighting and bombing rendered water pumps inoperable and the lack of electricity damaged the water supply network. Many issues that could have been easy to address were rendered difficult because of the violence. Floods hit Missan and Thi Qar provinces in 2004 and the deteriorated security situation made much aid relief almost impossible to deliver (UNAMI, various). Moreover, salinity, which is common in the south, became exacerbated. The higher levels of salinity make water undrinkable and not good for use in agriculture. Consequently, many people in the south have relied on bottled water which has been inaccessible due to insecurity.

The 2003 war hit the -already deteriorated- health system[25] severely. According to Diaz and Garfield (2003) 12 percent of all hospitals were damaged and 7 percent were looted. Moreover, the persistent electricity power shortcuts, unstable water supply and sewage system, and widespread insecurity, paralyzed the delivery of services in many areas preventing efficient health provision (Alwan, 2004)[26]. The system was also affected by an institutional vacuum and a politicization of the health services. Despite the damage, many health facilities continued operating[27], and health personnel were reported to have worked under tight security and limited conditions.

3.5 Food availability

Iraq has the largest public distribution system (PDS) of food in the world[28]. The food basket is composed of essential items such as wheat, rice, sugar, oil and soap[29]. According to the World Food Program (WFP, 2005), almost 100 percent of the population in Iraq received rations prior to 2003[30]. After the war, the system was partially interrupted but the majority of the population continued to receive food rations. The food quality and quantity deteriorated as the PDS was not only affected by looting and destruction, but also few processing factories compiled with safety regulations (Alwan, 2004). A survey in 2005 estimated that 15 percent of the population was *food*

[25] The health care system in Iraq was set up during the years of prosperity in the late 1970s, which allowed the regime to set up a health model based on European standards. It was also made fairly equitable with the modern facilities of the time, with many of the doctors and nurses came from other Middle East countries. But, it deteriorated during the wars and sanction years, not only in terms of infrastructure and supplies, but also many of the foreign personnel left the country.
[26] Water and health systems are reported to be operational and functioning as of 2006.
[27] Around 76 percent of hospitals had backup generators as power cuts were also common before 2003.
[28] The PDS is a universal in-kind transfer program which gives every Iraqi the right to a monthly entitlement, each individual receiving the same amount. Infants sometimes receive infant formula and weaning cereals.
[29] A ration consists of 2,215 kilocalories per person per day and provided the necessary calories, but it was still low in vitamins, protein and minerals: The PDS individual monthly ration is the following: wheat (9 kilos), rice (3 kilos), sugar (2 kilos), tea (200 grams), vegetable oil (1.25 kilo), detergent (500 grams), pulses (250 grams), adult milk (250 grams), soap (250 grams), infant formula (1.8 kilo), salt (100 grams) and weaning cereals (800 grams). Salt, Adult Milk, I. Formula and W. Cereal are infrequently distributed in some sporadic areas during last year.
[30] The PDS started just after the first Gulf War in 1991 and was later reinforced by the OFFP.

insecure and 47 percent depended on the ration to meet their basic food intake, and households reported that collecting rations was a psychological burden due to the persistent insecurity (COSIT and WFP, 2005). According to one of the surveys used in this research, COSIT (2005), 97 percent of the population reported receiving rations in May 2004, but there is no information on the quantity and quality of food consumption. Therefore, the analysis presented cannot establish precise links between food consumption and nutrition. However, I assume that, because of the deterioration of the food inspection systems, probably, the quality of the ration decreased.

4. Nutritional Outcomes

Nutritional outcomes for children can be measured by several anthropometric indicators. The three most common used are acute malnutrition, chronic malnutrition and general malnutrition (WHO, 1995). Acute malnutrition, or weight-for-height, is an indicator of *wasting* caused by severe, recent onset of adversities such as rapid reductions in food availability or interference with food intake due to infections. Thereafter, reflects current malnutrition status (e.g. at the time of the survey) relative to height. Chronic malnutrition, or height-for –age, is an indicator of *stunting* attributed to long-term malnutrition resulting from low growth due to protein deficiency, low-food intake for longer periods, concurrent illnesses, or detrimental health of the mother during pregnancy. It reflects the accumulated detrimental effect over a period of time. Underweight, or weight-for-age, is an indicator of *general malnutrition*; it reflects the body mass relative to age. From the above mentioned indicators, chronic malnutrition is important because children that become stunted during their early months/years of life are likely to remain, in future periods, short in height for their age (Martorell and Habicht, 1986). While wasting is an indicator of short-term health, and general under-

nutrition can reflect both, short and long term nutrition status, they might be overcome at later stages in life by the gain of weight. The literature on nutrition indicates that these measures do not necessarily move together (Victoria 1991). So, children that develop chronic malnutrition, or stunting, might or might not have acute malnutrition, or wasting[31]. I use these three indicators in my analysis, but a deeper examination is dedicated to height-for-age, given its relevance as a long-term determinant of health.

I follow international standards and standardise measures by using a reference population of well-nourished children[32]. The reference population is used to calculate anthropometric indices that can be expressed in form of z-scores. These z-scores are calculated for a child's height (or weight), given age and gender, by subtracting the median height (or weight) in the reference population and dividing by the standard deviation of the reference population (see appendix for details). The idea behind the standardisation is that children in normal conditions grow in similar patters (Falkner and Tanner, 1986; WHO, 1995), so any deficiency on growth can be attributed to a detrimental situation.

5. Data and Sample

5.1 Data

I use four different sources of data. A first data source is the *Iraq Living Conditions Survey* (ILCS), a national-wide household survey conducted in May/August 2004. The survey was done by COSIT, the Iraqi National Statistics Office with support from Fafo, a Norwegian Institute. The survey design was done in two-stages. The initial sample consisted of 22,000 households. Fieldwork was conducted between the months of

[31] The relationship between these two indicators is further discussed in subsequent sections.

[32] NCHS/WHO US reference population has been commonly used with the argument that it reflects ethnic diversity of a well-nourished population. Recently, the WHO has developed its own growth charts using a world-wide reference population. I use the NCHS/WHO.

March to May 2004 for 16 of the 18 provinces, which are called governorates in Iraq, and between July and August for the remaining two provinces. Additional information about the survey and on how children were measured is included in the appendix.

The second and third surveys used are the Multiple Indicator Cluster Surveys (MICS) conducted by COSIT and the Ministry of Health together with Unicef. Both surveys, MICS 2000 and MICS 2006 are nationally representative and are part of Unicef's global monitoring system for children. The first survey was conducted at the beginning/mid-2000 and the sample included 13,430 households. The second survey was carried out between February 2006 and June 2006. The sample included 18,144 households.

A fourth data source is the Iraq Body Count (IBC) database, compiled by an NGO based in London. This database records violent deaths that have occurred since March 2003. IBC uses key words to search and scan internet based media reports of violent deaths, which are a direct result of the conflict. This process uses public domain search engines and media outlets. Sources include also Arabic-language news media as well as some Iraqi newspapers that publish information in English. Data is also compared with morgue information from the Ministry of Health[33].

For the analysis at the provincial level I use all three household surveys, however at the district level, and for the identification of mechanisms of the effects of the war, I only use the ILCS.

5.2 Sample

Graphs A.1 and A.2, included in the appendix, show the distribution of z-scores for height-for-age and for weight-for-height -or length-, given age and gender. The graphs

[33] For details on the IBC data collection and compilation see www.iraqbodycount.org.

also include a theoretical normal distribution, which can be thought of being an approximate of the reference population with mean zero. The first graph shows that height-for-age z-scores are skewed to the left in the three years, but the distribution is more spread in 2004 and 2006 in comparison to 2006. In the contrary, weight-for-height z-scores seem to be slightly skewed to the right during the last two years, but as indicated in the appendix, the measurement of weights may pose some problems. Nevertheless, in the results section, I come back to discuss this: gaining weight, given height, age and gender, could be seen not only as an improvement of nutrition, but also, as the outcome of a lack of exercise and an unbalanced diet.

Table A.1 presents the descriptive statistics of the observable characteristics of children, less than 5 years old, for each of the three cross-sectional surveys. In addition, it also shows the means of the sub-samples of included and excluded children, and their difference and statistical significance. The included observations represent children whose z-scores are within conventional levels, between -6 or + 6 standard deviations of the reference population. Conversely, observations are excluded where z-scores are not within these conventional levels, which would indicate that children were measured with error, or, in some cases, that children were not measured at all (see appendix for details).

In 2000, the sub-sample of included children represents 92 percent of the total number of children, in 2004 74 percent and in 2006 is about 94 percent. The means of z-scores for the three nutrition indicators seem to slightly increase. For example, the average height-for-age z-score in 2000 was one SD below the reference population, while in 2006 the mean is 0.76 below. It is important to mention that while this is an indication of the average z-score, it is not possible to explicitly compare estimates as these are from three different surveys. I will come back to this in section 6.

I use 2000 as the baseline year. A typical child, in the 2000 survey sample, is one SD, of the height-for-age z-score, below the reference population, and also 0.3 SD below in the weight-for-age z-score. The child has 49 percent chance to be a girl, 57 percent likelihood to be living in an urban area, is likely to be part of an eight-member household, has 70 percent chance to have access to drinking water, and is likely to be living in a 4-room dwelling. His or her mother probably has finished primary school (63 percent) but not necessarily high-school (6 percent). In 2004, a child has almost the same probabilities to be in a similar situation, but would have a weight-for-height z-score similar to the reference population. Though, in 2006, a child has a height-for-age z-score 0.7 SD below the reference population, he or she is 0.25 SD above in the weight-for-height z-score. This indicates that stunting, low height, given age and gender, is a problem in Iraq. The fact that children's z-scores are, on average, above the reference population in weight-for-height indicates that children are gaining weight. As stated above, I come back to this in the results section.

Similarly in 2006, an average child lives in a smaller household with 62 percent chance to be residing in a urban area, moreover, his or her mother has less than 50 percent likelihood to have completed primary school. Columns 1d, 2d and 3d present the difference in means (and standard errors) between included observations, reported and excluded. The differences for the age of the child are significant in the three surveys, showing that younger children were more likely to be either measured with error, or not measured at all. In the case of the presence of illness, the differences are also statistically significant at 5 percent level. However, except in 2004, included children are more likely to have reported being ill. This seems a bit odd as one would expect ill children to be not measured, and not the opposite. Other differences are reported for the number of household members, urban areas, and access to drinking

water. The fact that there exist some statistically significant differences at conventional levels on observable characteristics may pose a selection bias problem. I approach this by looking further into the probabilities of being included in the sample and run a probit regression, of a dummy equal one if the child is included in the sample, on various individual and household characteristics. If the coefficients of these probits are statistically significant, it would indicate a selection on observables in the sub-samples and therefore, the estimation results could be biased. Table A.2 presents the marginal effects of these regressions for three different specifications in each year. In this table, I report coefficients of the sub-sample of the cohort of interest (the cohort that is treated as explained in the identification section), which includes children between 6 and 13 months old. The marginal effect coefficients are in the majority of cases not statistically significant. However, the age effect is statistically significant for the three specifications in 2004, although it changes sign from positive to negative. This suggests that a large number of children could be selected into the sample based on age. Indeed, in the 2004 survey, Fafo reported imputing age for 4.6 percent of the sample of children because age was not properly recorded. I discuss this further in the appendix. Nevertheless, in the estimation regressions, I add individual, household and location characteristics as well as month of birth to control for selectivity into the sub-sample (Wooldridge, 2002).

6. Identification and Empirical Strategies

6.1 Identification

In an ideal situation, but not necessarily feasible, in order to estimate the effect of the war on the nutrition status of children, one would first need to observe a child exposed to the war in two periods, before and after the conflict, and also observe the same child, but who is not exposed to the war, in the same two periods. This is clearly not possible

in any kind of setting as we only can observe a child either exposed or not exposed. Moreover, in the Iraqi case, there is no data that would allow us to observe the same child before and after the war. In addition, potential growth is reached at very young ages; therefore, it might not be plausible to compare the same children after the war. So, the identification strategy, in this paper, comes by exploiting differences in the timing and the geographical intensity of the conflict, where I compare z-scores among cohorts born before and after the war (i.e. before and after treatment) in provinces affected by different levels of violence. I classify provinces into high-intensity conflict and low-intensity conflict areas in order to identify a causal effect. Therefore, the date of birth and the place of residence determine the intensity of exposure to the war[34].

6.2 Empirical Strategy

I follow two empirical strategies. In the first one, I use three independent, random sample surveys to create a sort of pseudo-panel of cohorts. The selection of the cohort of interest is done through the following steps. First, I identify, in the 2004 survey, the cohort born after the initiation of the war (March 2003): this cohort, as research has shown (reviewed in section two), is likely to be more susceptible to changes in nutritional intake and quality of food, and also be more vulnerable to diseases if not breast-fed. Second, I track this same age-group of children in the 2000 and 2006 surveys. Therefore, in the pseudo-panel, I have 2000 as a baseline year, which reflects the before treatment year, and two post-treatment years: 2004 and 2006. Similarly, the treatment and control groups are defined by classifying provinces into high-intensity conflict and low-intensity conflict areas. The advantage of creating a pseudo-panel is that, by following a specific age-cohort, in randomly selected samples, it allows us to

[34] Other studies using cross-sectional data that have identified exposure to treatment based on age are Almond (2006), Bundervoet et al. (2008) and Duflo (2001).

observe behavioural relationships and responses (Deaton, 1985), which make possible identifying the effect of the treatment. Figure 2 depicts the cohort, aged 13 months old or younger, who is followed in the three different surveys. Table A.3 shows the summary statistics of z-scores for the same age-cohort.

[INSERT FIGURE 2]

In the second empirical strategy, I only use one single cross-sectional survey, the 2004 ILCS, and compare young cohorts to older ones in high and low intensity conflict areas. The uniqueness of this survey is that all children present in the sample were conceived before the war, so the decision of parents to have children is not affected here, unlike the possibility that it does in 2006. Moreover, given that all children have been exposed to the war, either because they were born before the war or because were in-utero when the war started, one can assume that, to a certain extent, all children have been affected by the war. Consequently, the strategies may capture the *differential effect* and not the overall effect of the war. Results from the two strategies, however, do not vary significantly.

The need for a second strategy is important because estimates from the first strategy could potentially have problems. First, the children's heights, weights and z-scores are likely to be sensitive to each survey not only because the surveys were conducted at different periods of time, but also used different measurement instrument**s**. The 2004 survey was conducted towards mid-year, during the summer months, unlike the others, which were conducted at the beginning of the year. This could create problems in the calculation of z-scores because children could be more likely to sweat and loose liquid during the summer, or be more prone to infections or to diseases during

other time of the year[35]. Nevertheless, the MICS 2000 and 2006 both follow similar standards, their comparison could, however, avoid the problem of having different methods of measurement. Nonetheless, because the peak of the incidence of violence occurred in February 2006, after the bombing of the Samarra Mosque, displacement is likely to pose a potential selection bias in the 2006 survey. The magnitude of this bias cannot be estimated as there is no information about displacement in the 2006 survey.

Second, the sampling designs of the three surveys, although allow for representativeness at the provincial levels, are not similar. This, consequently, does not permit estimating coefficients and standard errors that are adjusted for the sample designs of the surveys. Third, the 2004 survey has the advantage to cover several socio-economic dimensions such as labour status, displacement and pre-war characteristics of the households, which the other two surveys not cover. This permits assessing, not only, the possible selection into displacement, but also, allows controlling for mother and pre-war characteristics. Fourth, the 2004 survey also permits classifying conflict areas at the district level, a lower administrative unit than provinces, and therefore, I can increase variation between control and treatment areas. In addition, a lower unit of analysis allows capturing the extent of violence more precise. This is in particular relevant because there is anecdotal evidence that the war and subsequent shocks affected households within a specific area (district) in a similar way. For example, as the number of people killed increases in Samarra town, and therefore, the level of insecurity rises, a larger area, Samarra district, may also be affected because the insecurity hampers communication, destroys infrastructure and disrupts access to basic services; as channelling of resources and efforts is done from the provincial to the district level.

[35] In particular, an outbreak of cholera episode spark in the south of Iraq in mid-2003, subsequent outbreaks hit the north in 2007.

Figure 3 shows how the identification of age groups is calculated based on the timing of exposure to the war using the 2004 survey.

[INSERT FIGURE 3]

6.3 Empirical Model

In the first strategy, the treatment effect of the exposure to the war on children's z-scores is estimated through the following equation:

$$Y_i = \beta_1 + \beta_2 \left(C_i\right) + \beta_3 \left(T_t\right) + \beta_4 \left(C_i T_t\right) + e_i \qquad (1)$$

Where Y is the outcome of interest, C is a dummy to indicate if the cohort is born after the war (appears in 2004 or 2006 survey), and T is a dummy indicating if the cohort resides in a treated province (high-intensity conflict). β_1 is a constant term and e is a random, idiosyncratic, error term. The subscripts i and t represent the cohort i (born before or after the war) in province t (residing in treated or not treated province). The coefficient of interest, the Difference-in-Difference estimator (DID), is β_4 , which is the interaction of dummies C (cohort born after the war) and T (born in treated province t). It indicates the differential effect of the war on z-scores of children. The identifying assumption in the DID estimator is that in the absence of the war, ceteris paribus, the difference in trends of z-scores between young and old cohorts would be similar in the treated and non-treated districts , so β_4 would be 0.

This empirical model 1 does not control for any possible difference among the characteristics of the children in treatment and control groups, or for any possible time-

invariant correlation within provinces and districts. It is also possible that there are seasonal effects among cohorts. Although, selection into the sample does not seem to be a problem, it was shown in table A.2 that age in 2004 might be correlated with the inclusion in the sample. Therefore, it is important to control for this in the individual specifications. I therefore also run the following regression with various controls:

$$Y_i = \beta_1 + \beta_2 (C_i) + \beta_3 (T_i) + \beta_4 (C_i T_i) + \beta_5 X_i + \beta_6 PW_i + u + p + e_i \quad (2)$$

In the empirical model 2, I allow for group and area specific effects: u, and p are cohort (month of birth) and province time-invariant fixed effects, respectively. X_i is a vector of individual, location and household characteristics and PW_i is a vector of pre-war household characteristics. Adding covariates to the regression accounts for the possibility that children in treatment and control groups have systematically different characteristics in the two time periods (Wooldridge 2002).

6.4 Treatment Areas

Iraq has 18 provinces, which are called Governorates; each of them is sub-divided into districts. In total the country has 104 districts. I identify treatment areas at two levels, province and district, and use them for the two empirical strategies describe above, respectively. I use two measures to classify areas according to their exposure to the conflict. The first measure, which I use as an objective indicator, is the war-related deaths. The second measure, and subjective indicator, is the frequency of shooting in the neighbourhood reported by the household[36]. I assume that the measures capture –to a large extent- the damages of the war describe in section 3. In section 9, I attempt to

[36] I am not aware of any quantification done of the damages of the war on infrastructure, electricity or water and sanitation. Other household reported data on the stability of public services could provide a subjective measure as infrastructure has been extensively damaged by the war. However, with the available data, it is not possible to control for the state of the water and electricity systems before the war.

relate direct war-related mortality to various indicators including the status of public infrastructure and services. The way in which I measure the intensity of the war is explained in detail in the appendix. In addition, I also provide comparisons among war-related mortality estimates between the ILCS and the IBC, which is an independent source, in order to validate the violence indicator used in the paper.

Tables A.3 and A.4 show summary statistics of provinces and districts classified by their intensity of exposure to the conflict, respectively. Table A.3 shows the total number of war-related deaths up to 2004 totals 23,723 fatalities. Provinces classified as high-intensity conflict areas account for 75 percent of the total deaths, and have, on average, 1,300 war deaths. Table A.4 shows the percent of war-deaths by type of district: 60 percent (15,239) occurred in high-intensity districts, around 30 percent (7,607) in medium-intensity, and 10 percent (898) in low-intensity. On average there are 530 war fatalities per district.

Table A.6 presents the percentage of children living in the different types of conflict areas. About 66 percent of children in urban areas reside in an area that was exposed to violent deaths, 40 percent live in high-intensity conflict provinces and 60 in low intensity-conflict areas. If treatment is based at the district level, 22 percent live in high-intensity conflict districts, which correspond to the top 25 percent of most violent districts.

A map included in the appendix shows how the intensity of the conflict is geographically distributed across Iraq. The most violent areas are not only concentrated in and around Baghdad, but mainly are the capitals of the districts such as *Basrha*, *Najaf* and *Nasiriyah*. The geographical distribution of war deaths maps well with the anecdotal evidence of the conflict describe in section 3. In Basra, for example, British forces clashed several times with militias before taking over the city in early 2003. Later

on, the city was also in the hub of religious fighting between *Sadrists* and other religious groups. In *Falluja*, clashes between US troops and insurgents began in August 2003 but the fighting culminated in a siege of the town for several weeks a year later in 2004. Several districts in Baghdad were affected not only by fighting, but also, by bombing and revenge killings. The UN headquarters, the Red Cross and the Jordanian Embassy were targets of suicide bombers in the second half of 2003. The de-Baathification process[37] was linked to the various politically motivated murders as early as May 2003. In addition, violence spread with the emergence of local power groups and religious militants in several Shia cities in the south. This affected the holy city of *Najaf* in particular, where fighting among Shia political groups emerged after the killing of Ayatollah *Baqir al-Hakim*. Moreover, *Nasiriyah* fell under the rule of local tribesmen allied with the *Da'awa* Party, and in *Missan* province near the border with Iran, several towns were controlled by religious groups.

Graph A.3 show the results of a kernel local polynomial regression for height-for-age z-scores of children in 2000, 2004 and 2006 samples, respectively. The graphs show that there is a decrease in the average level of z-scores for high intensity conflict provinces from the baseline year, 2000, to the treatment periods, 2004 and 2006. The difference is clearer for 2006, where z-scores of children in high intensity conflict provinces are below the low intensity conflict areas. This provides initial evidence that the war has, probably, affected the nutrition status of children.

6.5 Threats to internal validity

The main assumptions in the identification and empirical strategies described above could potentially be violated. Hereafter, I therefore discuss some threats to the internal

[37] This refers to the process in which the CPA fired all officials who were in the highest three ranks of the Bath Party (the party of Saddam Hussein).

validity of the research. An essential condition of the identification strategy is related to the need to find variation that is exogenous to the outcome of interest (Meyer, 1995; Wooldridge, 2002). The war and its effects are seen as an exogenous shock to children's outcomes for the reasons describe in section 3, which provides evidence on the nature and initiation of the conflict. Although the war hit a great part of urban areas, the shock can be taken as exogenous to the individual and household characteristics.

However, a possible concern arises due to the displacement that occurred post-2003[38]. This is likely to be a problem in 2006 because displacement substantially increased from February 2006 onwards, after the bombing of the Samarra Mosque. Besides, I do not have displacement information. However, this is not necessarily a concern in 2004, not only because of the lower levels of movement, but also because the survey includes displacement information. Two questions help me identify the households that have migrated[39]. The first one asked: were you living in the same household in December 2002? A second question asked: were you living in the same household five years ago? For the 2004 sample of children, 9.6 percent live in households that are displaced during the past five years, and 7 percent are displaced after December 2002. This displacement could be attributed to the war and could pose a selection problem. Therefore, I check if there are differences on z-score outcomes between displaced and non-displaced children.

Table A.7 reports these comparisons: the differences are not statistically significant, which seems to point that displacement does not appear to pose a selection problem. However, as a robustness check, I do the following in the estimation of

[38] Infant mortality could also pose a selection problem. If increased, estimates from the analysis would be lower bias as those children that survive are potentially healthier. I have assessed infant mortality in the 2004 survey and it does not seem to increase after the war. However, this question is part of a separate paper which I am now in the process of assessing.

[39] This refers to internal migration. The questionnaires also asked questions on external migration of family members. However, if children migrated out of Iraq, they are not in my sample and therefore, lost from the analysis.

treatment effects. First, I treat all households displaced, either before or after 2002, as displaced; in order to avoid any kind of selection bias. Second, I drop all observations of children from households that reported being displaced after 2003. The results are robust.

A second concern that might confound the identification strategy is if the intensity of the conflict is correlated with pre-war conditions (i.e. treatment is associated with pre-treatment characteristics). This would create another selection problem, as some areas would be treated because of some pre-war situation. Again, I am only able to verify this in the second empirical strategy. I do the following. First, I select variables that could lead me to identify the situation of households before the war. The ILCS asked questions in reference to December 2002. I therefore, select the following variables: change of household place of residency, labour status of head, household size, street electricity functioning, household income, and infant mortality. Then, I aggregate the data to the district level and correlate with the measure of violence. The correlations are 0.25 for street lights functioning in 2002, -0.11 for average number of household members, 0.18 for district level infant mortality and 0.0 for average income per capita. These correlations are low. Although the highest correlation is with street lights functioning before the war, this seems to be because Iraq is by large an urban country. These areas were likely to have had street electricity functioning before the war. In the next section, I assess how various district characteristics are linked to the level of violence in each district.

6.6 Balancing Tests

The previous section outlined the main concerns for the validity of the identification strategy. Therefore, it is also important to check if the likelihood to be classified in high

or low intensity conflict province depends on the characteristics of each province. Therefore, I test whether there is a significant relationship between provincial level characteristics and the level of conflict intensity[40]. Table 1 reports comparison of observable characteristics of children by type of province in each survey. The columns show the means of selected observable characteristics and their standard deviations, and also show their differences. In the majority of cases, the differences are not statistically significant. However, the differences on weights are statistically significant for the three surveys, unlike for heights, where only the differences exist for the two last periods. On household characteristics, the average number of household members is also different in all three surveys, suggesting that high intensity conflict provinces have on average less household members than low intensity conflict areas. This, conversely, is supported by the fact that the war has affected disproportionally urban areas, where people tend to have fewer children.

Table 2 reports similar results when classifying treatment areas at the district level. Here, I am able to do a more detail analysis as the ILCS data is richer. Overall, individual, mother and household characteristics seem to be similar. Mothers' year of schooling appears to be higher in high-intensity districts. The father's mean year of schooling is also higher in high-intensity districts in comparison to the rest. In relation to security and assistance, 97 percent of the Iraqi population has received food rations during the past month; this is very similar across districts and also reflects the universality of the distribution system. The situation is different in terms of security. The major difference is on the percentage of households reporting shooting every day, 45 percent in high-intensity districts.

[40] i.e. if pre-war characteristics are unbalanced between the different treatment areas and unaffected.

To be able to compare closer if certain district characteristics may vary substantially, I do various regressions for each type of districts on their selected observable characteristics. Table A.8 shows the coefficients of these regressions. The dependent variable is labelled one if the district belongs to each of the conflict-intensity districts. The first column reports the coefficient of a regression for high-intensity districts on various characteristics averaged at the district level. The table shows that urban coefficient is statistically significant for all type of districts even for non-affected. However the sign of the coefficient differs. For high and low districts the coefficient is positive while for medium and non-affected the coefficient is negative. This reflects the fact that violence hit urban and capital districts harder. Other characteristics such as number of household members, electricity availability, and access to water are significant for at least three of the four types of districts. Although this might pose problems, and one would question any kind of selectivity, I net out this effect by controlling for various household characteristics and by including district fixed-effects. Moreover, because violence affected (richer) urban centres one can assume that, before the war, health status of children was greater in these areas than in low-intensity conflict areas. The estimates below are therefore not contaminated by a (poor) rural area effect. This evidence is confirmed in the subsequent section.

7. Estimation Results

7.1 Treatment at Provincial Level

The core of the identification strategy is shown in a two-by-two table. Table 3 presents estimates of the effects of the war on height-for-age z-scores for children. Panel A shows the first and second differences of the comparison of cohorts, born before the war and after, in high and low intensity conflict provinces. The second difference, located in

the third column, shows that cohorts born after the war, in provinces affected by high levels of violence, have 0.24 SD less in height-for-age than cohorts born in low-intensity conflict areas. However, these results do not control for time-invariant effects at the provincial level or for various characteristics of the children and households.

Table 4 presents the results of running models 1 and 2 when height-for-age is the outcome variable. Column one of panel A presents estimates of the baseline regression, model 1, and captures the same effect as in table 3. Columns two, three and four in the same panel add covariates: individual, household and provincial fixed effects, respectively. The estimates are very similar and significant at 10 percent level. In addition, the table also presents estimates using the subjective indicator, shooting in the neighbourhood, as a second measure of the intensity of the conflict. Here, the DID estimates are negative, but not statistically significant at conventional levels. These results point to the fact that, although the correlation between the two conflict measures is high, about 0.7, they do not necessarily provide similar impacts at the provincial level. In addition, it will be plausible that because the surveys were conducted in different periods there would be survey-specific or seasonal effects. I therefore now turn into the second empirical strategy.

Table 5 presents the results of running models 1 and 2 using the second empirical strategy. As explained in section 6.1, I consider young children, aged 6-13 months, and born after March 2003, as the after cohort, and similarly, old children aged 49-59 months as the before cohort, born before the war. Panel A presents unweighted estimates and panel B shows weighted results. Panel 1 shows the effects when taking war-mortality as a measure of the intensity of conflict and panel 2 presents the effects when taking shooting as the incidence indicator. The effects, when taking the objective measure, are between -0.22 with no controls to -0.21 when all controls are added,

including mother's weight and height. These results are significant at 5 percent and 10 percent levels, respectively. Correspondingly, the estimated effects, when taking the subjective measure, range from -0.29 to -0.27, significant at the 1 percent and 5 percent levels, respectively. The weighted estimates are, as expected, slightly higher for both measures, ranging from -0.34 to -0.39, and are highly significant. This suggests that estimates in table 4, which do not adjust for surveys designs, are probably biased downwards[41]. The estimates of treatment effects, so far, show a negative effect of the war on height-for-age z-scores of children. However, these may vary when using smaller treatment areas. In addition, since the conflict has intensified, one would expect the effects in 2006 to be stronger. In the next sections, I address these two aspects.

7.2 Treatment at District Level

Table 6 presents estimates of the effects of the war by comparing districts in the top of the war-mortality distribution to districts in the lowest level of the same distribution, (hereafter high-intensity and non-affected districts). The table reports estimates of treatment effects by the two measures exposure to the conflict. Panel A presents unweighted results and panel B weighted estimates. The first column in each panel represents the baseline regression with no controls. Columns 2-6 present estimates when controls are added. The unweighted results show that, when using the objective measure of violence, the effect on height-for-age z-scores of young children, in comparison to older ones, is about -0.42, significant at 1 percent level. Results with controls are similar. On the contrary, when using the subjective measure of violence, the effect is -0.29, significant at 5 percent, but other estimates are not statistically significant at

[41] An interesting factor in the results shown in tables 4 and 5 is that being a girl increases substantially the likelihood of having higher z-scores of height-for-age. This could reflect the fact that baby girls, interestingly, are more resilient or physically stronger in Iraq. Similar estimates were done separate for girls and boys, however, the estimated effects, although negative, were not statistically significant at conventional levels.

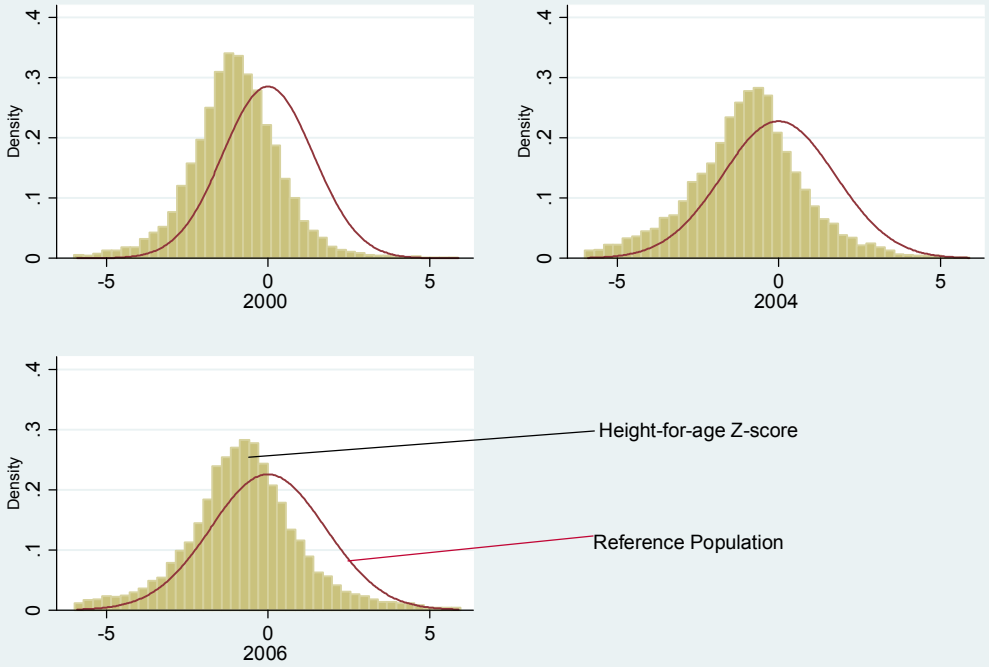
conventional levels when adding controls. The weighted estimates are all significant and higher: about -0.38 and -0.44 for the objective and subjective measures, respectively.

These results provide evidence that the gap between young cohorts, born after the war, and old cohorts, born before the war, is 0.4 SD wide in terms of height-for-age. However, it would be important to see if this gap still remains or increases in 2006, as the situation in Iraq deteriorated and violence increased. At the same time, it is necessary to verify if this could be attributed to the war, looking into 2000 would allow seeing if this gap was already present before the war. These issues are addressed in the subsequent sections 7.3 and 7.4.

7.3 Further evidence

Previous analyses have only estimated the effects of the war in 2004; here I look into the plausible effects in 2006: the second post-treatment period. Panel B of table 3 presents a basic second difference analysis of the effects of the war on height-for-age z-scores of children born after the war. The estimated effect is -0.3, significant at 1 percent level and slightly higher than the effect in 2004, presented in panel A. Panel B in table 4 shows the treatment effects when running models 1 and 2 on height-for-age z-scores. Using the objective measure and adding controls do not change substantially the results. Estimates go from -0.26, when controlling for individual characteristics, to -0.3 when adding household characteristics and provincial effects. Using the subjective measure provides, contrary to 2004, statistically significant results. The effect of the violence in young children born in high-intensity conflict provinces is -0.29. Taking stock of the results, and given the fact that an average Iraqi child, 6-13 months old in 2006, has a z-score 0.41 SD below the reference child, the effect could be approximated to decrease the average z-score of children to -0.71.

Graph 1: Standarised Z-scores of Height-for-age in 2000, 2004 and 2006 Samples



Graph 1: Standarized Height-for-Age Z-scores 2000, 2004 and 2006 Samples

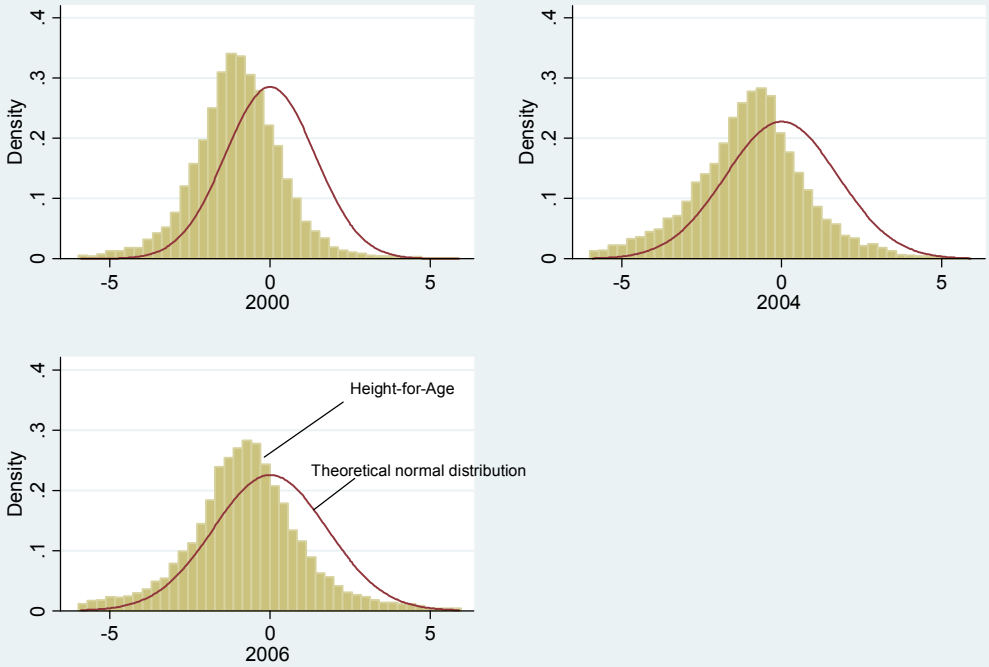
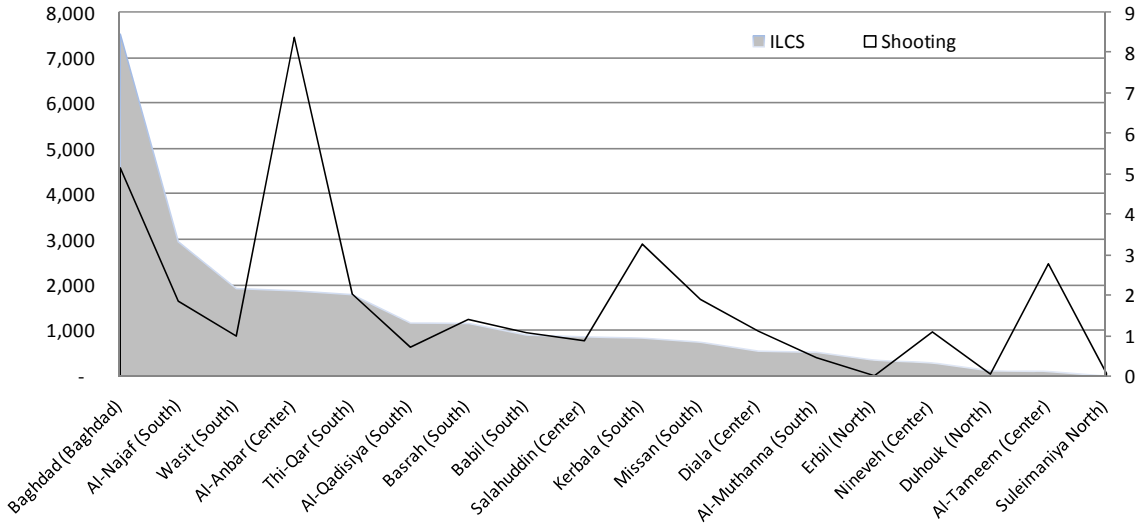


Figure 5: Number of People Killed by the War and Households Reporting Frequent Shooting in the Neighbourhood



Source: ILCS 2004 and IBC. Number of people killed by the war estimates are weighted and up to ILCS interview dates. Shooting counts number of households that reported daily shooting in their neighbourhood.Left aixs is for number of people killed, right axis for reported daily shooting.