

THE ASSOCIATION OF VIOLENCE ON EDUCATIONAL ACHIEVEMENT WITHIN THE
IRAQI POPULATION THROUGH 2003-2010

A THESIS SUBMITTED TO THE GRADUATE DIVISION OF THE UNIVERSITY OF
HAWAI'I AT MĀNOA IN PARTIAL FULFILLMENT OF THE REQUIREMENTS FOR THE
DEGREE OF

MASTER OF SCIENCE

IN
EPIDEMIOLOGY

August 2017

By
Fadi Youkhana

Thesis Committee:
Eric Hurwitz, Chairperson
Alan Katz
Victoria Fan

Keywords: Education, Operation Iraqi Freedom, war, Iraq, violence, schooling

Acknowledgments

Many people have supported my path to a graduate education at the University of Hawai‘i at Mānoa including professors, classmates, family and friends. To express my humble and sincere gratitude, I want to especially acknowledge and thank my committee members: Dr. Eric Hurwitz (Chair), Dr. Alan Katz and Dr. Victoria Fan for their continuous support, advice and suggestions with this project. I would also like to acknowledge and thank Dr. Carmel Salhi (Northeastern University) and Dr. Fan for their support and guidance and giving me the opportunity to be involved with the Iraq project which is the genesis of this study.

Abstract

This study assesses the impact of the violence in Iraq in 2003-2010 on the education of individuals aged 7-23 years. The Iraq Body Count and the 2011 Iraqi Multiple Indicator Cluster Survey were used which included 26,336 households and 83,121 persons. Governorates of high intensity of violence yielded a larger difference between expected and observed completed levels of education compared to governorates of low intensity. Participants in secondary cohort are estimated to complete 0.081 (95%CI 0.066, 0.96) levels of schooling compared to 0.78 (95%CI 0.771, 0.784) levels in primary cohort. Living in a household that is classified as “richest” via the wealth index quintile, and in a household whose head has had a secondary or post-secondary education yielded greater estimates for completing one-level of schooling than other households. The better we understand the impact of violence on education, the more equipped we are to propose, design, and execute intervention programs.

TABLE OF CONTENTS

Chapter 1: Introduction.....	1
<i>Operation Iraqi Freedom.....</i>	<u>2</u>
Chapter 2: Methods.....	5
Data Preparation.....	5
Statistical analysis.....	10
Chapter 3: Results.....	13
Summary statistics and demographics.....	13
Violence distribution and intensity.....	13
Educational achievement.....	14
Tables and Figures.....	15
Chapter 4: Discussion and conclusion.....	22
Discussion.....	22
Conclusion.....	24
Appendix.....	27
Chapter 5: References.....	32

CHAPTER1. INTRODUCTION

Educational attainment and achievement is often used as a predictive measure of earning higher wages, better health outcomes, better employment opportunities and larger societal economic growth (Coelli 2005). An individual's educational attainment also impacts his or her household. In a study that looked at surveys from 62 countries over 1990-2014, lower childhood undernutrition was found to be associated with higher paternal and maternal education levels (Vollmer et al. 2016). Educational achievement can be affected by many factors including family type and size, family income, parents' education and large-scale changes to the schooling and living environment (O'Brien and Jones 1999, Rossetti and Tanda 2000).

One of the factors that can affect the schooling and living environment is violence including violence as a result of armed conflict. Armed conflicts have ravaged the global community since the start of the 21st century with more than a third of the nations of the world involved (Akbulut-Yuksel 2009). The increase in conflicts has resulted in nearly 90% increase of civilian casualties within the past three decades (Wexler, Branski, and Kerem 2006). Children, one of the most vulnerable populations, have become overrepresented in civilian causalities (Onyango 1998). More than 40% of children that are out of school live in countries affected by armed conflict (Mason 2014).

Armed conflict can greatly affect educational attainment and achievement. Conflicts can lead to direct death or displacement of students and family members, destruction of schools and other infrastructure and delaying or disrupting the academic year. The disruption caused by wars on the lives and development of individuals, especially young people, is well studied. In a study that investigated the educational impact of the war in Croatia (1991-1995), young men completed fewer years of schooling compared to a group in Slovenia which did not experience war (Kecmanovic 2012). A study which analyzed the long-term consequences of large scale bombing during World War II suggested that children had 1.2 fewer years of schooling on average in cities that experienced the most physical destruction (Akbulut-Yuksel 2009). Moderate levels of violence around schools have shown to reduce the likelihood of high-school graduation in the United States and lower the likelihood that a student will attend college (Grogger 1997). Chamarbagwala and Morán analyzed the impact of the Guatemalan civil war of 1960-1996 and found a negative impact of the war on rural Mayan males and females who were of school age during the civil war (Rossetti and Tanda 2000).

Armed conflicts have decimated the Middle East and North Africa (MENA) region with an estimated conflict occurring every 2.3 years which has led to thousands of casualties, damaged infrastructure and political struggle (Naufal 2011). This study focuses on Iraq, which has experienced constant armed conflict since its independence in 1932 including the Ba'athist coup in 1968, the Iraq-Iran war in 1980-1988, the invasion of Kuwait in 1990, Operation Iraqi Freedom in 2003, the 2006-2007 sectarian violence and the current struggle with the so-called Islamic State which began with the group's seizure of large territories in Iraq including Mosul, the second largest city, in 2014.

Operation Iraqi Freedom

On March 20, 2003, the first strike of "Operation Iraqi Freedom" was launched to topple the government of Saddam Hussein and the Ba'athist government. Proponents of the war argued that Iraq was continuously developing weapons of mass destruction (WMD) and had been actively providing support for Al-Qaeda (Kull, Ramsay, and Lewis 2003). The operation consisted of 160,000 coalition troops led by the United States and Great Britain. The major operations lasted approximately three weeks and on May 1st, a declaration of the end of all major combat operations was announced, thus signaling the fall of the Ba'athist government. One study that analyzed mortality rates associated with the periods of 2003-2010 by surveying 2,000 randomly selected households found the risk of death rose to 2.9 times higher in males and 0.7 higher in females than the death rate during the period of 26 months before Operation Iraqi Freedom (Hagopian et al. 2013). In another study that surveyed 1,849 households in 2006, post-invasion mortality rates were found to be 7.8 per 1,000 people per year higher than pre-invasion rates (Burnham et al. 2006). Other estimated casualties of the invasion which were produced immediately after the collapse of the Ba'athist government revealed between 10,800 and 15,100 Iraqi fatalities with non-combatant civilian fatalities totaling approximately 30 percent of the total death count (Conetta 2003).

The casualties, however, did not cease after the fall of the Ba'athist government. The country has been destabilized by sectarian violence, militia interventions, economic turmoil and an influx of terrorist entities to deinstitutionalize any form of representative government. In 2006-2007, Iraq experienced its worst sectarian violence that resulted in an increase in civilian deaths (Figure 3) which almost pushed the country into a civil war (Patten 2007).

The on-going conflict has had a devastating impact on the population. Since 2003, more than 80% of Iraq's higher education institutions have been burnt or destroyed (Al-Rawi et al. 2005). The number of children receiving primary education between 2004-2008 declined by more than 88,000 (UNICEF 2010). Girls have experienced no improvement in enrollment in the same time period with only 89 girls enrolled in primary schools in Iraq for every 100 boys. Vidya Diwakar conducted a study which examined the impact of armed conflict on education accumulation and enrolment rates. Diwakar, like this study, uses household surveys (2007 Iraqi Household Socio-Economic Survey) and the Iraq Body Count (IBC). Although the two studies focus on the Iraqi population and use similar datasets, Diwakar's study differs in that it measured conflict exposure by the number of deaths as a percentage of the population and the number of conflict incidents. Unlike this study, Diwakar's analysis divided the participants into two cohorts, young (6-15 years old) and old (16-25 years old). Diwakar focused on primary school educational variables and used the older group as a control because the older students were not exposed to conflict while completing primary school. Diwakar's analysis suggested an increase in conflict is associated with a decrease in education (Diwakar 2015).

This thesis aims to examine the effect of the 2003-2010 violence on educational achievement in Iraq by attempting to address the following objectives/research questions:

- 1- Identify which governorates in Iraq have experienced more violence over the period of 2003-2010. Determine if governorates with more violence are different than governorates with less violence in terms of difference between observed vs. expected educational achievement in the governorates. The term "expected" here refers to the grade and level and individual should have completed in the previous school year to being surveyed based on the individual's age at the beginning of the school year. For example, an individual who was born in 2000 (11 years old at the time of the survey), should have completed an educational level of 4th grade in the previous school year.
 - a. Research question: Are the governorates that have experienced greater levels of violence producing larger differences in expected vs. observed the highest completed grade and level compared to governorates that have experienced the least violence?
- 2- Estimate the association between age of students and the difference in observed vs. expected years of education.

- a. Research question: Because older students are exposed to a longer duration of the violence, does this lead to a larger difference between observed vs. expected educational progress than younger students?
- 3- Estimate the association between the differences in observed vs. expected education achievement and the region of residency while adjusting for gender, wealth index and education of household head.
- a. Research question: What is the impact of other factors that could be affecting the difference in observed vs. expected years of education?

CHAPTER2. METHODS

Data preparation

Two datasets were used in the analysis for this study. The first is from the Iraqi Body Count project (IBC). The IBC records deaths from violent incidents that have occurred in Iraq after the 2003 international military intervention. The dataset is an on-going consolidated report from media outlets of violence that has led to civilian deaths. The collection also considers NGO, hospital, morgue and official figures and records. Every incident logged in the IBC includes a minimum and maximum number of individuals killed, location as reported by media outlets and the date. Those variables were used in the analysis of this study. Some incidents also included supplementary information such as “target”, “weapon used” and “time of day”; this information was not used in the analysis because it was not recorded for every incident, but was used in the geographical coding process. In addition, the analysis of the data was conducted under the assumption that the violence was random. Due to the inconsistent information of the target¹ of an attack and the possibility of collateral casualties, it was impossible to determine if attacks targeted a specific gender, age group or any other demographic indicator.

The IBC dataset had to be cleaned and made ready for analysis. This included adding a district and a governorate variable to each incident that was recorded (the specific protocol steps followed can be found at the end of the Appendix). To do so, a Searchable City Database was used to aid in assigning each incident a district and governorate. This database is part of the Iraq Common Operational Dataset produced on 22 July, 2014 by the Office for the Coordination of Humanitarian Affairs (OCHA) and MapAction. According to OCHA, this data set is intended for coordination and operations in humanitarian activities and is used as a geographical reference. Variables such as “City Name,” “place name in Arabic,” “Longitude,” “Latitude,” “Alternative City Name,” “Governorate” and “District” were used in assigning each IBC logged incident to a district and a governorate. For example, on August 16, 2007 a body was found in Karrada, Baghdad as reported by Reuters news outlet. The Searchable City Data Base was used to locate Karrada and log its district (Resafa) and its governorate (Baghdad).

¹ The “target” description provided by IBC was often missing, incomplete or vague (i.e. attack on police, bombing, bodies found, civilians shot...etc.)

This process was repeated for incidents that started in 2003 and ended on June 30, 2010². This totaled which totaled 29,081 incidents. From October, 2015 to February 2016, incidents that occurred on 2003-2006 were coded. From March 2016 to June 2016, the incidents from 2006-2010 were coded³. More than 94.5% of the data (27,479 incidents) was successfully assigned a district and a governorate. If no district could be found or not enough information was given, the incident was assigned to a governorate based on other information provided by the IBC variables “location” and “source.” From June 2016 to December 2016, final preparation and organization of the data was conducted. This included researching the media reports listed in the “source” variable to gain further information about the incident. This entailed eliminating spelling errors during the coding process and ensuring the district and governorate assignments were appropriate. The Searchable City Data Base was used in this process as a reference. After this procedure, 99.89% (29,050 incidents) of the data was assigned to governorates. The remaining 0.11% (31 incidents) was not assigned a district or a governorate because of information ambiguity (e.g., Northern Iraq, central Iraq...etc.), and thus was excluded from the study.

Some of the problems that occurred with the process included spelling ambiguity. Because the places of interest are originated in the Arabic language, its transliteration to an English pronunciation and spelling often led to variation of spelling for the same place. For example, the neighborhood of Al- Al Za’Faraniyah within the Resafa district of Baghdad was recorded in the IBC dataset as: Al Zafraniya, Zafraniya, Zafaraniyah, or Al-Za'faraniyah. In such instances the Searchable City Data Base Arabic and alternative spelling variables were used to determine a district. In addition, familiarity with the geography of the governorates and the transliteration process between Arabic and English were helpful in the coding process.

After assigning each incident a geographical reference (district and governorate), the information was used to analyze the differences in the intensity of violence. The governorate variable was used instead of the district variable for two reasons. The first was to limit the information ambiguity. More than 5.50% (1,599 incidents) of the data did not provide enough

² When considering the timing of an incident, the variable “End Date” was used instead of “Start Date.” Furthermore, June 30, 2010 was used as the last date for an incident in order to avoid using exposure data after the school year of 2010 was completed.

³ The term “coded” here refers to the process of assigning each incident a district and a governorate based on information given by the “location” variable of the IBC dataset.

information to narrow down an incident to a specific district. But more than 99.89% (29,050 incidents) of the data provided a specific governorate reference. The second reason was to reduce misclassification of the geographical location of the exposure. Because the IBC is a collection of on-going information, consistency in accuracy of specific districts can be problematic. The duration of the study (2003-2010) has resulted in a list of districts that were different from the second dataset used in the study which was from a survey conducted in 2010 (Appendix Table 2). In comparison, the governorate list has remained constant between the two datasets with 18 listings (Appendix Table 1). Furthermore, districts and district-borders have been changing between 2003-2010 as part of the on-going political struggle between the central government in Baghdad and the semi-autonomous region of Kurdistan. For example, in January 21, 2014, the Iraqi Council of Ministers approved a proposal to designate the districts of Tuz Khurmatu and Tal Afar as provinces(*Resolutions of Council of Ministers For Session No. 3 2014*). The proposal was reported as an attempt to resist the expansion of the Kurdistan government. Thus, due to the repeated redefining of districts, the governorate variable was used as the location reference. To determine which governorates had the highest and lowest intensity of violence, an average death count variable was created by computing the average between the minimum and maximum number of individuals killed per incident.

The second dataset used in this study is from the 2011 Iraqi Multiple Indicator Cluster Survey (MICS). Developed in 1995 to better understand the status of children and women by the UNICEF, the MICS assists local governments in collecting nation-wide data to help with policy decisions and program interventions (UNICEF 2000). The Central Statistics Organization (CSO), Kurdistan Region Statistics Office (KRSO) and the Iraqi Ministry of Health provided technical, coordination and financial support in completing the fourth round of Iraqi MICS. The 2011 MICS was used instead of the 2006 MICS survey for two reasons. First, the 2011 MICS surveyed nearly twice as many households (35,701 to 18,144) as that of 2006. In addition, 2006 would only have provided three years of exposure compared to eight years of exposure in the 2011 survey to the independent variable.

Within each district, linear systematic probability proportional to size (PPS) was used to select 31 Primary Sampling Units (PSUs) with the urban and rural areas within each district identified in the sample design as the main sampling domains. A household listing was carried out within the PSUs and a systematic sample of 10 households was drawn. The MICS surveys

(including the education questionnaire) included 35,701 households with 238,327 persons covering all 18 governorates and 118 districts of Iraq (UNICEF, n.d.). Multiple levels of exclusions were applied to the total number of cases for analysis (Figure 1). The first exclusion eliminated any entry that answered “NO” or “NA” or lacked an answer and was recorded as “.” to the question “Has (name) ever attended school or pre-school?” If an individual had never attended school, then that individual was no longer eligible for the study. This yielded 156,843 persons with 34,162 households.

The second exclusion criteria focused on the target age group of the study of individuals aged 7-23-years. Survey variables that reported the participant’s age at the beginning of the school year⁴ was used to execute the exclusions. Thus, individuals born before 1988 and after 2003 were eliminated. This was done so that individuals would be at most 15 years old by 2003 and thus would be expected to begin secondary education and would have been exposed to the violence. Furthermore, anyone born before 1988 would have been exposed to the violence of the Iraq-Iran war and the First Gulf war which could lead to a change of educational achievement but is different than the exposure of interest. Those born after 2004 were eliminated because an individual needed to be at least 7 years of age at the beginning of the school year in 2011.

Participants that were 6 years or younger did not have the opportunity to complete at least the first grade of primary school to be included in the study. This resulted in 83,147 persons and 26,452 households. Finally, any missing responses to the reported level of education, completed grade of education and “Non-standard” responses to education questioners were excluded. This resulted in a final number of cases of 83,121 persons and 26,336 households.

⁴ Age at the beginning of the school year was used instead of age reported at time of survey to minimize school age cut-off conflicts.

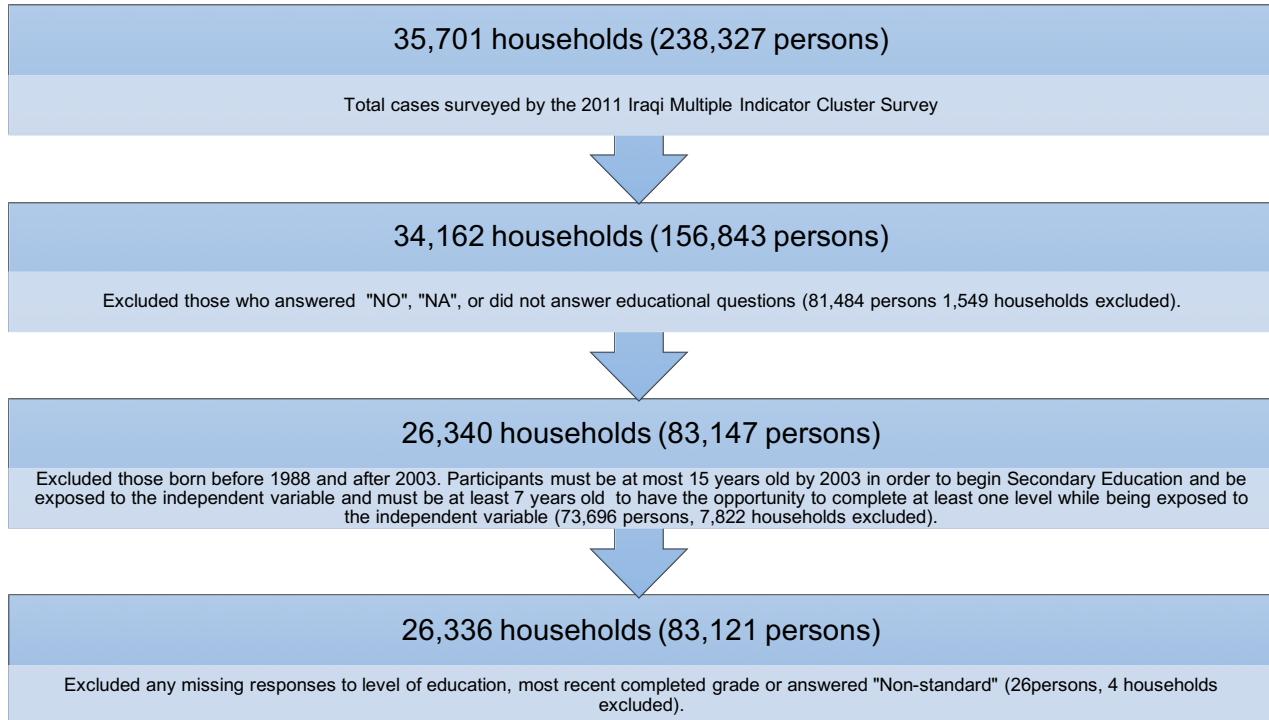


FIGURE 1: Exclusion criteria used in the analysis of 2011 Multiple Indicator Cluster Survey of Iraq.

According to the Iraqi Research Foundation for Analysis and Development (IRFAD), and the Iraqi Ministry of Education (2014), the educational cycle in Iraq is 12 years. Students are eligible for enrollment at age 6 and are required to complete 6 grades in primary school. Students then attend intermediate schooling, through grades 7-9 (13-15 years old) followed by secondary school through grades 10-12 (16-18 years old). Each individual was assigned an “expected value”⁵ for his/her educational status based on the age of the individual at the beginning of the school year. Since the surveys were conducted in 2011 in the months of February-May, an individual is expected to have completed the previous schooling grade (Table 1). It is important to note that post-secondary education was not used for this study. After completing secondary school, an individual may choose to continue his/her education through a diploma or a bachelor’s degree at a higher education institute. The variables impacting that choice (lifestyle, employment, accessibility) are beyond the data available for this study and thus an “expected” completed level of education cannot be assumed for post-secondary education.

⁵ An expected grade of completion value of 12 was assigned to all participants 19-23 years old regardless of completion or non-completion of Diploma, Bachelor or higher studies. Because the study focuses on primary, intermediate and secondary schooling cohorts, post-secondary education was not analyzed.

TABLE 1: Age at the beginning of school year (2011) of participants from the Multiple Indicator Cluster Survey, years of exposure to violence since 2003, highest level and grade expected of education completed. Table 1 was used to assign the “expected” value to all the participants.

Age at the beginning of school year (2011)	Years of exposure to violence while in school	Highest level of education expected to have attended in 2011	Highest grade expected to be completed in 2011
23	9	Secondary	12 th grade
22	9	Secondary	12 th grade
21	9	Secondary	12 th grade
20	9	Secondary	12 th grade
19	9	Secondary	12 th grade
18	9	Secondary	12 th grade
17	9	Secondary	11 th grade
16	9	Secondary	10 th grade
15	9	Intermediate	9 th grade
14	8	Intermediate	8 th grade
13	7	Intermediate	7 th grade
12	6	Primary	6 th grade
11	5	Primary	5 th grade
10	4	Primary	4 th grade
9	3	Primary	3 rd grade
8	2	Primary	2 nd grade
7	1	Primary	1 st grade

Statistical Analysis

The study focuses on individuals aged 7-23 years divided into three cohorts: primary schooling ages (7-12), intermediate schooling ages (13-15), and secondary schooling ages (16-23). The study population was stratified into the three cohorts in order to better understand the magnitude of the effect of the exposure to violence with respect to different levels of education. In order to better understand the relationship between the dependent, independent and covariate variables, the causal diagram via Figure 2 was used. The exposure to intensity of violence via civilian deaths per governorate is believed to have a direct impact on the educational achievement (dependent variable) of participants of the study. Wealth, age, household head education and household wealth index quintile score, can directly impact the educational achievement of a participant and thus are treated as possible confounding variables. Ideally, a participant’s educational achievement would have been monitored before and after the exposure but such observations are beyond the data available at the time of the study.

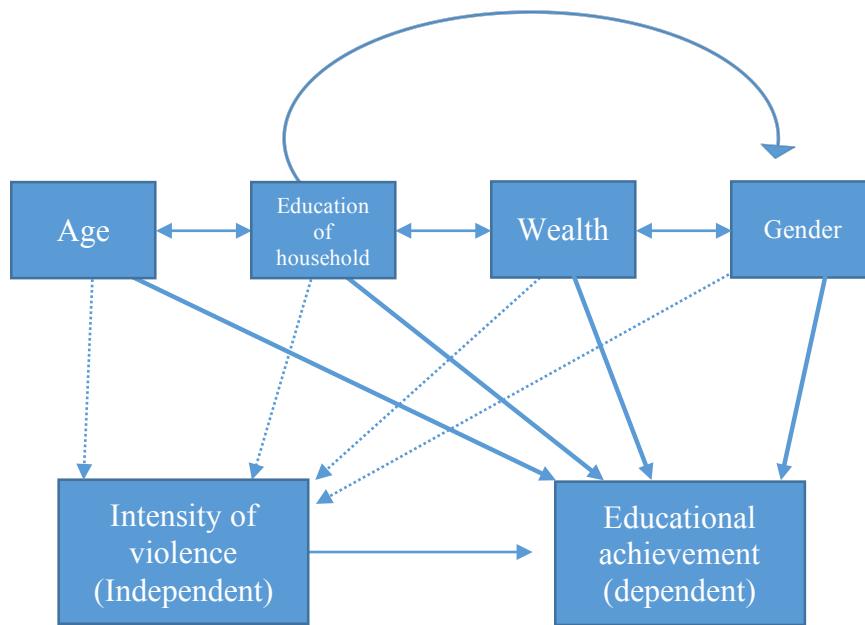


FIGURE 2:Causal diagram of the relationship between the exposure (intensity of violence measured by civilian deaths) and the outcome (educational achievement measured by the observed level of education completed based on a participant's age) and variables of interest.

First research objective: A frequency and distribution of the total number of violent incidents and civilian deaths (average of minimum and maximum death count reported per incident) by governorates over 2003-2010 were calculated. Population census (2009) and area of governorates, as listed by the Ministry of Planning of Iraq (2010), were used in order to determine the average death per 100,000 and per square kilometer per governorate (Appendix Table 5).

An average death per governorate of 228 per 100,000 was computed. This average was then used as a benchmark to define governorates of “high conflict intensity”. Governorates with a higher rate of death per 100,000 were given a dummy variable equal to 1. Following this procedure, 6 out of the 18 governorates were classified as high-intensity conflict governorates (Table 4). This variable was used as the independent variable of the study. A Pearson’s correlation test was used to determine the relationship between the expected vs. observed levels

of completed grades. A new variable of the difference between expected vs. observed level of schooling completed was created using the following formula:⁶

$$\text{Expected number of levels completed} - \text{observed number of levels completed} = \text{difference}$$

(Derived from age)

Finally, a two-tail T-test was used to assess whether the mean difference (average difference between expected vs. observed schooling levels) is different between high intensity vs. low intensity governorates stratified by primary, intermediate and secondary cohorts.

Second research objective: To estimate the association between the age of a participant and the observed completed level of education, a linear regression model was utilized using two continuous variables. The first, the participant's age at the beginning of the school year (7-23 years old) and second, the number of completed school levels. Three regressions were utilized to analyze the three different cohorts. The following linear regression formula was used:

$$Y = \alpha(\text{years of schooling}) + \beta(\text{age in 2011}) + \text{constant} + \varepsilon$$

Where Y = change in observed completed grade per 1year increase in age, α = observed completed years of schooling, β = age at the beginning of the school year of 2011. Three regressions were utilized to analyze the three different cohorts.

Third research objective: In order to investigate any potential factors that could impact educational achievement, a linear regression was used to estimate the association between the observed completed school levels and location (reference= low violence intensity) while adjusting for sex (reference= female), age at the beginning of the school year, household wealth index quintile ⁷(reference= poorest) and the education of the head of the household (reference = none). The following linear regression formula was used:

$$Y = \alpha + \beta X_1 + \beta X_2 + \beta X_3 + \beta X_4 + \varepsilon$$

Where Y = difference in expected vs. observed educational achievement, α = observed completed years of schooling, β = location of residence, X_1 = age at the beginning of the school year,

⁶ For example, if an individual is 22 years old and has only completed primary schooling will have the following formula (12-6=6) meaning that the individual has a difference of 6 units in the expected vs. observed years of education

⁷ The wealth index quintile is a variable calculated by MICS which describes a measure of economic status of the household. Its purpose is to rank the household based on assets owned by the household and accessible services. The 2011 Iraqi MICS ranked households in a range of: poorest, second, middle, fourth, and richest.

X_2 = gender, X_3 = household wealth index quintile and X_4 = education of head of household. Three regressions were utilized to analyze the three different cohorts.

A list of all variables used in the study can be found in Appendix Table 6. All analyses were conducted using RStudio® (Version 0.99.491). This study did not receive any specific grant from funding agencies in the public, commercial, or not-for-profit sectors.

CHAPTER3. RESULTS

Summary Statistics and demographics

The study included a total number of 83,121 persons surveyed and 26,336 households (Table 3). More than 51% of participants and households were in low intensity governorates while nearly 48% were in high intensity governorates. Of the participants included in the study, 54% were male and 46% were female. The ages of the participant ranged from 7 to 23 years. The most frequent age group were 7 year olds (7.5%) and the least frequent age group was the 23 year olds (3.79%) (Table 2). Participants 7-22 years recorded lower average years of schooling in high intensity governorates compared to low intensity governorates. Participants who were 18 years old recorded the largest difference between the average years of schooling between low and high intensity governorates of 0.502 years, or more than 6 months of schooling.

More than a third of the participants reported that their head of the household had completed primary schooling, while 20% of the population reported that their head of the household did not complete any schooling. Of those who never attended school or pre-school, 34% were females and 66% were males. More than 58% of the study population lived in an urban setting while 42% lived in a rural setting (Table 3).

Violence distribution and intensity

Baghdad accounted for the most number of violent incidents (38%), most civilian deaths (52%), and most deaths per 100,000 (786.1) and most deaths per km² (12.84). The region of Kurdistan (Dahuk, Erbil and Sulaymaniyah) accounted for the least deaths per 100,000 and the least number of incidents. Compared with other governorates, the three governorates of Kurdistan also ranked in the bottom five (out of 18) in deaths per km² and total number of civilian deaths (Table 4).

More than 49% of the total number of deaths occurred in 2006-2007. Baghdad experienced the most deaths with more than 29,000 civilians killed during 2006-2007 (Table 5). Figure 3 shows the distribution of the total number of deaths by the year of incident and governorate.

Education achievement

As seen in Figure 4, the ratio of participants performing below the expected level of education increased with age. Figure 5 illustrates the ratio of the most recent completed level of education for participants. While testing the Pearson Correlation between the observed level of education and the expected level of education (assigned using the participant's age (Table 1)), the relationship weakened as the age of the participants increased. The relationship between the observed level of education and the expected level of education was the strongest in primary school cohort with a correlation estimate of 0.784 (95%CI 0.779, 0.788). The correlation estimate decreased to 0.199 (95%CI 0.184-0.214) for intermediate schooling ages and 0.076 (95%CI 0.065-0.087) for secondary schooling ages (Table 6).

While testing the means of the difference between the expected vs. observed education grade completed, residents of governorates of high intensity of violence yielded a mean of 0.450 compared to 0.291 in primary schooling ages. In intermediate schooling ages, high intensity of governorates yielded a mean of 2.021 compared to 1.713 in low intensity governorates. In secondary schooling ages, high intensity governorates yielded a mean of 4.245 compared to a mean of 3.922 in low intensity governorates (Table 7).

While estimating the effect of age on the reported completed levels of schooling, participants of ages in primary schooling yielded a 0.777 (0.770-0.784) increase of observed completed level of schooling for every one-year increase in age. Intermediate schooling age group yielded a 0.481 (0.444-0.5187) while secondary schooling cohort yielded a 0.081 (0.066-0.096) increase of observed completed level of schooling for every one-year increase in age (Table 8).

Participants living in a governorate of high intensity violence estimated completing – 0.249 (95%CI -0.27, -0.23) levels of education in primary cohort, -0.514 (95%CI -0.57, -0.46) in intermediate cohort and -0.693 (95%CI -0.76, -0.63) in secondary cohort compared to low intensity governorates. Male participants living in governorates of high intensity violence estimated 0.57 (95%CI 0.51, 0.64) of completing one level of education with every year increase in age in secondary cohort while yielding smaller estimates in intermediate cohort, 0.08 (95%CI 0.02,0.14) and -0.04 (95%CI -0.06, -0.02) in primary cohorts respectively. Adjusting for variables identified as possible confounders (Figure 2) participants that were categorized as “richest” in the wealth index quintile estimated completing 3.13 (95%CI 3.01, 3.23) levels of

education in the secondary cohort compared to 1.73 (95%CI 1.63, 1.83) in intermediate cohort and 0.71 (95%CI 0.67, 0.75) in primary cohort. Participants that lived with a household head who had a secondary or higher education were estimated to complete a more years of education in all three cohorts compared to no education or education of only primary school (Table 9).

Results: Tables and Figures

TABLE 2: Summary statistics of participants from Multiple Indicator Cluster Survey dataset of population distribution, gender, average years of schooling in high intensity governorates, average years of schooling in low intensity governorates, average difference in years and months between high and low intensity governorates by age.

Age	n (%)	Male (%)	Female (%)	Average years of schooling in low intensity	Average years of schooling in high intensity	Average difference in years of schooling between low and high intensity governorates	Average difference in months of schooling
7	6232 (7.50%)	3284 (3.95%)	2948 (3.55%)	1.153	1.062	0.091	1.0908
8	6088 (7.32%)	3215 (3.87%)	2873 (3.46%)	2.012	1.905	0.107	1.2828
9	6150 (7.40%)	3234 (3.89%)	2916 (3.51%)	2.852	2.702	0.150	1.7964
10	6149 (7.40%)	3241 (3.90%)	2908 (3.50%)	3.648	3.443	0.205	2.4624
11	5589 (6.72%)	2978 (3.58%)	2611 (3.14%)	4.409	4.153	0.256	3.072
12	5348 (6.43%)	2839 (3.42%)	2509 (3.02%)	5.076	4.897	0.179	2.1432
13	5549 (6.68%)	3001 (3.61%)	2548 (3.07%)	5.729	5.497	0.232	2.7864
14	4910 (5.91%)	2595 (3.12%)	2315 (2.79%)	6.338	5.954	0.384	4.6128
15	4863 (5.85%)	2630 (3.16%)	2233 (2.69%)	6.729	6.417	0.312	3.7404
16	4645 (5.59%)	2504 (3.01%)	2141 (2.58%)	7.110	6.791	0.319	3.8328
17	4694 (5.65%)	2523 (3.04%)	2171 (2.61%)	7.524	7.142	0.382	4.5816
18	4058 (4.88%)	2246 (2.70%)	1812 (2.18%)	7.766	7.264	0.502	6.0228
19	4313 (5.19%)	2463 (2.96%)	1850 (2.23%)	7.811	7.471	0.340	4.0836
20	4199 (5.05%)	2345 (2.82%)	1854 (2.23%)	7.915	7.527	0.388	4.6512
21	3753 (4.52%)	2076 (2.50%)	1677 (2.02%)	7.846	7.623	0.223	2.6784
22	3428 (4.12%)	1934 (2.33%)	1494 (1.80%)	7.780	7.292	0.488	5.8608
23	3153 (3.79%)	1783 (2.15%)	1370 (1.65%)	7.531	7.614	-0.083	-0.9948

TABLE 3: Population demographics of participants including household head education, gender, region of living, and wealth index quintile by intensity of violence from the Multiple Indicator Cluster Survey of Iraq in 2011. Percentages in parenthesis indicate the ratio of the category in respect to the overall population.

Category	Low Intensity n(%)	High Intensity n(%)	Low intensity + High Intensity
Total number of participants	42,977 (51.70)	40,144 (48.30)	83,121
Total number of households	13,653 (51.62)	12,796 (48.38)	26,336
Male	23,208 (27.92)	21,683 (26.09)	44,891
Female	19,769 (23.78)	18,461 (22.21)	38,230
Household head education: None	11,005 (13.39)	5,938 (7.23)	16,943 (20.62)
Household head education: Primary	15,532 (18.90)	12,970 (15.78)	28,502 (34.68)
Household head education: Secondary +	16,044 (19.52)	20,695 (25.18)	36,739 (44.70)
Rural	15,730 (18.92)	18,637 (22.42)	34,367 (41.35)
Urban	27,247 (32.78)	21,507 (25.87)	48,754 (58.65)
Household wealth Index quintile: Poorest	11,926 (14.35)	9,751 (11.73)	21,677 (26.08)
Household wealth Index quintile: Second	10,735 (12.91)	8,303 (9.99)	19,038 (22.90)
Household wealth Index quintile: Middle	9,102 (10.95)	7,618 (9.16)	16,720 (20.12)
Household wealth Index quintile: Fourth	6,908 (8.31)	7,256 (8.68)	14,164 (17.04)
Household wealth Index quintile: Richest	4,306 (5.18)	7,216 (8.68)	11,522 (13.86)
Never attended school	25,986 (57.89)	18,899 (42.11)	44,885

TABLE 4: Total number of violent incidents, civilian deaths (average of minimum death count and maximum death count reported), death per incident, death per 100,000, death per km², and intensity of violence by governorates in 2003-2010 as reported by the Iraq Body Count. Intensity of violence was calculated by using the median death per 100,000 (169 deaths). Governorates with higher rates per 100,000 than the median were coded as high intensity while governorates with lower rates per 100,000 than the median were coded as low intensity.

Governorate	Number of Deaths (%)	Number of Incidents (%)	Death per km ²	Death per Incident	Death per 100,000	Violence intensity
Baghdad	56,448.5 (52.14)	11,030 (37.97)	12.393	5.118	786.1	High
Diyala	10,553.5 (9.75)	3,553 (12.23)	0.597	2.970	770.0	High
Anbar	7,351.5 (6.79)	1,963 (6.76)	0.053	3.745	506.4	High
Salah al-Din	4,968.5 (4.59)	2,018 (6.95)	0.204	2.462	394.5	High
Kirkuk	3,870.5 (3.58)	1,602 (5.51)	0.400	2.416	300.0	High
Ninewa	9,171.0 (8.47)	4,146 (14.27)	0.246	2.212	283.2	High
Babylon	3,411.0 (3.15)	1,045 (3.60)	0.666	3.264	197.5	High
Kerbala	1,864.5 (1.72)	275 (0.95)	0.370	6.780	185.8	High
Wassit	1,988.0 (1.84)	650 (2.24)	0.116	3.058	171.7	High
Basrah	4,270.0 (3.94)	1,751 (6.03)	0.224	2.439	167.1	Low
Najaf	1,385.5 (1.28)	210 (0.72)	0.048	6.598	117.3	Low
Thi-Qar	1,246.0 1.15	138 (0.48)	0.097	9.029	67.5	Low
Qadissiya	634.5 (0.59)	299 (1.03)	0.078	2.122	56.6	Low
Missan	352.0 (0.33)	180 (0.62)	0.022	1.956	34.9	Low
Muthanna	235.0 (0.22)	71 (0.24)	0.005	3.310	32.6	Low
Erbil	320.5 (0.30)	65 (0.22)	0.021	4.931	21.8	Low
Sulaymaniyah	179.0 (0.17)	49 (0.17)	0.011	3.653	11.5	Low
Dahuk	6.0 (0.01)	5 (0.02)	0.001	1.200	0.6	Low

TABLE 5: Number of civilian deaths (an average of minimum and maximum Iraq Body Count reported) per year (ending date of incident) by governorate as reported by the Iraq Body Count.

Governorate	2003	2004	2005	2006	2007	2008	2009	2010	Total	Intensity of violence
Anbar	270	2,112.5	1017	1343	1,747.5	450.5	287.5	123.5	7,351.5	High
Babylon	340.5	206.5	742	544.5	867.5	334	261	115	3,411	High
Baghdad	6,276	5118	9,496	17,708.5	11,521.5	3,456.5	2,120	752	56,448.5	High
Basrah	633	181	1,027	944	899	471	69.5	45.5	4,270	Low
Dahuk	0	0	2	1	0	2	1	0	6	Low
Diyala	150.5	399.5	829	2,892.5	3,530	1,938	568	246	10,553.5	High
Erbil	15	110	72.5	10	66.5	16	26.5	4	320.5	Low
Kerbala	367	574	87	309.5	304.5	101	42.5	79	1,864.5	High
Kirkuk	392	275.5	435	934.5	1,083.5	352.5	337	60.5	3,870.5	High
Missan	8.5	43	26	124	99	31	11.5	9	352	Low
Muthanna	120	16	21	33.5	40.5	1	3	0	235	Low
Najaf	554.5	278.5	41	199	261	12	5	34.5	1,385.5	Low
Ninewa	185	770	1,149	1301	2,663	1587	1,128.5	387.5	9,171	High
Qadissiya	66	9	36	242.5	220.5	39.5	19	2	634.5	Low
Salah al-Din	201	544	1,046	978	1,211	748	144	96.5	4,968.5	High
Sulaymaniyah	94.5	0	11	14	21.5	22	14	2	179	Low
Thi-Qar	946.5	44	36	63	58.5	57	40	1	1,246	Low
Wassit	102.5	197	192	724.5	485.5	183.5	80.5	22.5	1,988	High
Total (%)	10,722.5 (9.9)	10,878.5 (10)	16,265.5 (15)	28,367 (26.2)	25,080.5 (23.2)	9,802.5 (9.1)	5,158.5 (4.8)	1,980.5 (1.8)	10,825	

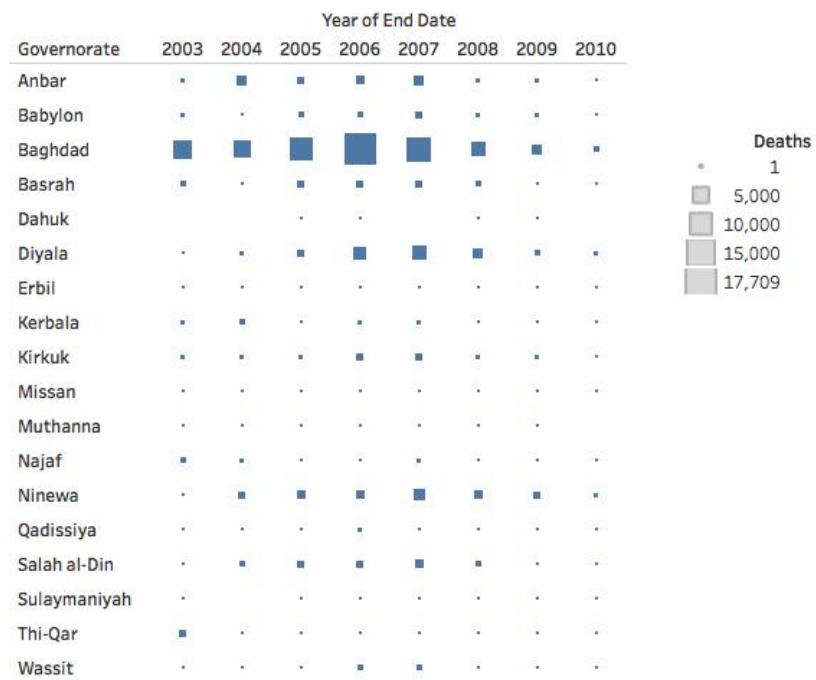


FIGURE 3: Total death counts (derived from the average of the minimum and maximum reported) vs. year of incident (end date of incident) as recorded by the Iraq Body Count using Tableau Desktop Version 10.0

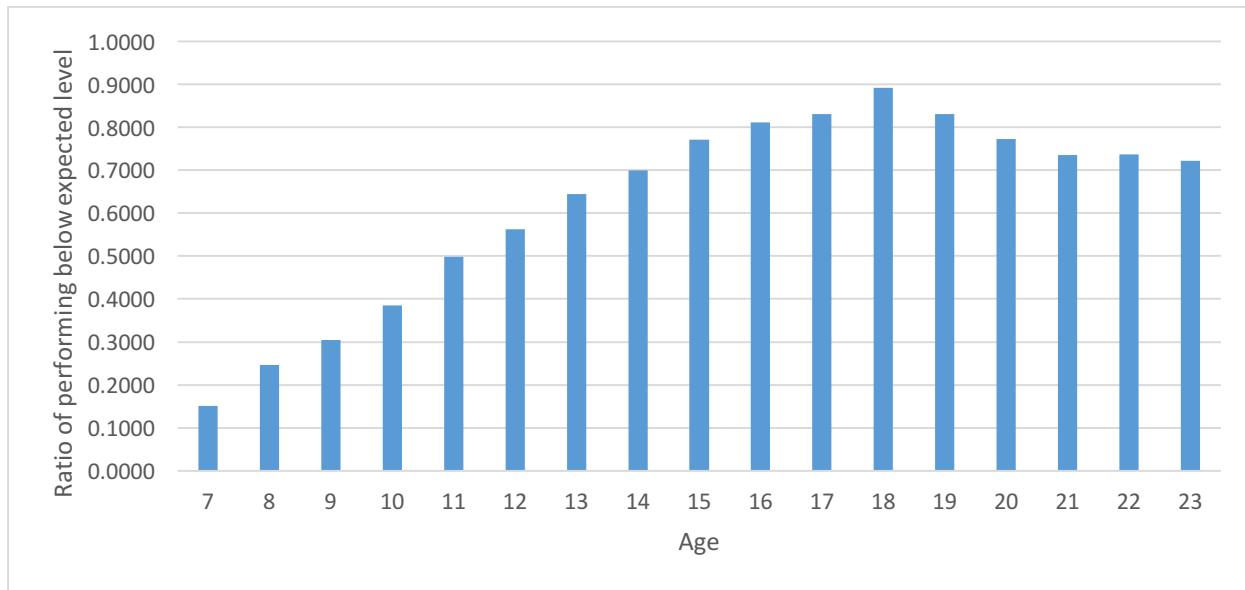


FIGURE 3: Ratio of participants performing at below expected level of education based on age at the beginning of the school year (2011) of 7-23 years using Multiple Indicator Cluster Survey.

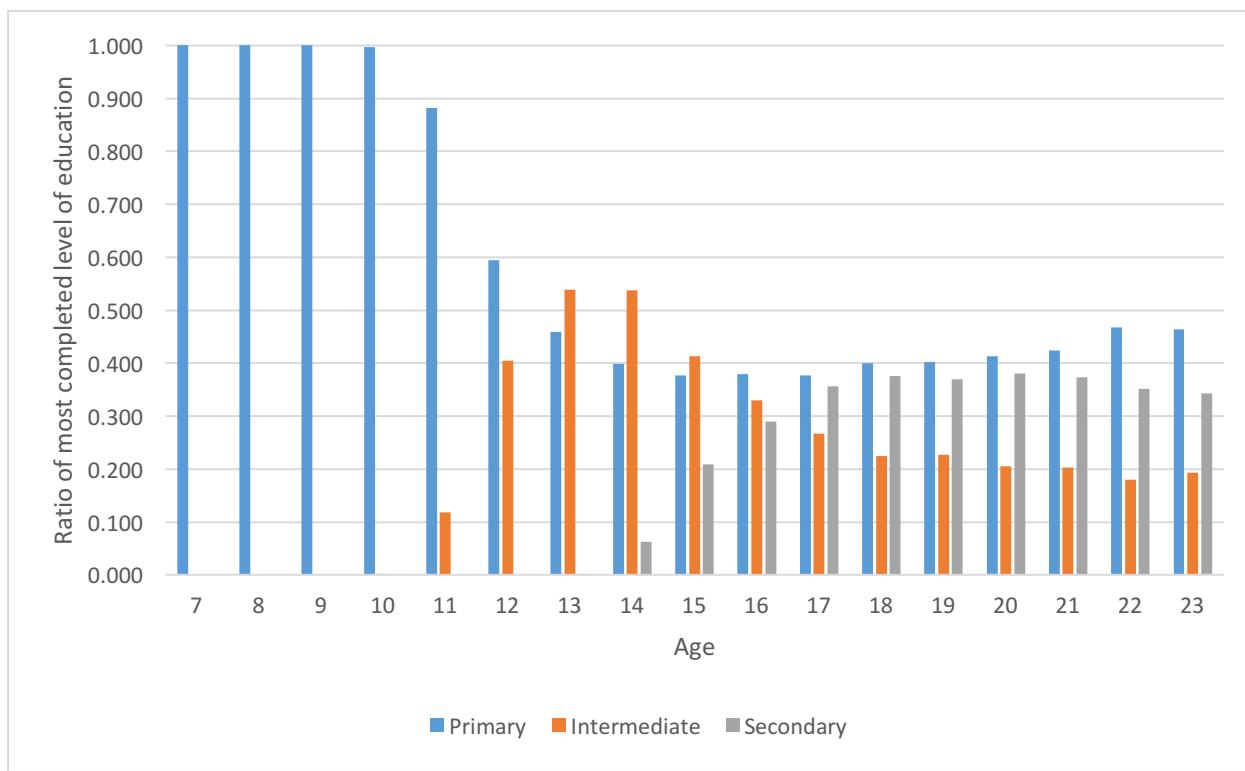


FIGURE 4: Ratio of most recent completed level of education for participants (7-23 years) of the Multiple Indicator Cluster Survey.

TABLE 6: Pearson's correlation test of the difference between observed vs. expected completed level of education based on a participant's age at the beginning of the school year of the three study cohorts using RStudio® (Version 0.99.491).

Level of Education	T-value	DF	P-value	Correlation estimate	Lower 95% CI	Upper 95% CI
Primary school	237.97	35,554	< 2.2e-16	0.784	0.779	0.788
Intermediate school	25.124	15,320	< 2.2e-16	0.199	0.184	0.214
Secondary school	13.713	32,241	< 2.2e-16	0.076	0.065	0.087

TABLE 7: Two-tail T-test of the mean difference (expected- observed completed level of education) between governorates of high intensity and low intensity of violence in the three schooling cohorts using RStudio® (Version 0.99.491).

Level of Education	Sample Estimate	Lower 95% CI	Upper 95% CI	T-value	DF	P-value
Primary school						
High intensity	0.450	-0.182	-0.136	-13.568	34,952	<2.2e-16
Low intensity	0.291					
Intermediate school						
High intensity	2.021	-0.371	-0.245	-9.563	15,162	<2.2e-16
Low intensity	1.713					
Secondary school						
High intensity	4.245	-0.392	-0.253	-9.073	32,060	<2.2e-16
Low intensity	3.922					

TABLE 8: Results of three simple linear regressions of observed completed grade and age at the beginning of school year for primary, intermediate and secondary schooling cohorts using the Multiple Indicator Cluster Survey using linear regression model in RStudio® (Version 0.99.491).

Coefficients:	Estimate	Lower 95% CI	Upper 95% CI	Std. Error	T.value	Pr(> t)	Df	R ²	F-stat
Primary									
Intercept	-4.2699	-4.331	-4.209	0.312	-136.0	<2e-16	35,554	0.6143	5.663e+04
Age	0.7772	0.7709	0.7836	0.003	238.6	<2e-16			
Intermediate									
Intercept	-0.6228	-1.147	-0.981	0.2677	-2.326	0.02	15,320	0.0396	631.2
Age	0.4811	0.444	0.5187	0.0192	25.124	<2e-16			
Secondary									
Intercept	5.924	5.628	6.22	0.1512	39.19	<2e-16	32,241	0.0033	108.4
Age	0.081	0.066	0.096	0.0078	10.41	<2e-16			

TABLE 9: Regression results of a participant's completed level of education and residence(ref=low intensity) with adjustment of gender (ref=female), household wealth index quintile (ref=poorest) and the education of the household head (ref=none) and age using linear regression model in RStudio® (Version 0.99.491).

Primary cohort						
Residual Std. Error	DF	R ²	F-stat	P-value		
0.9917	35,544	0.1968	5,993	< 2.2e-16		
Categories:	Estimate	Lower 95% CI	Upper 95% CI	Std. Error	T-value	Pr(> t)
(Intercept)	-4.5058	-4.5709	-4.4407	0.0332	-135.6090	< 2e-16
High intensity	-0.2490	-0.2700	-0.2280	0.0107	-23.2520	< 2e-16
Age	0.7723	0.7661	0.7784	0.0031	247.8180	< 2e-16
Gender (Male)	-0.0405	-0.0612	-0.0199	0.0105	-3.8440	0.000121
Fourth	0.4857	0.4525	0.5190	0.0170	28.6350	< 2e-16
Middle	0.3621	0.3317	0.3925	0.0155	23.3470	< 2e-16
Richest	0.7092	0.6712	0.7472	0.0194	36.6080	< 2e-16
Second	0.2291	0.2008	0.2575	0.0145	15.8370	< 2e-16
Household head- Primary	0.0298	-0.0001	0.0597	0.0153	1.9550	0.050585
Household head- Secondary+	0.3033	0.2733	0.3332	0.0153	19.8420	< 2e-16
Intermediate cohort						
Residual Std. Error	DF	R ²	F-stat	P-value		
1.804	15,310	0.1799	305.4	< 2.2e-16		
Categories:	Estimate	Lower 95% CI	Upper 95% CI	Std. Error	T-value	Pr(> t)
(Intercept)	-1.1074	-1.5991	-0.6157	0.2509	-4.4150	1.02e-05
High intensity	-0.5143	-0.5726	-0.4561	0.0297	-17.3110	< 2e-16
Age	0.4653	0.4306	0.5001	0.0177	26.2590	< 2e-16
Gender (Male)	0.0802	0.0228	0.1375	0.0293	2.7380	0.00618
Fourth	1.1573	1.0667	1.2478	0.0462	25.0630	< 2e-16
Middle	0.8034	0.7176	0.8892	0.0438	18.3600	< 2e-16
Richest	1.7339	1.6337	1.8340	0.0511	33.9360	< 2e-16
Second	0.4153	0.3326	0.4979	0.0422	9.8520	< 2e-16
Household head- Primary	-0.1021	-0.1837	-0.0205	0.0416	-2.4530	0.01418
Household head- Secondary+	0.5619	0.4809	0.6429	0.0413	13.5950	< 2e-16
Secondary cohort						
Residual Std. Error	DF	R ²	F-stat	P-value		
2.878	32,231	0.1725	610.7	< 2.2e-16		
Categories:	Estimate	Lower 95% CI	Upper 95% CI	Std. Error	T-value	Pr(> t)
(Intercept)	4.6874	4.4021	4.9728	0.1456	32.1970	< 2e-16
High intensity	-0.6930	-0.7571	-0.6289	0.0327	-21.1920	< 2e-16
Age	0.0668	0.0528	0.0808	0.0071	9.3540	< 2e-16
Gender (Male)	0.5760	0.5127	0.6394	0.0323	17.8220	< 2e-16
Fourth	1.8648	1.7631	1.9665	0.0519	35.9460	< 2e-16
Middle	1.1874	1.0899	1.2850	0.0498	23.8530	< 2e-16
Richest	3.1262	3.0184	3.2339	0.0550	56.8640	< 2e-16
Second	0.6954	0.5990	0.7918	0.0492	14.1360	< 2e-16
Household head- Primary	-0.2881	-0.3736	-0.2026	0.0436	-6.6010	4.15e-11
Household head- Secondary+	0.8390	0.7530	0.9250	0.0439	19.1200	< 2e-16

CHAPTER5. DISCUSSION AND CONCLUSION

Discussion

The aim of this study was to assess the impact of civilian deaths as a result of armed conflict in Iraq over 2003-2010 on educational achievement. To do so, the intensity of the violence per governorate had to be determined. Governorates Al-Anbar, Baghdad, Kirkuk, Salah al-Din, Ninewa and Diyala, Babylon, Kerbala and Wassit yielded higher deaths per 100,000 than the median (169) and thus were determined to be high intensity. The rest (Basrah, Dahuk, Erbil, Missan, Muthana, Najaf, Qadisiya, Sulaymaniyah and Thi-Qar) yielded lower deaths per 100,000 than the median and were thus determined to be low-intensity.

Since 1991, the Kurdistan regional government has operated with a degree of de facto autonomy from the central government of Baghdad. Its strong relationships with Western leaders, its military and the region's relative stability resulted in little impact from the post-2003 security and political struggle compared to the rest of Iraq (Bahcheli, Bartmann, and Srebrnik 2004). This was evident through the civilian death counts as a result of armed conflict in 2003-2010. The three governorates of Kurdistan, Dahuk, Erbil and Sulaymaniyah, recorded the lowest number of violent incidents and the lowest deaths per 100,000 (Table 4).

Living in a governorate with a lower intensity of violence could be a factor leading to the student completing higher levels of schooling compared to students living in high intensity governorates. However, the mean difference⁸ between expected and observed completed levels of education between governorates of high vs. low intensity yielded minor differences (Table7). Participants who were of primary schooling age and lived in the low intensity governorates reported, on average, 0.291 years of difference between the observed vs. expected completed levels of education compared to 0.450 years of participants who were of primary schooling age and lived in a high intensity governorate. Participants in intermediate cohort reported 1.713 mean difference in low intensity governorates compared to 2.021 years in high intensity governorates. Participants in the secondary cohort reported 3.922 mean difference in low intensity governorates compared to 4.245 years in high intensity governorates. Thus, in all three cohorts,

⁸ Difference in this context refers to (expected- observed=difference). For example, if an individual has a difference value of 0, it implies that the individual is currently attending the level of school expected based on the individual's age.

participants yielded a larger difference between the expected vs. the observed level of education completed while living in a high intensity governorate.

While assessing the relationship between age and observed completed level of education, students in primary cohort are estimated to complete 0.78 (0.770, 0.783) levels of schooling with every one-year increase in age. Students in intermediate cohort are estimated to complete 0.48 (0.44, 0.52) and students in secondary cohort are estimated to complete 0.08 (0.06, 0.09) levels of schooling with every one-year increase in age. The difference between younger and older students could be explained by the duration of exposure. The increase of exposure to violence with age (Table 1) could be a predictive factor in estimating lower completion of education levels.

Adjusting for location and sex, individuals of the “richest” category and of the primary cohort are estimated to complete of 0.71 levels of education with every year increase in age. The intermediate cohort was estimated to complete 1.73 years and secondary 3.10 years of schooling. The “richest” category yielded larger estimates than all the other household wealth index quintile for all three cohorts. This suggests an association between the household wealth quintile score and an increase in the observed level of education.

After adjusting for location of residence, males were estimated to complete 0.04 years less than females in participants that were of primary schooling age. The estimated effect reversed as males were estimated to complete 0.08 more years in intermediate cohort and 0.57 in secondary schooling than females. Although this could suggest an association between gender and educational completion, it is important to keep in mind cultural, social and religious norms of Iraq. Most females in Middle Eastern countries are considered to be of marriage age between 16-23 years old. Thus, females could be getting married and becoming full-time housewives and discontinuing their education. Females are also more likely to never attend school than males (66% of participants who reported to never attending school or pre-school were females).

Results also suggested an association between the education of the household head and the difference between the expected vs. observed completed grade of schooling. Participants in primary school cohort whose household head had a secondary school or post-secondary education were estimated to complete 0.30 (0.27, 0.33) years of schooling compared to those with household head of no education. Participants in intermediate and secondary cohorts are estimated to complete 0.56 (-0.14, 0.74) and 0.84 (0.75, 0.93) respectively (Table 9). This

suggest that living in a household whose head has had a secondary or post-secondary household education benefits the resident individual in terms of completing schooling levels.

This study has multiple strengths. A total number of cases of 83,121 eligible persons covering 26,336 households in all 18 governorates and 118 districts allowed the authors to have representative samples of gender (54% males and 46% females), school-age groups (7-23), and residence in rural (42%) and urban regions (58%). This supports the external validity of the study. Furthermore, the impact of violence was measured by civilian deaths using an independent secondary dataset (IBC) to determine the independent variable hence reducing the likelihood of reporting bias.

One of the limitations of the study is that participants were not followed over time and thus immigration or migration could not be adjusted for in the theoretical structure of the study. Naturally people living in a country struggling with armed conflict for over a decade could decide to immigrate to a safer country with better financial, educational or social prospects. Thus the confounding factors analyzed (Figure 2) could all benefit or prevent participants from escaping the independent variable, intensity of violence per governorate, via immigration. Furthermore, those surveyed in 2011 and were determined to be residing in low intensity governorates could have migrated within Iraq to escape high intensity governorates. Ideally, those individuals would have been followed over time to determine the impact of migration and produce a more accurate estimates of the impact of violence. However, the cross-sectional nature of the study prevents from following the surveyed individuals over time. Thus, it is not possible to account for the relocation of individuals and/or families across governorates. This means that an individual might have had different levels of the exposure if he/she moved from one governorate to another between 2003-2010. Furthermore, this study doesn't account for individuals who might have partially lived in Iraq during the time of exposure (2003-2010) but might have been displaced by the time of the MICS study.

The IBC dataset does not account for total deaths caused by the armed conflict in 2003-2010, but only that of civilian deaths. Ambiguity between civilian vs. non-civilian (armed militia, ex-military, foreign fighters...etc.) casualties as reported by the media could lead to a higher number of deaths per governorate. In addition, participants in the secondary schooling cohort (16-23 years old) could have been recruited by local militias or were forced to take arms to defend their neighborhood and thus disrupting their educational achievement. Similarly, the

IBC does not account for wounded individuals that may have been permanently disabled. This could impact an individual's educational achievement. Furthermore, the IBC dataset is considered to have a "passive" approach in counting non-combatant civilian deaths with no special effort made to find deaths that are unreported. Studies have shown mortality rates to be much higher than those reported in the IBC (Burkle and Garfield 2013). The study is likely underestimating the effect of the armed conflict by only looking at civilian deaths reported by the IBC.

Finally, due to lack of supplementary demographic information, it is difficult to determine causality. An individual might be enrolled in a different grade than the expected grade based on age due to financial reasons, learning disability, school accessibility, joining armed forces or local militias, immigration or lifestyle choices. Although the study looked at the wealth index of a household, it is important to remember that the wealth index, and all other variables, could have changed in 2003-2010 and thus could impact the progress of an individual's education.

Conclusion

Violence that has ravaged Iraq after the invasion of 2003 varies depending on location of residence. Although this study could not conclusively link the intensity of violence based on the location of residence, it is clear that schooling age individuals are not performing at an expected level of schooling based on their age. To determine the true impact of armed conflict, more studies are needed that focus on the educational progress (or lack thereof) of Iraqi's youth. The loss, or delay, of educational achievement has long term implication on Iraq's development and recovery. The recent conflict with the Islamic State has further escalated the loss of educational achievement. The better we understand the impact of armed conflict on education, the better equipped we are to propose, design, and execute intervention programs.

APPENDIX

APPENDIX TABLE 1: Aggregate governorates recorded in Multiple Indicator Cluster Survey and assigned in the Iraq Body Count dataset.

Iraq Body Count governorate	Multiple Indicator Cluster Survey governorate
Anbar	Al-Anbar
Babylon	Babil
Baghdad	Baghdad
Basrah	Basrah
Dahuk	Dohuk
Diyala	Diyala
Erbil	Erbil
Kerbala	Karbala
Kirkuk	Kirkuk
Missan	Missan
Muthanna	Al-Muthana
Najaf	Al-Najaf
Ninewa	Ninewa
Qadissiya	Al-Qadisiya
Salah al- Din	Salahaddin
Sulaymaniyah	Suleimaniya
Thi-Qar	Thi-Qar
Wasit	Wasit

APPENDIX TABLE 2: Aggregate districts recorded in Multiple Indicator Cluster Survey dataset and assigned in the Iraq Body Count dataset. district with the red font color indicates it was not listed as part of the dataset but was geographically estimated to match its correspondent district.

IBC district	HH district	IBC district	HH district	IBC district	HH district
Dahuk	duhok	Daquq	daqooq	Kalar	kalar
Zakho	zakho	Choman	choman	Midaina	al mudina
Abu Ghraib	abu ghareeb	Darbandikan	darbandikhan	Manathera	al manadhera
Akre	akre	Balad	balad	Samawa	al samaoua
Ain Al-Tamur	aen alttamr	Kut	koot	Ba'quba	bakooba
Afaq	al afak	Suwaira	al swera	Mergasur	mergasoor
Adhamia	al ahddamiya	Makhmur	makhmoor	Mejar Al-Kabi	al majar
Amara	al amara	Rania	ranya	Daur	alddor
Azezia	al aziziya	Samarra	samaraa	Penjwin	penjween
Ba'aj	al bahaaj	Badra	badra	Pshdar	pshdar
Basrah	al basra	Resafa	al rassafa	Maimouna	al mimona
Dabes	al dbs	Tarmia	tarmeea	Qal'at Saleh	khla salah
Diwaniya	al diwanyia	Telafar	tallahfar	Shikhan	shekhan
Fao	al faw	Tilkaif	talkaef	Tikrit	tkreet
Hamza	al hamza	Shatt Al-Arab	shut alarab	Sinjar	sinjar
Hawiga	al haweeja	Soran	soran	Ru'ua	rawa
Hashimiya	al hashmeea	Sulaymaniya	sulaymanyia	Ramadi	rammady
Hai	al hay	Suq Al-Shoyokh	souk al	Koisinjaq	koisinjaq
Hilla	al hillia	Mahmoudiya	al mahmoodiya	Amedi	amedi
Ana	ana	Hamdaniya	al hamdanya	Shamiya	al samia
Thawra1	al sadr1	Heet	heet	Abu Al-Khaseeb	al qaseeb
Thawra2	al sadr2	Na'maniya	al nahmaniya	Mosul	nainawa
Muqdadiya	al miqdadya	Hindiya	al hindeea	Fares	al dujael
Karkh	al karkh	Musayab	al musaeeb	Chibayish	al gebauesh
Khalis	al khals	Najaf	al najaf	Hatra	al hadhar
Kufa	al koofa	Mahawil	al mahaweel	Kahla	al kahlaa
Rutba	al rutba	Mada'in	al madaeen	Khidhir	al khadr
Baiji	bejee	Nassriya	al nasiria	Akre	bardarash
Falluja	falluja	Rumaitha	al ramitha	Erbil	dashty hawler
Kadhimia	al kadmiya	Salman	al salman	Erbil	khebat
Chamchamal	chamchamal	Rifa'i	al rafee	Sharbazher	mawat
Ka'im	al qaeem	Shatra	al shatra	Sulaymaniya	qaradagh
Erbil	erbil	Shirqat	al shargat	Soran	rawandooz
Zubair	al zabear	Haditha	haditha	Chamchamal	said sadiq
Baladrooz	balad rooz	Halabja	halbja	Sharbazher	shahrazoor
Ali Al-Gharbi	ali algabi	Kirkuk	kerkuk	Tooz	tozhormatoo
Qurna	al qrna	Shaqlawa	shaqlawa	Thethar	samaraa
Kerbala	karbalaa	Sumel	semel	Thethar	balad
Khanaqin	khanaqeen	Sharbazher	sharbazher		
Dokan	dokan	Kifri	kfree		

APPENDIX TABLE 3: Percentage of the previously completed grade of individuals surveyed 7-23 years old in 2011 as reported by Multiple Indicator Cluster Survey.

Age (Expected Level)	Preschool kindergarten	Primary	Intermediate	Secondary	Post- secondary
23yrs (Secondary)	0.000	0.450	0.190	0.138	0.222
22yrs (Secondary)	0.000	0.419	0.201	0.171	0.210
21yrs (Secondary)	0.000	0.417	0.209	0.192	0.183
20yrs (Secondary)	0.000	0.401	0.229	0.238	0.132
19yrs (Secondary)	0.000	0.400	0.223	0.298	0.078
18yrs (Secondary)	0.000	0.377	0.280	0.328	0.014
17yrs (Secondary)	0.000	0.380	0.337	0.281	0.002
16yrs (Secondary)	0.000	0.372	0.438	0.189	0.001
15yrs (Intermediate)	0.000	0.413	0.553	0.034	0.000
14yrs (Intermediate)	0.000	0.470	0.528	0.001	0.000
13yrs (Intermediate)	0.000	0.632	0.368	0.000	0.000
12yrs (Primary)	0.000	0.942	0.058	0.000	0.000
11yrs (Primary)	0.000	0.998	0.002	0.000	0.000
10yrs (Primary)	0.000	1.000	0.000	0.000	0.000
9yrs (Primary)	0.000	1.000	0.000	0.000	0.000
8yrs (Primary)	0.000	1.000	0.000	0.000	0.000
7yrs (Primary)	0.004	0.996	0.000	0.000	0.000

APPENDIX TABLE 4: Population census (2009) and area of governorates, as listed by the ministry of planning of Iraq, was used in order to determine the average death per 100,000 and per square kilometer.

Governorate	Population	Area (km²)
Dahuk	968901	6553
Muthanna	719824	51740
Sulaimaniya	1551974	17023
Erbil	1471053	15074
Missan	1009565	16072
Najaf	1180681	28824
Anbar	1451583	137808
Qadisiya	1121782	8153
Thi-Qar	1846788	12900
Wasit	1158033	17153
Salahuddin	1259298	24363
Basrah	2555542	19070
Ninevah	3237918	37323
Kerbela	1003516	5034
Kirkuk	1290072	9679
Diala	1370537	17685
Babylon	1727032	5119
Baghdad	7180889	4555

APPENDIX TABLE 5: List of variables used from the Multiple Indicator Cluster Survey.

Variable	Description	Format	Range
HL5Y	Year of birth	Numeric	1988-2003
HL6	Age	Numeric	7-23
HL4	Sex	Character	Male/Female
ED3	Ever attended school or pre-school	Character	Yes/No
ED4A	Highest level of education attended	Character	Preschool/kindergarten, Non-standard, Primary. Secondary, Intermediate, Higher studies, Bachelor, Diploma
ED4B	Highest grade completed at that level	Numeric	0-6
HH71	Muhafaza(governorate)	Character	Dahuk, Muthanna, Sulaimaniya, Erbil Missan, Najaf Anbar, Qadisiya Thi-Qar, Wasit Salahuddin, Basrah Ninevah, Kerbela Kirkuk, Diala Babylon, Baghdad
Helevel	Education of household head	Character	None, Primary, Secondary+
Windex5	Wealth index quintiles	Character	Poorest, Second, Middle, Fourth, Richest
Schage	Age at the beginning of school year	Numeric	7-23

Cleaning and Preparation

Prior to analysis, the IBC dataset had to be cleaned and organized. This included adding a district and a governorate variable to each incident that was recorded. For example, on August 16, 2007 a body was found in Karrada, Baghdad as reported by Reuters news outlet. The Searchable City Data Base was used to locate Karrada and log its district (Resafa) and its governorate (Baghdad). This process was repeated for all the incidents in 2003-2010 which totaled 31,941 recorded violent incidents. The following protocol was used to systematically code the incidents:

General Description:⁹

Two main excel files were used. The first is the “Searchable Database,” containing information of cities, villages and which governorates and districts they match to. This file also includes longitude, latitude and alternate district listing. The second file is the IBC list of violent incidents, which will include the coding via five different columns.

Protocol¹⁰

1. Note that there are 5 columns that need to be filled out:
 - a. District: Names of district location of incident
 - b. Confidence: dummy code for confidence in coding:

⁹ It is important to note that if this process was to be repeated, the coder must be somewhat familiar with the geography and place-names of Iraq. A fluency in Arabic is strongly recommended as the coder often has to understand transliteration of Arabic place-names

¹⁰ Protocol was developed by Dr. Carmel Salhi, Assistant Professor in the Department of Health Sciences at Northeastern University and Dr. Victoria Fan, Assistant Professor of Health Policy and Management at the University of Hawai'i at Mānoa.

- i. A “0” absolute certainty district of incident is accurate. This meant the district was explicitly listed in the description, or a neighborhood/place-name was given which lead to one specific district
 - ii. A “1”, if more than one district is possible
 - iii. A “2” if no district can be assigned. This meant that the description given by the incident was too ambiguous to narrow the location of the district
 - c. Alternate District: The name of a second district if the confidence code was designated as “1”
 - d. Baghdad: Coded as “1” for Baghdad. A large portion of the data (approximately 9%), included incidents with no reference to a specific district, but listed Baghdad as the governorate.
 - e. Governorate: Assign each incident a governorate based information available from above
2. Do each of the following steps separately for 100 rows at a time (i.e. do step “a” for rows 1-100, then do step “b” for rows 1-100, etc.):
- a. First note if the incident took place explicitly in Baghdad; if so, mark a 1 in the “Baghdad” column. If marked it as 1, this means that the incident could not be further identified and the data only states that it occurred in Baghdad (i.e. Baghdad, vicinity of Baghdad, central Baghdad).
 3. Then note if the incident location explicitly states a district name. If it does, put the name of the district in the “District” column, making sure to use the spelling from the “Searchable City Database,” not the IBC spelling.
 4. Next, if the district is not explicitly identified, search for the village or street name (exactly as it’s spelled in the IBC database), in the “Searchable City Database.” Use any additional information from the “Location” column in the IBC database to narrow down the district name, like governorate. If time permits, search the name on a search engine (i.e. google) and narrow down the district. It is also helpful to search the “Searchable City Database” with the Arabic version of the name using an online Arabic keyboard.
 5. If no district can explicitly be assigned to an incident, use the “source” variable to search for the news article from the agency listed as the source for the incident. Original media reports may offer more information as to where the incident took place.
 6. If there is only one match, list the district name in the “District” column and label your confidence in the “Confidence” column.
 7. If there are multiple matches, put the most likely one in the “District” column, the second best match in the “Alternate District” column and label your confidence in the “Confidence” column.
 8. If there are no reasonable matches with exact spelling, then leave the “District” column blank.
 9. Any incident that has the terms “in the vicinity of” or “near” should be labeled with a value of 1 in the “confidence” column.
 10. We will use the preceding steps for the first few coding sessions, particularly around exact spellings, and then see how it might be adjusted to account for potential alternative spellings of villages.
 11. After completing the coding for each hundred rows, randomly select a few of incidents to double-check coding. If an error occurred, all the rows completed within the current session are to be recoded.
 12. Repeat steps until IBC incidents (Ending date) are coded from 1/1/03 to 6/30/2010

CHAPTER 6. REFERENCES

- Akbulut-Yuksel, Mevlude. 2009. "Children of War: The Long-Run Effects of Large-Scale Physical Destruction and Warfare on Children."
- Al-Rawi, I., S. N. Azzawi, I. K. Jalili, H. Al Bayati, D. Adriaensens, and C. Varea. 2005. *List of Killed, Threatened or Kidnapped Iraqi Academics Retrieved 30 December, 2009*.
- Bahcheli, Tozun, Barry Bartmann, and Henry Srebrnik. 2004. *De Facto States: The Quest for Sovereignty*. Routledge.
- Burkle, Frederick, and Richard Garfield. 2013. "Civilian Mortality after the 2003 Invasion of Iraq." *The Lancet* 381 (9870): 877–79.
- Burnham, Gilbert, Riyadh Lafta, Shannon Doocy, and Les Roberts. 2006. "Mortality after the 2003 Invasion of Iraq: A Cross-Sectional Cluster Sample Survey." *The Lancet* 368 (9545): 1421–28.
- Central Statistical Organization, Ministry of Planning. 2010. "Iraq's Governorates by Area and Their Relative Share of Area and Population 1997 , 2009." Demographic Statistics. Ministry of Planning, Republic of Iraq. <http://cosit.gov.iq/en/population-manpower-staistics/life>.
- Coelli, Michael B. 2005. "Leading Determinants of Education Attainment." University of British Columbia.
- Conetta, Carl. 2003. *The Wages of War: Iraqi Combatant and Noncombatant Fatalities in the 2003 Conflict*. Project on Defense Alternatives, Commonwealth Institute.
- Diwakar, Vidya. 2015. "The Effect of Armed Conflict on Education: Evidence from Iraq." *The Journal of Development Studies* 51 (12): 1702–18.
- Groger, Jeffrey. 1997. "Local Violence and Educational Attainment." *Journal of Human Resources*, 659–82.
- Hagopian, Amy, Abraham D. Flaxman, Tim K. Takaro, Sahar A. Esa Al Shatari, Julie Rajaratnam, Stan Becker, Alison Levin-Rector, Lindsay Galway, Berq J. Hadi Al-Yasseri, and William M. Weiss. 2013. "Mortality in Iraq Associated with the 2003–2011 War and Occupation: Findings from a National Cluster Sample Survey by the University Collaborative Iraq Mortality Study." *PLoS Med* 10 (10): e1001533.
- Iraqi Research Foundation for Analysis and Development. 2014. "Iraq Education." .org. <http://www.irfad.org/iraq-education/>.
- Kecmanovic, Milica. 2012. "The Short-Run Effects of the Croatian War on Education, Employment, and Earnings." *Journal of Conflict Resolution* 57 (6): 991–1010. doi:10.1177/0022002712454268.
- Kull, Steven, Clay Ramsay, and Evan Lewis. 2003. "Misperceptions, the Media, and the Iraq War." *Political Science Quarterly* 118 (4): 569–98.
- Mason, Mark. 2014. "Two Key Issues in Educational Development: Private Schooling for the Poor, and Sustaining Education amidst Armed Conflict."
- Naufal, George S. 2011. "Labor Migration and Remittances in the GCC." *Labor History* 52 (3): 307–22.
- O'Brien, Margaret, and Deborah Jones. 1999. "Children, Parental Employment and Educational Attainment: An English Case Study." *Cambridge Journal of Economics* 23 (5): 599–621.
- Onyango, Philista. 1998. "The Impact of Armed Conflict on Children." *Child Abuse Review* 7 (4): 219–29.
- Patten, David A. 2007. "Is Iraq in a Civil War?" *Middle East Quarterly* 14 (3): 27–32.
- Resolutions of Council of Ministers For Session No. 3. 2014. <http://www.cabinet.iq/ArticleShow.aspx?ID=4226>.
- Rossetti, Stefania, and Paola Tanda. 2000. "Human Capital, Wages and Family Interactions." *Labour* 14 (1): 5–34.
- UNICEF. 2010. *Girls' Education in Iraq. A Situational Analysis*.
- . n.d. *MICS.(2011). Iraq Multiple Indicator Cluster Survey Final Report*.
- UNICEF, MICS. 2000. "Multiple Indicator Cluster Survey (MICS)."
- Vollmer, Sebastian, Christian Bommer, Aditi Krishna, Kenneth Harttgen, and S. V. Subramanian. 2016. "The Association of Parental Education with Childhood Undernutrition in Low-and Middle-Income Countries: Comparing the Role of Paternal and Maternal Education." *International Journal of Epidemiology*, dyw133.
- Wexler, Isaiah D., David Branski, and Eitan Kerem. 2006. "War and Children." *JAMA* 296 (5): 579–81.