Violent Conflicts and Educational Outcomes: The LRA Insurgency in Northern Uganda Revisited

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Abstract

I investigate the consequences of the Lord's Resistance Army (LRA) insurgency on the educational outcomes of individuals in Northern Uganda. I employ an identification strategy that exploits variations in conflict intensity across birth cohorts and geographic locations using a Difference-in-Differences (DiD) model. Empirical results show that individuals exposed to the conflict experience a decline in completed years of schooling and literacy. There are differential effects between gender and place of residence, but not between duration of exposure. Additionally, we examine the possible supply and demand transmission mechanisms explaining the main result. Evidence suggests that conflict-induced degradation of school infrastructures, increases in school size, and the teacher-student ratio due to displacement, as well as the reduction in household education expenditure due to direct exposure to violent events, exacerbate educational outcomes. These key mechanisms are vital in formulating effective policy interventions that address the critical supply and demand barriers to education and improve access to education during and in the post-conflict period.

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Armed conflicts continue today in different parts of the world, more so in Africa where the intensity, nature, and geographic distribution of conflicts have changed over time (Okumu et al., 2020). During Africa's colonial and post-independence periods, conflicts were mostly ideological-driven guerrilla warfare. However, numerous armed conflicts today are driven by the prospect of political power, contesting over resources, assertion of extremist ideologies, control over borders (mainly sub-national ethnic boundaries), addressing grievances, etc. These conflicts tend to be fought within and across states, have the participation of non-state actors on one or more sides, use excessive violence against the civilian population, and with varying degrees of formal organisation structure (Vinci, 2005). Accordingly, there has been a surge in the literature studying the microeconomic effects of violent conflicts across different countries with a focus on discerning causes and effects of conflicts at a micro level as well as providing policy interventions for peace-building and development in the post-conflict period (Verwimp et al., 2019). These studies have shown that armed conflicts have significant impacts on education outcomes. However, most studies rely on aggregate-level measures of conflict exposure, and few have been able to show specific causal mechanisms linking violent conflicts and education outcomes.

This study provides evidence on the impact of exposure to armed conflict during middle childhood and adolescence on individuals' educational outcomes. Between 1987 and 2006, the population in northern Uganda endured one of Africa's longest and most brutal conflicts between the enigmatic Lord's Resistance Army and the Ugandan government. The initial years of the insurgency (1987 - 1994) were characterized with low-intensity violence and had relatively less success on the battleground. However, after 1994 the conflict escalated turning into seemingly random violence (Jackson, 2002), with both the insurgents and the national army carrying out acts of brutal violence against the civilian population. During this violent period, community social service centers and households were attacked by the insurgents. Abduction and forced enslavement of people especially children of school-going age became a common feature in LRA conflict areas. To improve security provision, government representatives and security operatives resorted to forced relocation, with entire communities and social services moved into Internally Displaced Camps (IDP) across the region. Ethnic militia units were formed to supplement security and aid government forces in the war. It is against this backdrop that I exploit the variation in exposure to conflict intensity across geographic area and birth cohorts to examine the impact of the LRA insurgency on the educational outcomes of individuals in northern Uganda.

It has been noted that children and adolescents are easily susceptible to negative environmental factors (Attanasio, 2015) and shocks such as armed conflict have both short- and long-term negative consequences. Differences in the magnitude of conflict exposure experienced by individuals across the region during their middle childhood and adolescence stages are vital in expounding on the individual and sub-regional variances in education attainment, labor productivity, and earnings, health, and socio-economic welfare (Almond et al., 2018; Currie and Vogl, 2013) in Northern Uganda. Therefore, for policy intervention to be effective in remedying these negative impacts and closing the developmental lags in post-conflict areas it is crucial that the causes and consequences of armed conflict are fully examined.

I show that exposure to a shock event (i.e., LRA conflict intensity measured by the number of fatalities within a 3 km radius of an individual's household) negatively impacts individuals' education outcomes and there are heterogeneous effects across genders, with females experiencing a stronger negative impact. Overall, due to the unique attributes of the region of study, we observe differences between these findings and results from elsewhere. This warrants the need to analyze the impacts of conflicts within a specific context if we are to achieve optimal results from policy interventions undertaken during- and in the post-conflict periods.

The key insight from studies such as Akresh and de Walque (2008); Bertoni et al. (2019); Chamarbagwala and Morán (2011); Dabalen and Paul (2014); León (2012); Shemyakina (2011); Swee (2015); Verwimp and Van Bavel (2014) is that while the impacts of conflict on educational outcomes are negative, the extent of these impacts varies depending on the nature of the conflict in question, country attributes, student demographics and the outcome variable of interest. For example, in studies where gender heterogeneity is explored, results show that exposure to conflict differs between male and female students. Verwimp and Van Bavel (2014) shows that exposure to conflict reduced the probability of completing primary school by 7 to 17 percentage points for males in comparison to the non-exposed group of males. This conflict exposure reduced the gender gap in schooling but only for females from non-poor households in Burundi. Likewise, Dabalen and Paul (2014) studied the effect of the 2002 – 2004-armed conflict in Côte d'Ivoire on years of schooling and observed a reduction of 0.94 years for the school-going-age cohort in comparison to an older cohort in conflicted-affected regions. This estimated effect is larger for males and older individuals in the affected cohort.

On the other hand, Chamarbagwala and Morán (2011) find that school-age in-

dividuals in areas of Guatemala more exposed to violence complete fewer years of schooling with females more affected (these experienced a decline of 30 percentage points) in comparison to their male counterparts (23-pp). In Tajikistan, Shemyakina (2011) observes that girls of school-going-age who resided in conflict areas were unlikely to complete their required schooling level compared to girls of similar age who lived in unaffected regions. For Nepal, Valente (2014)) finds conflict intensity to be associated with an increase in female education attainment more than their male counterparts. This heterogeneity in effects underscores the importance of evaluating each conflict within a given context to provide meaningful insights that are vital for effective policy interventions.

This study extends the growing body of literature on the micro-economic effects of exposure to violent conflict on human capital formation and contributes in two ways. First, I examine the impact of the LRA insurgency on the educational outcomes of individuals in northern Uganda. As noted by Cuesta and Leone (2020), the use of geographical information is advantageous as individual, household, village or cluster Geo-information can be matched with better precision to geo-location data on shock events. This allows for a more precise identification of shock exposure and intensity. In this endeavor, I link household level geo-coded data from the Uganda National Household Surveys (UNHS) to geo-information on conflicts from the Uppsala Conflict Data Program Georeferenced Event Dataset (UCDP GED) and the Armed Conflict Location and Event Data project (ACLED) to construct a more refined measure of an individual's exposure to conflict across space and time. To the best of my knowledge, only a limited set of studies[1] have attempted to use geo-coordinates to measure of conflict exposure at different levels of aggregation.

Second, I use the unique features of the UNHS to explore the possible mechanisms that explain the link between armed conflicts and educational outcomes. Despite the growing body of literature, there still exist information gaps concerning the specific causal mechanisms explaining the link between violent conflicts and education outcomes. This down to data paucity which limits researchers from making clear conclusions most especially in the developing world where most conflicts often occur. In the context of Uganda, one study that is most closely related to the spirit of this study is Blattman and Annan (2010). They investigated the consequences of military conscription of children on human capital and labor market outcomes. However, in that

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[1]For example, Bertoni et al. (2019) and Chukwuma and Ekhator-Mobayode (2019) use displaced cluster level geo-information in their analyses of the impact of Boko Haram conflict on education and health use respectively.

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study they use a unique and limited sample of individuals[2], results of which cannot be extended to individuals who were not abducted child soldiers or those indirectly affected by the LRA conflict. I differ in a meaningful way by examining additional channels other than child soldiering.

First, I explore the supply-side mechanisms where I show that conflicts cause the disuse and neglect of school infrastructure, increase in school size and the student-teacher ratio. Specifically, the LRA attacks on households and schools resulted in forced displacement of entire communities by government as a measure to ensure safety as well as separate civilians from combatants. New learning centers in IDP camps were congested and lacked the necessary teaching facilities and staff. Teachers abandoned their workstations, sought new employment options, and moved to more secure places. This resulted in a shortfall in the availability of experienced teachers in conflict areas. Second, I examine the demand-side mechanism such as child labor participation and household education expenditures. Results indicate that conflict intensity is associated with both supply and demand.

The remainder of the study is organized as follows. Next section 1 introduces background information on the LRA conflict and Uganda's education system. In section 2, I describe the data sources, while section 3 is the identification and empirical strategy used in examining the research question. An overview of the estimation results and discussion is in section 4. In section 5, I explore the possible transmission mechanisms, and in section 6 is the conclusion and recommendations.

1 Context and Overview of the LRA Insurgency and Education Disruption in Northern Uganda

1.1 The LRA Insurgency

The conflict in northern Uganda was rooted in Uganda's colonial legacies (Kustenbauder, 2010; Rohner et al., 2013) and for close to two decades between 1987 – 2006, the region experienced a protracted insurgency by the LRA rebels against the government, its armed forces, and local militias. Nevertheless, the origins of the LRA movement can be traced to the point in time when Yoweri Museveni and the National

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[2]The study uses data from the Survey of War Affected Youth (SWAY) which contained 741 individuals born between 1975 and 1991 in Kitgum and Pader districts of Northern Uganda. The 741 youths had direct experience of the war as abductees whose educational and labour market outcomes are compared to a control group of non-abducted youth in the area.

Resistance Movement (NRM) came to power in 1986. This period was characterised by increased ethnic politicization and polarization, which resulted in the emergence of several rebel outfits waging wars of insurgency against the NRM government in several parts of northern Uganda. Among others, these included the Uganda People Democratic Army (UPDA), the Holy Spirit Mobile Forces (HSMF), Holy Spirit Movement II (HSM II), and Joseph Kony's Uganda Christian Democratic Forces (Liu and HRPC, 2003).

With the defeat of earlier groups such as UPDA and HSMF by the NRM government, coupled with a lack of clear leadership, Kony a relative of the HSMF leader was able to assemble the fragmented rebel factions into a group under his leadership which later morphed into the insurgent group known as the LRA in the early 1990s. The LRA ranks were also filled with officers from past national armies who had not been integrated into the national army. Many joined the LRA fearing retaliation if they had returned to communities in which they had committed atrocities (Vinci, 2005). The LRA initially enjoyed the support of the Acholi and Langi people who are the dominant tribes in the region. Its stated mission is said to have been the overthrow of Museveni's government (Kim, 2019). However, this claim was negated due to the brutal violence the LRA meted out on the local civilian population in the region.

The LRA armed insurgency was characterized by unpredictable attacks, massacres, body maiming, sexual violence, and abductions in the region. There was massive displacement of communities into IDPs and a lack of social services to locals in inaccessible areas. It is estimated that over 75,000 civilians were abducted with the majority of these being school-age-going children and nearly two million had been forced into Internally Displaced People (IDP) camps by August 2005 (Bussmann, 2015; Global IDP Project, 2005; O'Reilly, 2015). Child abductions were used to bolster LRA ranks and homesteads were looted for supplies (Blattman and Annan, 2010). It is also estimated that between 30,000 – 40,000 children became night commuters[3] due to fear of being abducted by the LRA. Due to this prevailing insecurity, the government and army deemed it necessary to force the local population into IDP camps. The thinking was that this would enable the army to protect civilians from the LRA as well as enable it to quickly distinguish between non-combatants and LRA fighters. Between 2002 and 2005 the conflict escalated and violence against civilians

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[3]Children who traveled to urban areas to seek shelter on the streets or public buildings every night as a safe measure against LRA abductions.

peaked as government efforts to pacify the north intensified. Strategic advances by the national army and political negotiations resulted in a cessation of hostilities in 2006[4].

1.2 Education disruptions in Northern Uganda

The education system in Uganda follows a similar structure to that of the United Kingdom. It is composed of primary, secondary/post-primary, and tertiary/post-secondary education levels. The primary level usually begins at 6 years of age until age 12 (primary 1 to 7), students who do not proceed to secondary education enroll in post-primary level institutions which comprise of Business, Technical, and Vocational Training schools lasting 2 to 3 years. The secondary school level lasts 6 years divided into 4 years of Ordinary level (O' level) and 2 years of Advanced level (A' level). Passing the national exams is a prerequisite to progressing through the different education levels. On completion of A' level, students proceed to the tertiary education level (2 to 5 years). Primary and secondary education (O' level only) is compulsory for all citizens up to age 16 (Ayorekire and Twinomuhangi, 2012).

Due to the insurgency, there was a breakdown of the education system in northern Uganda between the late 1980s and early 2000s. School infrastructure such as buildings and furniture was destroyed or badly damaged. An increase in LRA conflict violence resulted in entire schools and communities being chaotically relocated to makeshift learning centers in towns and IDP camps. For instance, 60% of primary schools in Gulu, Pader, Kitgum, Apac, and Lira districts had been abandoned or displaced by 2004 (Global IDP Project, 2005). Abandoned school buildings, especially those located on main routes to town centers, were occupied by government soldiers as military detachments. Schools that remained functioning became overcrowded increasing the student-teacher ratio in the region to between 1:150 to 1:300 in comparison to the national average of 1:65 (Brown, 2006; Global IDP Project, 2005).

Destruction and displacement of school infrastructure also meant that schools were no longer able to provide shelter, teachers, and scholastic materials. Basic facilities such as classrooms, toilets, laboratories, and libraries were lacking in school relocation areas such as IDP camps. As such, these schools lacked the capacity and resources to provide the minimum education services needed by the displaced communities. The total number of registered candidates for the primary national

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[4]Agreement on cessation of hostilities

exams decreased from 117,000 students in 2002 to 50,000 in 2003 in conflict-affected districts (Global IDP Project, 2005). Regional performance in national exams was largely poor in comparison to other regions of the country with no student passing in the first division, an indication of the magnitude of regional disparities in education access, quality, and performance.

Teacher and student absenteeism increased due to LRA attacks on schools, especially primary schools that were isolated outside of town centers. Teachers abandoned their workstations moving to towns or other secure locations, thus lowering the quality of teachers available in conflict areas. Failure of teachers to return to relatively safe areas coupled with lack of effective monitoring, accountability, and organization by local governments and education officials due to the conflict further disrupted the education system and exacerbated the education outcomes of children in the region (Global IDP Project, 2005).

In addition, the insurgency critically affected both the mental and physical health of individuals in the region thus creating barriers to schooling. Abduction of school-going age children to boost rebel ranks as child soldiers and sex slaves to commanding officers exposed them to trauma, sexually transmitted infections (STIs), and early pregnancy. It has been noted that the LRA used sexual bondage as a weapon which further exacerbated HIV prevalence rates in the region (Global IDP Project, 2005). School-going-age children used to commute to urban areas to seek shelter on the streets or public buildings every night as a safe measure against LRA abductions. This impacted their ability to attend school regularly. These night commuters also reported sexual harassment and assault, leaving them at a high risk of exposure to HIV/AIDS, other STIs, and early pregnancy. It was further reported that girls and women displaced into IDP camps were forced to engage in unprotected "survival sex", to make ends meet (Global IDP Project, 2005). Pregnant and HIV/AIDs impacted individuals generally find it hard to return to school and as such these precipitate high dropout and lower school completion rates which affects future employment and wages, thus reinforcing the cycles of poverty.

With improved security after the cessation of hostilities, most IDPs have been re-settled in their former home villages or in new ones. Different reconstruction programs have been initiated but overall, the socioeconomic conditions of northern Uganda are still lagging other parts of the country. Consequently, this study aims to investigate the impact of the LRA insurgency on educational outcomes in the region and guide education policy and initiatives in the region. Education outcomes are a predictor

of labor productivity and future earnings, factors that are necessary if Uganda is to meet its middle-income status target as set out the Vision 2040 (NPA, 2013).

2 Data

2.1 Education

The study uses the 2002/03 and 2005/06 Uganda National Household Surveys (UNHS) waves. The UNHS are priority surveys structured similarly to the World Bank Living Standard Measurement Surveys (LMS) carried out every three years to track the socio-demographic and economic characteristics of the population. Survey samples are drawn through a stratified two-stage sampling design with Enumeration Areas (EAs) grouped by districts of similar socio-economic characteristics and a rural-urban dichotomy at the first stage. The EAs were drawn using Probability Proportional to Size (PPS) in the second stage, sampling units used are households and these are selected using systematic random sampling (UBOS, 2006). The 2003 survey wave consisted of 9711 households containing 52,088 individuals of which 56% were below the age of 18. It was carried out at the onset of the conflict escalation. For 2006, the wave consisted of 8008 households with 42,975 individuals of which 55% were below the age of 18 and it was carried out towards the end of the escalation period.

The UNHS socioeconomic module captures information on household demographics, well-being, housing, health, and education. Household and individual-level data is based on responses of the household survey respondent whereas community-level data is based on responses by community leaders and members. Information on education consists of individuals' school attendance, education attainment (highest level attained), grade completion, school dropout, etc. The community module captures information access and availability of education resources such as type of school, distance to school, academic performance in national exams (primary level), school size, number of teachers, and school infrastructure in each local setting. The dataset also provides geo-coordinates information for both surveyed households and communities which is to be linked with geo-referenced conflict data.

Table A1 and Table A2 displays the descriptive statistics for both dependent and independent variables. Children surveyed in 2003/2006 were on average 3.14 years behind their appropriate grade and the mean number of education years completed was 3.2. The variables are in reference to individuals aged 6 to 16 years eligible for mandatory school enrolment.

2.2 Conflict

The primary data on conflict used in this study to measure exposure to conflict is extracted from the Uppsala Conflict Data Program Geo-Referenced Events Dataset (UCDP GED). This georeferenced event dataset is aimed at providing the academic community with comprehensive data on violent events both spatially, and temporally from 1989 onwards (Pettersson and Öberg, 2020). Data collected on each event contains location, date, type, and number of fatalities allowing for identification of administrative regions in which conflicts happen. An event is defined as an incidence where armed force was used by an organized actor against another organized actor, or against civilians, resulting in at least one direct death at a specific location and date (Högbladh, 2020). Data were collected using three sets of sources: global newswire reporting, global monitoring and translation of local news performed by BBC, and secondary sources such as local media, NGOs' reports, case studies, archives, etc., (ibid, 12 - 14). Conflict events are subjected to numerous data quality control checks and locations are determined using source information, these processes are expounded on in the UCDP GED documentation (Sundberg and Melander, 2013).

Using geospatial data taken from the Database of Global Administrative Areas (GADM 3.6) which contains a high-resolution database of all Uganda's administrative levels, I match the geo-location of each conflict event and fatalities. Fig.1a shows geographical variations in conflict intensity measured as the total number of reported LRA conflict fatalities between 1989 and 2007 at GADM level 2 (county level) in Northern Uganda. Areas in the darker shade of blue indicate areas that experienced the most conflict fatalities. Fig.1b shows the total number of recorded LRA conflict events during the same conflict period. Darker shaded red areas show local administrative areas that experienced a higher number of conflict events.

The alternative source of conflict data exploited in this study to measure conflict intensity is the Armed Conflict and Location Event (ACLED) program. It provides disaggregated information on each violent event such as exact location, date, type, and fatalities reported (Raleigh et al., 2010). In comparison to UCDP GED, ACLED has a limited coverage period between 1997 – 2007. There also exist conceptual differences[5] in how violent events are defined as well as data collection methods (Eck,

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[5]The inclusion criteria of UCDP GED are based on whether a fatality was recorded, rather than whether an act of political violence occurred. The event must result in at least one direct death at a specific location-date for it to be recorded, unlike ACLED. Due to its inclusion criteria, non-fatal events, and non-violent events such as troop movements, arrests, demonstrations, etc. are included in the ACLED dataset. No specification is given as to what constitutes armed conflict. ACLED

2012; Raleigh and Kishi, 2019). As a result, I use the UCDP GED in the primary analysis and results with the ACLED are presented in the appendix.

Figure 1. The LRA insurgency in Northern Uganda (UCDP GED1989 – 2007)

(a) Fatalities   (b) Conflict events
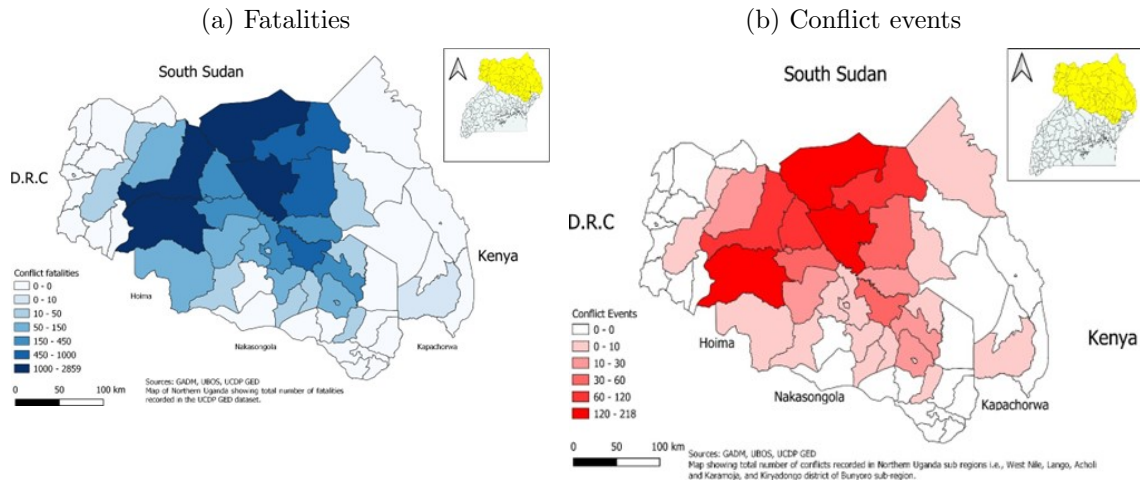
2.2.1   The two measures of conflict intensity

Using the geo-coordinates available in the UNHS, UCDP, and ACLED datasets, I construct a proximity-to-conflict event analysis by computing the distance between households and conflict sites, and then the sum of fatalities that happened within the locale of each surveyed household tracing the progress of conflict intensity across space and time[6]. First, I define and construct distance thresholds between households and conflict sites progressively at 1, 3, and 5 km. Secondly, I compute the number of fatalities that occurred within each of these distances over the period that is relevant to my study (i.e., 1989 up until the date of the survey) based on geo-information. The measure of conflict intensity, number of fatalities, uses the cumulative number of fatalities within a 1, 3, and 5 km radius of a household up until the date of the survey whereas the number of conflict events uses the cumulative number of LRA conflict events (i.e., even if no fatalities are recorded).

    The LRA employed the use of fear as a war strategy by carrying out brutal atrocities such as rape, body mutilation, death, and abductions; unpredictable raids and ambushes on civilian and army targets to maximize its control over the region's

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makes no distinction between events in terms of their lethality which results in all events having the same weight.

  [6]This measure of conflict intensity follows similar construction as set out in Bertoni et al. (2019).

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population (Vinci, 2005). Hence, I use the number of fatalities within a 3 km radius of a household as the primary measure of conflict intensity.

3 Empirical Strategy

I consider three outcomes of interest: (1) completed years of schooling, (2) primary school completion, and (3) literacy[7]. By 2006, the average completed years of schooling was 4.34 (3.2) for males (females), 17 percent (12%) of males (females) had attained primary school education and literacy was 76 percent (63%) for males (females) individuals surveyed in 2005/2006. Given the time frame of the LRA insurgency and the population demographics[8], many individuals' schooling period coincides with that of the conflict allowing for the observance of their education outcomes. Knowing that the LRA insurgency caused considerable displacement of the population to IDP camps or migration to other safe areas (Global IDP Project, 2005), I control for migration bias in the model. This is achieved by using information on household migration patterns before and during the conflict across both survey years. I further test for robustness by restricting the sample to individuals who have not migrated since the start of the conflict.

Estimation Model: Completed Years of Schooling, Primary School Education Attainment and Literacy.

Using data from the UNHS waves, I compare the impact of exposure to the LRA insurgency on educational outcomes in two groups of individuals i.e., treatment and control groups. The treatment group consists of individuals born $1974 \leq j \geq 1999$, i.e., these were of mandatory school-going age (6 -16) as of 1989 or after. The control group includes individuals who by 1989 were no longer of mandatory school age i.e., individuals born $1962 \leq j \geq 1970$. Following previous studies[9] on the impacts of violent conflict on education outcomes, I estimate the following model:

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[7]Literacy is considered separately from the variables-completed years of schooling and primary school completion. 318 individuals are literate without gaining formal education, 5934 individuals are literate without attaining primary school education, and 8804 individuals have not completed mandatory schooling. There exists both formal and informal education settings in communities. As a result, studying literacy separately remains informative as it is acquired in both settings.

[8]55.7% of the total population surveyed in Northern Uganda was less than 18 years of age. Therefore, their education outcomes are directly or indirectly affected by the LRA insurgency.

[9]Among others Bertoni et al. (2019); Chamarbagwala and Morán (2011); Dabalen and Paul (2014); Valente (2014) use a similar methodology.

$$Educ_{ihdt} = \alpha + \tau Conflict_h + \beta(Conflict_h * Treat_{it} + \gamma X_{ihdt} + \mu_t + \delta_d + \varepsilon_{ihdt} \quad (1)$$

Where $Educ_{ihdt}$ is the number of completed years of schooling, primary school completion dummy, or literacy dummy for individual i born in year t from household h located in district d at the time of the survey. The impact of conflict exposure is captured by the estimate β which is related to the interaction between the household measure of conflict exposure and the dummy variable taking the value one if the individual belongs to the treatment cohort ($Treat_{it}$) and were exposed to the LRA conflict during their mandatory schooling age. $Conflict_h$ is the cumulative number of fatalities within a 3km radius of a household up until the date of survey (s) i.e., $Conflict_h = \sum_{1989}^{s} fatalities(3km)_h$. X_{ihdt} is a vector of controls that consist of individual and household characteristics at the date of the survey. δ_d are district dummies and μ_t represents birth cohort dummies. In addition, I control for the survey year. ε_{ihdt} is the error term. I use clustered standard errors at the birth cohort and district level.

In Equation 1 above, I exploit variation in exposure to conflict intensity by birth cohort, survey date, and geographical location, to investigate differences in education outcomes in Northern Uganda. This identification allows for comparison between cohorts who are born a few years apart and experience different conflict intensities during their would-be mandatory schooling years. The intuition is that an individual aged 16 years at the time of the survey in 2003 will have been exposed to a different conflict intensity[10] during their mandatory schooling in comparison to another aged 16 years surveyed in 2006 in the same district, and there would be differences in conflict exposure across time and locations between two individuals.

Results are presented within a 3 km radius of households using conflict data from the UCDP GED dataset. There is no official definition of a catchment area or radius within which a conflict event or related fatalities would significantly impact access and use of social services in Uganda. In the literature on micro-economic effects of violent conflict from Sub-Saharan Africa, distance measures used vary depending on the outcome of interest. For example, Bertoni et al. (2019) used village-level geo-coordinates, set a 5 km radius to examine the impact of Boko Haram conflict on education in North-East Nigeria while Chukwuma and Ekhator-Mobayode (2019)

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[10]Cumulative number of fatalities or conflict events is measured up to until a household's survey date.

used DHS[11] cluster geo-coordinates to create catchment areas between 3 km to 10 km when examining the impact of armed conflict on access to maternal health services in Nigeria.

An intuitive way around this is to use average distances between households and the nearest social services such as education and health services. With an average distance of 1.78 km between households and the nearest education services, a 3 km radius from a household is deemed to be optimal here in analyzing the impact of the LRA insurgency on education outcomes. I further explore the effect of the number of fatalities and conflict events that occurred at different radii from households. Results are presented in Table 3.

Descriptive statistics for conflict measures used in the main difference in difference analysis (UCDP GED dataset) and the alternative analysis using the ACLED dataset are reported in Table A1 and Table A2, respectively. In Table A1, the measures of conflict intensity used are the total number of conflict events and fatalities up to the date of a household's interview. On average, in a 3 km radius of a household in Northern Uganda, UCDP data reports 0.2 conflict events and 0.6 fatalities perpetrated by the LRA in the region. Conflict measures derived from the ACLED dataset are presented in Table A2 and cover the period 1997 – 2007 in comparison to 1989 – 2007 in UCDP. The ACLED dataset contains higher average values, and this is due to conceptual differences in how violent events are defined as well as data collection methods (Eck, 2012; Raleigh and Kishi, 2019). Results using the ACLED constructed measures are reported in Table A4 and Table A5, for both the number of conflict events and number of fatalities within a 3 km radius of a household measures of conflict intensity, respectively.

3.1 Preliminary Analysis

3.1.1 Parallel Trend Assumption

The main identifying assumption of the Difference in Difference (DiD) strategy used is that individuals' education outcomes in LRA-affected areas and non-affected areas follow the same trend in the absence of conflict. To test the validity of this assumption, I compare average education outcomes for older birth cohorts (i.e., these are

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[11]Most geo-information from surveys is displaced to ensure confidentiality. For example, the Demographic Households Surveys (DHS) geospatial information is restricted to cluster level and is randomly displaced up to 2 km (urban) and rural ones by up to 5 km. Geospatial displacement can cause measurement errors in the regressions. In this study, I use restricted geo-information of households surveyed.

individuals born 1962 to 1970 and are the control group in the main DiD regression) who were out of mandatory school age by 1989, between those residing in LRA affected districts to those in non-affected districts. Figure A1a plots the average completed years of schooling outcomes by cohort of birth between those residing in affected and non-affected, Figure A1b shows the average share of individuals who have attained primary school education and Figure A1c shows average literacy by cohort of birth between those residing in affected and non-affected. The graphs show parallel trends for the two groups.

Next up, I regress the education outcomes on a dummy variable equal to 1 if the district is affected by the LRA insurgency and zero otherwise, year of birth dummies and two-way interactions between affected district dummy and year of birth dummies and results are presented in Table A3. None of the results from the interactions are statistically significant for all three education outcomes in columns 1, 2, and 3. Education outcomes are higher in affected districts but there is no significant differential effect of the LRA for the birth cohorts (1963 -1970) relative to the reference cohort (1962).

4   Result

4.1   Impact of LRA conflict intensity on education outcomes.

In Table 1 below, I use the cumulative number of fatalities within a 3 km radius of a household as a measure for conflict intensity to estimate the effect of exposure to the LRA insurgency in Northern Uganda on education outcomes. Results from the preferred specification (column 3) show the effect of LRA conflict exposure on the number of completed years of schooling for individuals in Northern Uganda. The coefficient of interest is negative, and this result indicates that a one standard deviation increases in the number of conflict fatalities within a 3 km radius of an individual's household i.e., an increase of 25 fatalities led to a loss of 1.5 completed years of schooling. With an average of 3.87, this induces about a 10% fall relative to average completed years of schooling. In column 6, I present the estimates for primary education attainment and find the coefficient to be small and non-significant. For literacy (column 9), I find that a one standard deviation increase in the number of fatalities within a 3 km radius of an individual's household led to a decline in literacy by 0.21 percentage points and this induces an 11% fall relative to average literacy.

Across all columns in Table 1 (except 4, 5, and 6) and Table 2, the coefficient

for $Fatalities(3km)_h$ and $Conflicts(3km)_h$ are positive and highly significant. From the data used to calculate conflict intensity measures, we find that on average rebel activities were more pronounced in towns and other urban centers. These areas tend to be focal community points for service delivery by the local governments or central government and as such services such as schools, health facilities, law enforcement offices, etc., are located near or within urban centers. This would also mean that urban areas will have a greater concentration of individuals with higher education outcomes than their rural counterparts. Using the data, we can see that on average the total number of fatalities (conflict events) in a 3 km radius of a household between 1989 and 2006 is 2(0.7) in urban areas versus 0.3(0.1) in rural areas. In terms of completed years of schooling, the average is 6.6 for urban dwellers in our control group whereas the average is 3.7 for those in rural areas. The results are robust as I include individual and household characteristics in the specification. These include the gender of the individual, migration status during the conflict, gender, and education level of household head, number of household members, if the household's main economic activity is agriculture, household's poverty status, and if the place of residence is rural or urban. These variables are determinants of school attainment.

The magnitude of the LRA insurgence on education outcomes in Northern Uganda follows similar findings elsewhere in sub-Saharan Africa. Results obtained for completed years of schooling are analogous to findings in Ivory Coast and Nigeria. For Ivory Coast, Dabalen and Paul (2014) discovered that an increase in conflict intensity resulted in a decline of 0.94 years in the average years of education. In examining the Boko Haram conflict in North-East Nigeria, Bertoni et al. (2019) observed that a one standard deviation increase in the number of fatalities within a 5 km radius of a child's village results in an 11% drop in average years of completed education. These results are also like research findings outside of sub-Saharan Africa. For example, in Guatemala, Chamarbagwala and Morán (2011) observe that during periods of high conflict intensity average education years declined by 15% and 12% for males and females, respectively. Rodríguez and Sánchez (2012) find that armed conflict in Colombia reduces average years of schooling by 9%.

Note that since treatment is assigned by year of birth and geographical level, two-way clustering of standard errors is performed along those two dimensions. There are fewer than optimal clusters, therefore I present confidence intervals generated by cgmwildboot (Caskey, 2015). Bootstrapped by districts, coefficients on completed years of education, primary school completion, and literacy rate are less significant,

Table 1. Effect Of the LRA Insurgency On Education Outcomes.

	Completed years of schooling			Primary school completion			Literacy		
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
$Fatalities(3km)_h * Treat_i$	-1.773**	-1.774**	-1.455***	-0.127	-0.127	-0.094	-0.245***	-0.245***	-0.213***
	(0.836)	(0.836)	(0.478)	(0.130)	(0.131)	(0.091)	(0.030)	(0.030)	(0.029)
	[-3.15, -0.4]	[-0.15, 0.36]	[-2.16, -0.4]	[-0.33, 0.09]	[-0.33, 0.08]	[-0.75, 0.58]	[-0.46, -0.2]	[-0.44, -0.21]	[-0.34, -0.07]
$Fatalities(3km)_h$	1.802**	1.802**	1.445***	0.136	0.136	0.098	0.257***	0.258***	0.218***
	(0.839)	(0.839)	(0.463)	(0.129)	(0.129)	(0.088)	(0.034)	(0.037)	(0.028)
	[0.40, 3.18]	[0.39, 3.18]	[0.40, 2.13]	[-0.07, 0.34]	[-0.07, 0.34]	[-0.45, 0.69]	[0.24, 0.48]	[0.24, 0.44]	[0.07, 0.34]
Male			1.217***			0.123***			0.197***
			(0.222)			(0.025)			(0.035)
			[1.03, 1.36]			[0.10, 0.14]			[0.12, 0.17]
Ever migrated			0.052			0.015			-0.036*
			(0.078)			(0.009)			(0.018)
			[-0.11, 0.08]			[-0.00, 0.03]			[-0.03, 0.14]
Household head education years			0.235***			0.023***			0.029***
			(0.040)			(0.004)			(0.004)
			[0.19, 0.24]			[0.02, 0.03]			[0.02, 0.02]
Male household head			-0.738***			-0.084***			-0.063***
			(0.124)			(0.016)			(0.018)
			[-0.85, -0.60]			[-0.10, -0.06]			[-0.08, -0.04]
Household size			0.045***			0.004**			0.007**
			(0.015)			(0.002)			(0.003)
			[0.02, 0.06]			[0.002, 0.01]			[0.00, 0.01]
Agricultural household			-0.271***			-0.025*			-0.005
			(0.077)			(0.012)			(0.018)
			[-0.38, -0.13]			[-0.05, 0.003]			[-0.03, 0.01]
Other controls	No	No	Yes	No	No	Yes	No	No	Yes
Year of Birth dummies	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
District dummies	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Survey year dummies	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Time trends	No	Yes	Yes	No	Yes	Yes	No	Yes	Yes
Observations	15139	15139	15139	15139	15139	9097	9097	9097	9097

Notes: Robust standard errors in parentheses, clustered at district and cohort of birth level. 95% confidence interval generated with the cgmwildboot procedure in bracket. Completed years of schooling, primary school education attainment and literacy are the dependent variables computed at the time of survey. $Fatalities(3km)_h$ is the cumulative number of fatalities within 3km of a household over the conflict period up until the time of survey. The treatment group consists of birth cohort (1974 -1999) who are of mandatory schooling age at the start or during the conflict. Consequently, treated is a dummy variable taking the value one if the individual belongs to treatment cohort and were exposed to the LRA conflict during their mandatory schooling age. The control group consists of individuals whose year of birth is between 1962 to 1970 i.e., these are no longer of mandatory school age. Ever migrated is a dummy, equal to 1 if individual has migrated during the war period and zero otherwise. Other control variables include gender, age of household head, gender of household head, education level of household head, household involved in agricultural activity, household size, household poverty indicator, urban residence, etc. Significance levels ***$p<0.01$, **$p<0.05$, $p<0.1$. Source: UNHS (UBOS), UCDP.

unchanged, and insignificant respectively. The statistical significance of the other results in the regression remains virtually unchanged.

4.2 Additional Results

4.2.1 Alternative measure of conflict intensity

Table 2 below reports the results on the impact of LRA insurgency exposure on the education outcomes of interest using the number of conflict events within a 3 km radius of an individual's household. Results in column 1 show the effect of LRA conflict exposure on the number of completed years of schooling for individuals in Northern Uganda. The specification used includes controls, survey weights, fixed effects, and district-specific time trends to account for any unobserved time-varying characteristics at the district level that might influence the effect of the LRA insurgency. Our coefficient of interest is negative, and this result indicates that a one standard deviation increase in conflict events i.e., an increase of 3 conflict events within a 3km radius of an individual's household led to a loss of 0.2 completed years of schooling. With an average of 3.87, this induces a 0.3% fall relative to the average completed years of schooling.

In column 2, I find that a one standard deviation increase in conflict events decreases the probability of attaining primary school education by 2.3 percentage points. As the mean of the dependent variable primary is 0.21, this implies that a one standard deviation increase in the number of conflict events reduces the likelihood of primary school education attainment by 0.2% of the mean. In column 3, I find that a one standard deviation increase in conflict events within a 3 km radius of an individual's household led to a decline in literacy of 2.4 percentage points which suggests a one standard deviation increase in conflict events reduces literacy by 0.18% of the mean.

The results are robust as I include individual and household characteristics in the specification. These include the gender of the individual, migration status during the conflict, gender, and education level of household head, number of household members, whether the household's main economic activity is agriculture, household's poverty status, and if the place of residence is rural or urban. The results under the alternative conflict intensity measure i.e., the number of conflict events are smaller in magnitude and highly significant in comparison to results under the main specification which uses the number of fatalities within a 3 km radius of a surveyed household.

Table 2. Effect of the LRA insurgency on Education outcomes: Number of conflict events.

	Completed years of schooling	Primary school completion	Literacy
	(1)	(2)	(3)
$ConflictEvents(3km)_h * Treat_i$	-0.262**	-0.023***	-0.024***
	(0.098)	(0.003)	(0.008)
	[-0.43, 0.09]	[-0.03, -0.009]	[-0.03, -0.01]
$ConflictEvents(3km)_h$	0.192***	0.016***	0.027***
	(0.063)	(0.002)	(0.008)
	[0.07, 0.28]	[0.005, 0.23]	[0.016, 0.026]
Other controls	Yes	Yes	Yes
Year of Birth dummies	Yes	Yes	Yes
District dummies	Yes	Yes	Yes
Survey year dummies	Yes	Yes	Yes
Time trends	Yes	Yes	Yes
Observations	15139	15139	9097

Notes: Robust standard errors in parentheses, clustered at district and cohort of birth level. 95% confidence interval generated with the cgmwildboot procedure in bracket. Completed years of schooling, primary school education attainment and literacy are the dependent variables computed at the time of survey. $ConflictEvents(3km)_h$ is the cumulative number of conflict events within 3km of a household over the conflict period up until the time of survey. The treatment group consists of birth cohort (1974 -1999) who are of mandatory schooling age at the start or during the conflict. Consequently, treated is a dummy variable taking the value one if the individual belongs to treatment cohort and were exposed to the LRA conflict during their mandatory schooling age. The control group consists of individuals whose year of birth is between 1962 to 1970 i.e., these are no longer of mandatory school age. Ever migrated is a dummy, equal to 1 if individual has migrated during the war period and zero otherwise. Other control variables include gender, age of household head, gender of household head, education level of household head, household involved in agricultural activity, household size, household poverty indicator, urban residence, etc Significance levels ***$p<0.01$, **$p<0.05$, $p<0.1$. Source: UNHS (UBOS), UCDP.

However, only coefficients on literacy rate are highly significant once standard errors are bootstrapped.

4.2.2 Robustness

The Main results estimated are robust to various checks. As discussed earlier in section 5 above, I use an alternative conflict dataset – ACLED (1997 - 2006) to provide further insight into the effect of the LRA insurgency on education outcomes in Northern Uganda. Results obtained from using an alternative dataset are comparable to those obtained using the UCDP dataset. Results obtained in Table A4 and Table A5, show a similar impact of conflict on education outcomes, though the magnitude is smaller. This is further reassuring of the main results attained in Table 1 and Table 2.

To further explore the geographical dimension of the conflict, I examine the effect of LRA insurgency fatalities and conflict events occurring at different kilometer radii of a household. To do this, I construct conflict intensity measures at distances split between 0 and 3km, 3 and 6km, and between 6 and 10km radii of households[12].

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[12]99% of households surveyed have a school within 10km.

Table 3. Effect of the LRA insurgency on Education outcomes at different distance radii

	Completed years of schooling	Primary school completion	Literacy
	(1)	(2)	(3)
$Fatalities(3km)_h$	-1.455***	-0.094	-0.213***
	(0.478)	(0.091)	(0.029)
	[-2.16, -0.4]	[-0.75, 0.58]	[-0.34, -0.07]
$Fatalities(3-6km)_h$	-0.116	-0.006	-0.016
	(0.080)	(0.010)	(0.015)
	[-0.23, -.005]	[-0.01, 0.05]	[-0.03, .003]
$Fatalities(6-10km)_h$	-0.080	-0.029	0.010
	(0.121)	(0.026)	(0.012)
	[-0.27, 0.11]	[-0.07, 0.01]	[-0.04, .004]
Other controls	Yes	Yes	Yes
Year of Birth dummies	Yes	Yes	Yes
District dummies	Yes	Yes	Yes
Survey year dummies	Yes	Yes	Yes
Time trends	Yes	Yes	Yes
Observations	15139	15139	9097

Notes: Robust standard errors in parentheses, clustered at district and cohort of birth level. 95% confidence interval generated with the cgmwildboot procedure in bracket. Completed years of schooling, primary school education attainment and literacy are the dependent variables computed at the time of survey. $Fatalities(3km)_h$ is the cumulative number of fatalities within 3km of a household over the conflict period up until the time of survey. The treatment group consists of birth cohort (1974 -1999) who are of mandatory schooling age at the start or during the conflict. Consequently, treated is a dummy variable taking the value one if the individual belongs to treatment cohort and were exposed to the LRA conflict during their mandatory schooling age. The control group consists of individuals whose year of birth is between 1962 to 1970 i.e., these are no longer of mandatory school age. Ever migrated is a dummy, equal to 1 if individual has migrated during the war period and zero otherwise. Other control variables include gender, age of household head, gender of household head, education level of household head, household involved in agricultural activity, household size, household poverty indicator, urban residence, etc. Significance levels ***$p<0.01$, **$p<0.05$, $p<0.1$. Source: UNHS (UBOS), UCDP..

Results are reported in Table 3 below. These indicate that the number of fatalities and conflict events that occur closer to households (i.e., at a 3km radius of the household) have a higher significant effect on educational outcomes (row 1). Reported results in rows 2 and 3 use measures of conflict intensity where I include the number of fatalities occurring between 3 and 6 km, and between 6 and 10 km radius of a household respectively showing the magnitude of the effect becomes smaller and insignificant with distance.

Next, I investigate whether migration causes possible biases in the main specification. Do individuals respond to conflict intensity by changing residential locations? The UNHS provides information on household migration patterns which among others include year of migration, former place of residence (rural or urban), former district of residence, etc. Considering the timing of migration, I use this information to con-

struct the variable *Ever migrated* used in the main specification. To examine possible migration biases, I re-estimate the main specification using a sample of individuals who never migrated during the conflict.

The sample reduces to 12921 individuals while the magnitudes of the effect do not differ much from the ones obtained in the main specification, the significance level is unchanged for completed years of schooling but there is a reduction in significance for literacy. Results[13] are reported in Table 4. For completed years of schooling, results are presented in column 1, primary school education attainment is still insignificant (column 2). In column 3, results for literacy are reported. Here, the magnitude increases but the level of statistical significance is reduced. Overall, migration does not cause a significant bias in the main estimates as the variable Ever migrated has been curated to time migration of a household at the onset and during the course of the conflict. Note that the coefficient on years of schooling is less significant once standard errors are bootstrapped while the coefficients on primary school completion and literacy remain unchanged.

Finally, I implemented a placebo test re-estimating the main regression specification using placebo groups for both treatment and control groups in the DiD analysis. The placebo treatment and control groups consist of individuals who supposedly completed mandatory schooling by the start of the conflict. Placebo treatment includes individuals born 1962 -1970 who are compared to a placebo control group born 1958 – 1961[14]. Results reported in Table A6 of the Appendix show that the effect of the conflict intensity measure is not significant. Estimates for completed years of schooling are reported in columns 1 and 4, primary school education attainment in columns 2 and 5, and literacy in columns 3 and 6. These results can be used to buttress the validity of the parallel trend assumption and are reassuring of the main estimates obtained in the DiD.

4.2.3 Heterogeneity

Results obtained show that exposure to the LRA conflict reduces the education outcomes of individuals in Northern Uganda. However, it is possible that the magnitude of the effect is heterogeneous. Preceding research has documented how conflicts can

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[13]Coefficient on completed years of schooling and literacy are less significant at 5% and 1% levels respectively once standard errors are bootstrapped while the coefficient on primary school completion remains unchanged.

[14]By 2002, 56.1% of the population was aged less than 18 years (UBOS, 2006b) and as such there is a small sample available in the survey to be used for the control group in the placebo test.

Table 4. Effect of the LRA insurgency on Education outcomes excluding migrants.

	Completed years of schooling	Primary school completion	Literacy
	(1)	(2)	(3)
$Fatalities(3km)_h * Treat_i$	-1. 287***	-0.055	-0.203***
	(0.365)	(0.81)	(0.022)
	[-1.94, -.28]	[-.22, .14]	[-.32, -.04]
$Fatalities(3km)_h$	1.150***	0.048	0.213***
	(0.334)	(0.079)	(0.026)
	[.19, 1.72]	[-.15, .21]	[.034, .31]
Other controls	Yes	Yes	Yes
Year of Birth dummies	Yes	Yes	Yes
District dummies	Yes	Yes	Yes
Survey year dummies	Yes	Yes	Yes
Time trends	Yes	Yes	Yes
Observations	10624	10624	6388

Notes: Robust standard errors in parentheses, clustered at district and cohort of birth level. 95% confidence interval generated with the cgmwildboot procedure in bracket. Completed years of schooling, primary school education attainment and literacy are the dependent variables computed at the time of survey. $Fatalities(3km)_h$ is the cumulative number of fatalities within 3km of a household over the conflict period up until the time of survey. The treatment group consists of birth cohort (1974 -1999) who are of mandatory schooling age at the start or during the conflict. Consequently, treated is a dummy variable taking the value one if the individual belongs to treatment cohort and were exposed to the LRA conflict during their mandatory schooling age. The control group consists of individuals whose year of birth is between 1962 to 1970 i.e., these are no longer of mandatory school age. Ever migrated is a dummy, equal to 1 if individual has migrated during the war period and zero otherwise. Other control variables include gender, age of household head, gender of household head, education level of household head, household involved in agricultural activity, household size, household poverty indicator, urban residence, etc. Significance levels ***$p<0.01$, **$p<0.05$, $p<0.1$. Source: UNHS (UBOS), UCDP..

Table 5. Effect of the LRA insurgency on Education outcomes by gender

	Completed years of schooling		Primary school completion		Literacy	
	Male	Female	Male	Female	Male	Female
	(1)	(2)	(3)	(4)	(5)	(6)
$Fatalities(3km)_h * Treat_i$	-1. 116*	-1. 942***	-0.152**	-0.084	-0.056	-0.277***
	(0.555)	(0.458)	(0.062)	(0.133)	(0.051)	(0.058)
	[-1.94, -.28]	[-2.63, -.67]	[-0.75, 0.58]	[-0.28, 0.17]	[-0.36, -0.01]	[-0.36, -0.01]
$Fatalities(3km)_h$	0.890	1.946***	0.156**	0.089	0.116***	0.280***
	(0.540)	(0.450)	(0.072)	(0.131)	(0.039)	(0.008)
	[.19, 1.72]	[0.69, 2.63]	[-0.45, 0.69]	[-0.16, 0.29]	[0.011, 0.36]	[0.011, 0.36]
Other controls	Yes	Yes	Yes	Yes	Yes	Yes
Year of Birth dummies	Yes	Yes	Yes	Yes	Yes	Yes
District dummies	Yes	Yes	Yes	Yes	Yes	Yes
Survey year dummies	Yes	Yes	Yes	Yes	Yes	Yes
Time trends	Yes	Yes	Yes	Yes	Yes	Yes
Observations	7250	7889	7250	7889	4031	5066
Full Sample	15139		15139		9097	

Notes: Robust standard errors in parentheses, clustered at district and cohort of birth level. 95% confidence interval generated with the cgmwildboot procedure in bracket. Completed years of schooling, primary school education attainment and literacy are the dependent variables computed at the time of survey. $Fatalities(3km)_h$ is the cumulative number of fatalities within 3km of a household over the conflict period up until the time of survey. The treatment group consists of birth cohort (1974 -1999) who are of mandatory schooling age at the start or during the conflict. Consequently, treated is a dummy variable taking the value one if the individual belongs to treatment cohort and were exposed to the LRA conflict during their mandatory schooling age. The control group consists of individuals whose year of birth is between 1962 to 1970 i.e., these are no longer of mandatory school age. Ever migrated is a dummy, equal to 1 if individual has migrated during the war period and zero otherwise. Other control variables include gender, age of household head, gender of household head, education level of household head, household involved in agricultural activity, household size, household poverty indicator, urban residence, etc. Significance levels ***$p<0.01$, **$p<0.05$, $p<0.1$. Source: UNHS (UBOS), UCDP..

have significant differentials in education outcomes across gender (Bertoni et al., 2019; Brück et al., 2019; Buvinić et al., 2014; Chamarbagwala and Morán, 2011; Shemyakina, 2011; Valente, 2014). To check for this possibility in this setting of the LRA insurgency, I examine the effect of conflict by gender.

Results reported in Table 5 indicate that there is evidence of the statistically significant differential effect of conflict intensity between males and females on education outcomes. High conflict intensity exposure leads to a loss of 1.9 years of completed years of schooling for females[15] at a higher level of significance in comparison to a loss of about 1 year for their male counterparts[16] (columns 1). An explanation for this disparity is that before the LRA insurgency, males supposedly had a higher average number of completed years of schooling in comparison to females (6.3 vs. 3.2). This differential effect can also be attributed to the fact that schools were viewed as safe places which might have caused an increase in school enrolment and attendance for males to protect themselves from recruitment or re-recruitment into the war (WCRWC, 2005). The magnitude for primary school education attainment is

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[15]Coefficients on completed years of schooling remain statistically significant once bootstrapped while those on literacy and primary education become insignificant.

[16]Coefficients on literacy remain statistically significant once bootstrapped while those on completed years of schooling and primary education become insignificant.

negative with a decline of 0.15 percentage points for males but it is insignificant for females. For literacy, I find that the magnitude of the effect is higher for men at a higher level of significance than that of their female counterparts.

Next, I will consider the type of place of residence. Results reported in Table A7 indicate that only literacy levels are negative and significant, and completed years of schooling and primary school completion results are insignificant. The differential effect here can be partly explained by the fact that most education services tend to be in or around towns. Another reason is that forced school relocations during the conflict were to safe areas or IDP camps and these were mainly concentrated in or near urban areas in comparison to rural areas. LRA attacks were more pronounced in less protected areas such as villages and newly established IDP camps (Global IDP Project, 2005, p. 41). In Table A8, I find a negative coefficient on the triple interaction term which indicates that individuals residing in areas with high conflict exposure have a higher impact on the number of completed years of schooling in comparison to those residing in low conflict intensity areas. There are no significant results for primary schooling completion and literacy. Further on, I find no heterogeneity in the impact of conflict by duration of exposure.

5   Possible Transmission Mechanism

5.1   Supply Side

As noted by Justino (2016), violent conflicts have an extremely negative effect on education supply in the form of destruction of vital education infrastructures and resources, displacement of communities, and limited access. This curtails the conditions or environment necessary for the advancement of education. I intend to explore how the LRA insurgency induced neglect in the provision or maintenance of school infrastructures, increased school size as individuals were displaced or forcibly relocated to learning centers in safe zones, and an increase in the student-teacher ratio. To elucidate how this may contribute to explaining the negative effect of conflict on education outcomes, I provide evidence on the effect of the LRA insurgency on community-level school characteristics that form an enabling education environment.

I construct proxy school characteristics using a set of variables provided under the community module of the UHNS. These are student/teacher ratio, school size, and conditions. To estimate the effect of the LRA insurgency on the school environment, I regress each school characteristic on the community-level number of fatalities

Table 6. Supply Side Mechanisms - Effect of the LRA insurgency on school conditions.

	Infrastructure	School size	Student/teacher ratio
	(1)	(2)	(3)
$Fatalities(3km)_h * Treat_i$	-0.007***	0.009***	-0.093**
	(0.001)	(0.0.001)	(0.040)
	[-0.01, 0.01]	[0.007, 0.02]	[-0.04, 0.14]
Survey year dummies	Yes	Yes	Yes
Community dummies	Yes	Yes	Yes
Mean	0.73	6.5	55.9
Observations	5670	5670	5670

Notes: Robust standard errors in parentheses, clustered at district and cohort of birth level. 95% confidence interval generated with the cgmwildboot procedure in bracket. Reported in the first row are the dependent variables for each regression. $Fatalities(3km)_h$ is community level number of fatalities up until the time of survey. *Student/Teacher* is the school-level ratio between the number of students and the number of teachers. *School size* is the total number of students in school relative to size of school. *Infrastructure* is the state of school infrastructure. Significance levels ***p<0.01, **p<0.05, p<0.1. Source: UNHS (UBOS), UCDP.

controlling for year-fixed effects and community-fixed effects.

Results reported in Table 6 indicate an increase in conflict intensity reduces the probability of school infrastructure construction or maintenance (column 1). One reason for this effect is that local governments lack the capacity to supervise, implement education standards, and upgrade infrastructure (Global IDP Project, 2005). Another likely explanation is that resources are scarce in times of war which results in the central government re-directing resources towards the war effort or other more essential services. Results shown in column 2 also indicate that conflict intensity increased school sizes. This result can be explained by the displacement of communities and schools due to direct LRA rebel attacks. The local governments ordered displaced schools to operate as learning centers and teachers were to report to the nearest learning centers irrespective of where their students ended up. Schools isolated outside of town centers were closed and students were relocated to schools in safe areas or to learning centers. In column 3, results indicate that conflict intensity reduces the student/teacher ratio. This is partly explained by the local government's directive for all displaced students and teachers to report to their nearest learning centers.

Table 7. Demand Side Mechanisms - Effect of the LRA insurgency on household decisions.

	Child labor participation	Household education expenditure
	(1)	(2)
$Fatalities(3km)_h * Treat_i$	0.001	-0.030**
	(0.004)	(0.015)
	[-0.07, 0.06]	[-0.001, 0.0003]
Survey year dummies	Yes	Yes
Community dummies	Yes	Yes
Mean	017	0.01
Observations	8514	15136

Notes: Robust standard errors in parentheses, clustered at district and cohort of birth level. 95% confidence interval generated with the cgmwildboot procedure in bracket. Reported in the first row are the dependent variables for each regression. $Fatalities(3km)_h$ is number of fatalities that occurred in a 3 km radius of household during previous year. *Child labor participation* is an indicator variable equal to one if child is engaged in labor market activities and zero otherwise. *Household education expenditure* is the share of education of a household's total expenditure per annum. Significance levels ***$p{<}0.01$, **$p{<}0.05$, $p{<}0.1$. Source: UNHS (UBOS), UCDP.

5.2   Demand Side

Next, I explore the demand side mechanisms. The independent variable for the regressions is the household-level number of LRA insurgency fatalities during the conflict up until the year of the survey. Child labor is a dummy variable taking the value 1 if the child participates in any labor activity and zero otherwise. Education expenditure is education expenses as a share of total household expenditure per capita.

In Table 7, column 1, results indicate that exposure to conflict intensity increases child labor market participation but the magnitude is statistically insignificant. Due to conflicted related impacts such as death, injury, or recruitment, children are forced to drop out of school early and join the labour market to replace lost household labour (Rodríguez and Sánchez, 2012; Justino et al., 2014). Results in column 2, show that exposure to conflict decreases a household's expenditure on education. In times of shocks such as violent conflicts, households are forced to reallocate resources to make up for negative effects emanating such as poverty, adverse health shocks, etc. Disruptions to the education system due to displacement, threat of child abductions, persistent fear, and insecurity induce households to scale back education expenses. This is reflected in the household's annual expenditure on education in comparison to other household expenses.

6 Conclusions

For about 19 years, the region experienced protracted insecurity at the hands of the LRA insurgents culminating in 2006. Despite government and donor-led reconstruction efforts, little is known about how wide the variation in conflict intensity across the region has caused disparities in development. A more disaggregated view of these differentials by using the wide variation in LRA conflict intensity can enable policymakers to develop the appropriate interventions rather than taking an aggregate view.

In this study, I examine the causal impact of the LRA insurgency on educational outcomes in Northern Uganda by exploiting variation in exposure to conflict intensity by birth cohort, survey date, and location to investigate differences in education outcomes in Northern Uganda. I find that conflict exposure reduces the number of years of completed schooling, with the magnitude of the effect being larger for females. I also find that conflict reduces literacy, with the effect being larger for males.

In addition, I identify key supply- and demand-side mechanisms that shape education systems in a conflict setting. In terms of supply-side, I show that conflict intensity negatively affects the education environment and causes supply-side barriers in two ways. First, combat events relate to the destruction and neglect of infrastructure necessary for the functioning of education services. Second, violent conflict resulted in the breakdown of communities as people got displaced, this affected students and teachers who were forcibly relocated by local government and the national army. On the demand side, I show how conflict may adversely affect the demand incentives for education due to factors such as low returns to education whereby children are forced to participate in the labour market early or household resource re-allocation where households reduce education expenditure and re-allocate resources elsewhere. It should be noted that some mechanisms such as perception of fear and insecurity, recruitment of child soldiers, etc., cannot be fully examined in this article due to data limitations.

A vital caveat applies here, it is possible that the timing and implementation of the survey could lessen the estimated magnitude of the effect of the conflict. Nonetheless, the empirical findings of this study on Northern Uganda bring forth vital evidence that complements existing studies on the impact of violent conflicts on education.

Overall, our findings show that the LRA insurgency in Northern Uganda had a significant detrimental impact on educational outcomes through different supply and demand bottlenecks. Understanding the critical barriers through which violent con-

flicts affect education is essential in the development of effective policy interventions during and in the aftermath of conflicts.

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A Appendix

Table A1. Descriptive stats

Variable Name	Obs.	Mean	SD	Min	Max
Completed years of schooling	15167	3.87	3.548	0	17
Primary completed	15167	0.21	0.406	0	1
Literacy	15167	0.55	0.498	0	1
Treated	15563	0.88	0.324	0	1
Male	15167	0.48	0.500	0	1
Ever migrated	15167	0.30	0.458	0	1
Household head education	15167	5.82	4.270	0	17
Male household head	15167	0.72	0.448	0	1
Household size	15139	7.41	3.300	1	25
Agricultural household	15167	0.42	0.494	0	1
Poverty	15167	0.49	0.500	0	1
Urban place of residence	15167	0.35	0.478	0	1
Distance to nearest school	15167	1.78	2.557	0	84
Distance to nearest health center	15167	3.77	10.860	0	350
N. of conflict events in 3 km radius	15167	0.34	3.514	0	108
N. Fatalities in 3 km radius	15167	0.81	25.116	0	1374

Source: UNHS, UCDP

Table A2. Descriptive stats

Variable Name	Obs.	Mean	SD	Min	Max
Completed years of schooling	15167	3.87	3.548	0	17
Primary completed	15167	0.21	0.406	0	1
Literacy	15167	0.55	0.498	0	1
Treated	15167	0.88	0.324	0	1
Male	15167	0.48	0.500	0	1
Ever migrated	15167	0.30	0.458	0	1
Household head education	15139	5.82	4.270	0	17
Male household head	15167	0.72	0.448	0	1
Household size	15167	7.41	3.300	1	25
Agricultural household	15167	0.42	0.494	0	1
Poverty	15167	0.49	0.500	0	1
Urban place of residence	15167	0.35	0.478	0	1
Distance to nearest school	15167	1.78	2.774	0	84
Distance to nearest health center	15167	3.67	13.343	0	350
N. of conflict events in 3 km radius	15167	0.28	3.387	0	60
N. Fatalities in 3 km radius	15167	3.18	5.735	0	132

Source: UNHS, ACLED (1997 -2007)

Figure A1. Parallel Trends Assumption: Pre-conflict trends in education outcomes.
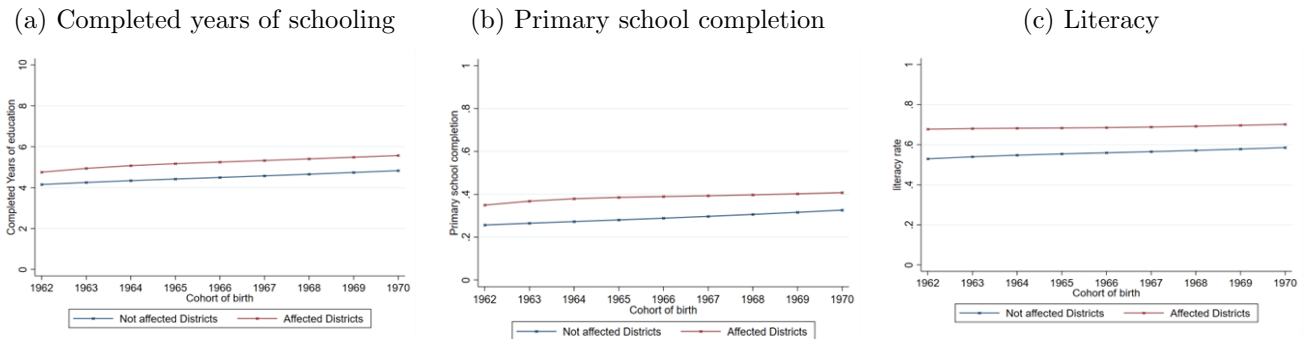

(a) Completed years of schooling   (b) Primary school completion   (c) Literacy

Table A3. Parallel trend assumption test in regression form.

	Education years	Primary School Completion	Literacy
	(1)	(2)	(3)
YOB 1963*Affected Districts	1.619	0.366	-0.003
	(2.339)	(0.266)	(0.295)
YOB 1964*Affected Districts	0.065	0.076	-0.027
	(2.044)	(0.232)	(0.258)
YOB 1965*Affected Districts	0.413	0.079	0.038
	(2.044)	(0.232)	(0.258)
YOB 1966*Affected Districts	1.955	0.339	0.015
	(2.341)	(0.266)	(0.295)
YOB 1967*Affected Districts	1.881	0.245	0.017
	(1.938)	(0.220)	(0.244)
YOB 1968*Affected Districts	0.024	0.051	-0.169
	(2.044)	(0.232)	(0.258)
YOB 1969*Affected Districts	0.709	0.183	-0.046
	(1.940)	(0.220)	(0.245)
YOB 1970*Affected Districts	1.178	0.206	0.014
	(1.938)	(0.220)	(0.244)
Affected Districts	-0.078	-0.063	0.142
	(1.654)	(0.188)	(0.209)
Constant	4.078***	0.244***	0.494***
	(0.370)	(0.042)	(0.047)
YOB dummies	Yes	Yes	Yes
N	178	178	178

Source: UBOS

Table A4. Effect of the LRA insurgency on Education outcomes: Number of Fatalities

	Completed years of schooling	Primary school completion	Literacy
	(1)	(2)	(3)
$Fatalities(3km)_h * Treat_i$	-0.241**	-0.022***	-0.019***
	(0.083)	(0.007)	(0.005)
	[-0.87, 0.28]	[-0.09, 0.04]	[-0.13, 0.06]
$Fatalities(3km)_h$	0.169**	0.014***	0.019***
	(0.070)	(0.004)	(0.0112)
	[-0.34, 0.74]	[-0.03, 0.08]	[-0.06, 0.12]
Other controls	Yes	Yes	Yes
Year of Birth dummies	Yes	Yes	Yes
District dummies	Yes	Yes	Yes
Survey year dummies	Yes	Yes	Yes
Time trends	Yes	Yes	Yes
Observations	15139	15139	9097

Notes: Robust standard errors in parentheses, clustered at district and cohort of birth level. 95% confidence interval generated with the cgmwildboot procedure in bracket. Completed years of schooling, primary school education attainment and literacy are the dependent variables computed at the time of survey. $Fatalities(3km)_h$ is the cumulative number of fatalities within 3km of a household over the conflict period up until the time of survey. The treatment group consists of birth cohort (1974 -1999) who are of mandatory schooling age at the start or during the conflict. Consequently, treated is a dummy variable taking the value one if the individual belongs to treatment cohort and were exposed to the LRA conflict during their mandatory schooling age. The control group consists of individuals whose year of birth is between 1962 to 1970 i.e., these are no longer of mandatory school age. Ever migrated is a dummy, equal to 1 if individual has migrated during the war period and zero otherwise. Other control variables include gender, age of household head, gender of household head, education level of household head, household involved in agricultural activity, household size, household poverty indicator, urban residence, etc. Significance levels ***$p<0.01$, **$p<0.05$, $p<0.1$. Source: UNHS (UBOS), ACLED.

Table A5. Effect of the LRA insurgency on Education outcomes: Number of conflict events

	Completed years of schooling	Primary school completion	Literacy
	(1)	(2)	(3)
$ConflictEvents(3km)_h * Treat_i$	-0.149***	-0.015***	-0.021***
	(0.044)	(0.003)	(0.003)
	[-0.40, 0.09]	[-0.07, 0.04]	[-0.03, -0.01]
$ConflictEvents(3km)_h$	0.092***	0.009**	0.020***
	(0.023)	(0.001)	(0.002)
	[-0.02, 0.20]	[-0.03, 0.04]	[0.01, 0.03]
Other controls	Yes	Yes	Yes
Year of Birth dummies	Yes	Yes	Yes
District dummies	Yes	Yes	Yes
Survey year dummies	Yes	Yes	Yes
Time trends	Yes	Yes	Yes
Observations	15139	15139	9097

Notes: Robust standard errors in parentheses, clustered at district and cohort of birth level. 95% confidence interval generated with the cgmwildboot procedure in bracket. Completed years of schooling, primary school education attainment and literacy are the dependent variables computed at the time of survey. $Fatalities(3km)_h$ is the cumulative number of fatalities within 3km of a household over the conflict period up until the time of survey. The treatment group consists of birth cohort (1974 -1999) who are of mandatory schooling age at the start or during the conflict. Consequently, treated is a dummy variable taking the value one if the individual belongs to treatment cohort and were exposed to the LRA conflict during their mandatory schooling age. The control group consists of individuals whose year of birth is between 1962 to 1970 i.e., these are no longer of mandatory school age. Ever migrated is a dummy, equal to 1 if individual has migrated during the war period and zero otherwise. Other control variables include gender, age of household head, gender of household head, education level of household head, household involved in agricultural activity, household size, household poverty indicator, urban residence, etc. Significance levels ***$p<0.01$, **$p<0.05$, $p<0.1$. Source: UNHS (UBOS), ACLED.

Table A6. Placebo Test for Differences in Trends in Education Outcomes

	(1)	(2)	(3)	(4)	(5)	(6)
$Fatalities(3km)_h * Treat_i$	-0.031	-0.005	0.008			
	(0.041)	(0.005)	(0.008)			
	[-1.85, 0.35]	[-0.03, 0.02]	[-0.54, 0.50]			
$Fatalities(3km)_h$	-0.030	0.001	-0.014			
	(0.021)	(0.002)	(0.006)			
	[-1.88, 1.93]	[-.004, .006]	[-0.43, 0.39]			
$ConflictEvents(3km)_h * Treat_i$				-0.012	-0.006	-0.002
				(0.049)	(0.012)	(0.001)
						[-0.03, 0.04]
				[-0.37, 0.36]	[-0.12, 0.16]	
						9
$ConflictEvents(3km)_h$				-0.056	0.003	-0.011
				(0.042)	(0.005)	(0.012)
				[-0.28, 0.20]	[-.014, .016]	[-0.03, 0.12]
Other controls	Yes	Yes	Yes	Yes	Yes	Yes
Year of Birth dummies	Yes	Yes	Yes	Yes	Yes	Yes
District dummies	Yes	Yes	Yes	Yes	Yes	Yes
Survey year dummies	Yes	Yes	Yes	Yes	Yes	Yes
Time trends	Yes	Yes	Yes	Yes	Yes	Yes
Observations	4264	4264	3275	4264	4264	3275

Notes: Robust standard errors in parentheses, clustered at district and cohort of birth level. 95% confidence interval generated with the cgmwildboot procedure in bracket. Completed years of schooling, primary school education attainment and literacy are the dependent variables computed at the time of survey. $Fatalities(3km)_h$ and $ConflictEvents(3km)_h$ are defined as cumulative number of fatalities and conflict events that occurred in a 3 km radius of the household h up to the time of survey. $Treat_i$ is an indicator taking value 1 if individual is born 1962 – 1970 and were exposed to the LRA conflict. Control variables include gender, age of household head, gender of household head, education level of household head, household involved in agricultural activity, household size, household poverty indicator, urban residence, etc. Significance levels ***p<0.01, **p<0.05, p<0.1. Source: UNHS (UBOS), UCDP.

Table A7. Effect of the LRA insurgency on Education outcomes by type of place of residence

	Completed years of schooling	Primary School Completion	Literacy
	(1)	(2)	(3)
$Fatalities(3km)_h * Treat_i * Urban$	1.651	0.094	-0.199***
	(0.999)	(0.205)	(0.037)
	[-0.02, 3.20]	[-0.13, 0.326]	[-0.28, -0.085]
$Fatalities(3km)_h * Treat_i$	-2.280	-0.162	-0.090***
	(1.605)	(0.239)	(0.037)
	[-4.95, 0.512]	[-0.54, 0.224]	[-0.15, -0.025]
$Fatalities(3km)_h * Urban$	-1.928*	-0.118	0.028
	(1.053)	(0.198)	(0.017)
	[-3.53, -0.107]	[-0.33, 0.096]	[-0.06, 0.118]
$Fatalities(3km)_h$	2.560	0.192	0.254***
	(1.606)	(0.222)	(0.42)
	[-0.29, 5.246]	[-0.17, 0.539]	[0.16, 0.324]
Controls	Yes	Yes	Yes
Survey weights	Yes	Yes	Yes
Year of birth dummies	Yes	Yes	Yes
District dummies	Yes	Yes	Yes
Observations	14897	14897	14897

Notes: Robust standard errors in parentheses, clustered at district and cohort of birth level. 95% confidence interval generated with the cgmwildboot procedure in bracket. Completed years of schooling, primary school education attainment and literacy are the dependent variables computed at the time of survey. $Fatalities(3km)_h$ is the cumulative number of fatalities within 3km of a household over the conflict period up until the time of survey. The treatment group consists of birth cohort (1974 -1999) who are of mandatory schooling age at the start or during the conflict. Consequently, treated is a dummy variable taking the value one if the individual belongs to treatment cohort and were exposed to the LRA conflict during their mandatory schooling age. The control group consists of individuals whose year of birth is between 1962 to 1970 i.e., these are no longer of mandatory school age. Ever migrated is a dummy, equal to 1 if individual has migrated during the war period and zero otherwise. Other control variables include gender, age of household head, gender of household head, education level of household head, household involved in agricultural activity, household size, household poverty indicator, urban residence, etc. Significance levels ***$p<0.01$, **$p<0.05$, $p<0.1$. Source: UNHS (UBOS), UCDP.

Table A8. Effect of the LRA insurgency on Education outcomes by area conflict intensity

	Completed years of schooling	Primary School Completion	Literacy
	(1)	(2)	(3)
$Fatalities(3km)_h * Treat_i * High$	-1.850**	-0.408	-0.150
	(0.826)	(0.264)	(0.106)
	[-0.111, 3.294]	[-0.157, 0.341]	[-0.148, 0.091]
$Fatalities(3km)_h * Treat_i$	-1.353***	0.026	-0.156***
	(0.444)	(0.143)	(0.044)
	[-5.017, 0.560]	[-0.553, 0.239]	[-0.398, 0.031]
$Fatalities(3km)_h * High$	2.343**	0.413	0.078
	(0.885)	(0.263)	(0.122)
	[-3.667, -0.07]	[-0.339, 0.106]	[-0.112, 0.170]
$Fatalities(3km)_h$	0.897*	-0.022	0.239***
	(0.511)	(0.141)	(0.054)
	[-0.359, 5.337]	[-0.178, 0.553]	[-0.022, 0.405]
Controls	Yes	Yes	Yes
Survey weights	Yes	Yes	Yes
Year of birth dummies	Yes	Yes	Yes
District dummies	Yes	Yes	Yes
Observations	14897	14897	14897

Notes: Robust standard errors in parentheses, clustered at district and cohort of birth level. 95% confidence interval generated with the cgmwildboot procedure in bracket. Completed years of schooling, primary school education attainment and literacy are the dependent variables computed at the time of survey. $Fatalities(3km)_h$ is the cumulative number of fatalities within 3km of a household over the conflict period up until the time of survey. The treatment group consists of birth cohort (1974 -1999) who are of mandatory schooling age at the start or during the conflict. Consequently, treated is a dummy variable taking the value one if the individual belongs to treatment cohort and were exposed to the LRA conflict during their mandatory schooling age. The control group consists of individuals whose year of birth is between 1962 to 1970 i.e., these are no longer of mandatory school age. Ever migrated is a dummy, equal to 1 if individual has migrated during the war period and zero otherwise. Other control variables include gender, age of household head, gender of household head, education level of household head, household involved in agricultural activity, household size, household poverty indicator, urban residence, etc. Significance levels ***$p<0.01$, **$p<0.05$, $p<0.1$. Source: UNHS (UBOS), UCDP.