

Legacies of Civil Wars: The Health Costs Long After the Fighting Ends

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Abstract

Researchers have for a long time tried to measure the costs to civil war, with most studying the immediate and direct effects of war. Here we argue that civil wars have negative health consequences that last well beyond the period of active fighting. Using cross-national analysis of the World Health Organisation's (WHO)'s disability-adjusted life years (DALY) dataset for the 2000 and 2012 period, this negative effect is particularly strong during the 1990s, while decreasing after the turn of the century. This substantial long-term effect remains after controlling for several political and economic factors. We find evidence to support earlier notions that civil war through diseases and conditions seem to disproportionately affect women and children. While there is also evidence indicating that the legacy costs of a civil conflict last well over twenty-years, where a conflict during the 1990s still has a lingering long-term impact on healthy life-years in 2012.

Keywords: Civil war; public health; disability-adjusted life year

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1 Introduction

The end of the Cold War has been numerous fluctuations in the number and severity of armed conflicts. As of 2014, intrastate conflicts are by far the most common, accounting for almost 63% of the 40 armed conflicts (Pettersson and Wallensteen, 2015). It is this type of armed conflict that has shown to both last the longest, as well as, having the greatest consequences (Fearon, 2004). Collier and Hoeffler (2008), using macro-level data, estimate the total cost of a civil conflict on a country to be as high as US\$65 billion. To date, most investigations on the consequences of civil war and its aftermath have been at a macro level, using cross-country panel data to estimate the impact on gross domestic product (GDP) (Collier, 1999; Collier et al., 2003). Even on a rarer microeconomic level, the analysis on the costs of civil war is almost always economic, focusing on household surveys to assess income, skills, size and survivability of firms (Collier and Duponchel, 2012).

Yet, the costs of conflict can be wide ranging not only for countries directly affected, but also for neighbours. These harmful outcomes are both economic and social, with effects in the short, medium and long-term (Blattman and Miguel, 2010). The direct or immediate short-term costs from civil conflict on factors of production and technology are only a fraction of their longer-term consequences of social, institutional and psychological misery. While it is unsurprising that civil wars kill and maim people, what matters more is that civil wars continue to directly kill and harm people long after the shooting stops (Ghobarah et al., 2003).

In many countries conflict leads to numerous hidden casualties and the devastation can mean civilians die for years after a conflict has ended. As argued by Anderton and Carter (2009), estimated fatalities from genocides and politicides after a war is disturbingly higher than battle-related deaths. In Afghanistan almost 1 million people died in military related fatalities after the US and coalition invasion, while Cambodian genocide took an estimated 2.7 million lives. Deaths from military related activities, however, are only part of the indirect aftermath on civilians engendered by conflict. There remains widespread violence and health effects on the civil popula-

tion well after the fighting ends. In Rwanda, it has been estimated that over 200 000 women refugees have been raped during and after the civil war and the transmission of HIV was reported as a deliberate act (Carballo and Solby, 2001; Elbe, 2002). While in the DRC, following the civil war, adult and infant mortality shot up by almost 20 percentage points (Guha-Sapir and Van Panhuis, 2002).

In a more general context of civil conflict and its impact on public health there is strong correlation that the region with the highest incidence of civil conflict, Africa, is also the region with the highest number of years lost due to disease and disability. In 2012, Africa experienced 13 civil conflicts (41% of the civil conflicts) and had the highest disease burden, losing the equivalent of 740 DALY's per 1 000 people. This is over three times larger than the region, Americas, with the lowest DALY rates of 273 per 1 000 people (WHO, 2015). Interestingly, the Americas was also the region to have the least amount of armed conflict in 2012, with only 2 conflicts taking place (Pettersson and Wallensteen, 2015).

The World Health Organisation (WHO) differentiate violence into three categories: self harm (i.e. suicide), interpersonal violence (i.e. violence between partners, family violence, rape, sexual assault or institutional violence in schools, prisons or and workplaces) and collective violence (i.e. armed conflict, genocide, terror and organised crime). Together, these form a system of violence ranging from individual and relationship related to communal and large scale violence. From a public health perspective, while the health effects during a civil conflict is well established,¹ only a very limited amount of studies have looked at its long-term impact (see Ghobarah et al., 2003) and none have looked at the evolution of the conflict health relationship over time. Conflict in a country creates an environment whereby all forms of violence and lingering health effects are possible, and many are considered as a legacies well past a conflicts end (Dunne, 2013). It this to this health effect that this paper now turns to.

¹There is a well established short-term relationship between infectious disease outbreaks, health system breakdowns and refugees, while disease deaths from conflict are found to be substantially more frequent than deaths from direct violence (Toole, 1997; Roberts et al., 2001).

The WHO now provides DALY for two time periods 2002 and 2012, this paper will look to address two key gaps in the long-term impact of civil war on public health literature. First it will look to compare the effect civil conflict has on public health over the 2 different time periods 2002 and 2012 and investigate if there is a substantial difference in the effect over the 2 time periods. Second, this paper will look to use a difference-in-difference estimation technique to determine the effect in DALY's between countries with and without civil conflict. The next section will offer a brief overview of cost of conflict literature and the legacies of war. This is followed by a description of the DALY measurement. Section four will discuss the theoretical framework and the hypothesis being tested, while section five will provide the empirical analysis. The sixth and final section closes with conclusions and policy recommendations.

2 The Economic and Social Costs of Civil Conflict

The causes of conflict are as varied as the nature of conflict and the roots of war are multifaceted, with important historical contexts. There are a number of potential factors that can be identified including colonial legacy; military governments and militaristic cultures; ethnicity and religion; unequal development; inequality and poverty; bad leadership and/or polity frailties and inadequacies; external influences; greed/opportunity/feasibility; and natural resources (Collier and Hoeffler, 2004; Fearon and Laitin, 2003; Ross, 2006; Cunningham and Lemke, 2014). Very few conflicts are simple, they are often a combination of factors and this fact can have important implications for the legacies it leaves behind, from the achievement of peace, the success of post conflict reconstruction policies and its health system.

There are differences in opinion on the effects of war. Some suggest a positive role of modernisation, conflict and war can be positive or at least have positive effects, but most emphasise that the destructive effects of conflict and war have real costs and impact upon economies negatively. They also have legacy costs that can last for a long time. As we shall see

the actual costs of conflict are huge, both direct and indirect, and tend to fall on some of the world's poorest countries. The true costs are almost invariably understated as the legacy costs can continue for many years (Dunne, 2013).

The costs of armed conflicts are massive and wide ranging. These harmful effects are both economic and social, with consequences in the short, medium and long-term (Blattman and Miguel, 2010). Starting with the short and medium term ones that are generally recognized, these include the lives lost, the permanent injuries, the refugees, military expenditure, asset losses (i.e. destroyed capital including human), GDP or production losses (i.e. income), trade losses. The aftermath of a civil conflict leaves behind a persisting legacy of poverty and misery. Military expenditure is generally higher after a civil war, where over 17% of a country's GDP is lost to military spending for the first decade after a war (Collier et al., 2003). There are similar negative effects to capital whereby by the end of the 1st decade of post-war peace, capital flight has risen to over 26%. A even more power effect is seen for human capital, where conflicts cause mass migration of to other regions which in-turn potentially provide a post-conflict channel of further emigration. In addition to the these economic and political costs, there are other legacy costs which are often not considered, including, intergenerational effects, transboundary effects, and environmental effects.

Alternatively, another way of looking at the costs is to distinguish, destruction and deferred accumulation and legacy costs The immediately apparent costs are loss of life. Most wars are relatively small, with most in the 25-999 battle related deaths. In some datasets these would not be considered as the definition of an active war is ones with greater than 1000 battle related deaths per annum. The vast majority of conflicts have less than 100,000 battle related deaths. But this is not the whole story by any means, as in many countries conflict leads to many hidden casualties and the devastation can means people die for years after a conflict ends - a legacy cost of the conflict that is often ignored. Certainly fatalities for genocides and politicides are disturbing. Up to 1992 Afghanistan had seen over 1 million fatalities, with estimates suggesting almost 1 million military related casualties since the US and coalition invasion. A figure that is

dwarfed by the genocide in Cambodia which took an estimated 2.7 million lives (Anderton and Carter, 2009). While the accuracy of these figures can be questioned, as more recent estimates tend to reduce the figures given here (for example in Bosnia) and as they contain relatively imprecise estimates of wider/indirect deaths from war, they still give support to the argument that the costs of conflict can be very large.

Deaths are only part of the violence engendered by conflict. The World Health Organization (2002) differentiates among forms of violence by grouping them into three categories: self-harm (including suicide), interpersonal violence (e.g., violence between intimate partners and other forms of family violence; rape and sexual assault by strangers; violence committed in institutional settings, such as schools, prisons, and workplaces), and collective violence (e.g., armed conflict between, among, and within states; violent political repression and genocide; violent acts of terror; organized crime). Together, these form a system of violence progressing from individual and relationship-related violence to communal and large-scale violence. The existence of conflict in a country creates the environment in which all forms of violence are possible and the less “headline” forms often remain as a legacy when the conflict is supposedly over.

It is clear that mortality rates only capture one dimension of the human consequences of civil conflict, but it remains a useful overall measure of the crisis and its impact. As seen in the above example, mortality rates can be highly inaccurate, but compared to the other health indicators (e.g. morbidity and psychological) it is substantially easier to measure and capture. But some studies have tried to assess these costs. Hoeffler and Reynal-Querol (2003) conducted an econometric study investigating the effects civil conflict has on child mortality and found that infant mortality increases by 13% during a war and remains persistent in the five years of post-conflict peace. In a review of case study data, Guha-Sapir and Van Panhuis (2002) found that, following a civil war, deaths resulting directly from combat is only a minor component of the overall rise in mortality. This supports the hypothesis that civil wars kill far more people after the fight ends than they kill combatants during the conflict.

As a way to confirm this Ghobarah et al. (2003) used a newly released

WHO DALY data set to measure the impact civil war has on national healthcare. Their empirical results suggested that civil wars significantly reduces national healthcare performances. By distinguishing major diseases, gender and age groups they find significant effects of civil war increasing the post-conflict incidence of death and disability caused by infectious diseases. Moreover, Ghobarah et al. (2003) estimates that the legacy effect of civil war on DALYs was roughly as large as the effect during war. This study, conducted almost 15 years ago, remains one of the only studies that looks at the healthcare costs of civil fighting and as the nature of wars and healthcare have evolved over time it is of great interest to update this study. Moreover, as the WHO has released new DALY data for 2012, a comparison can be done regarding the impact civil war has on health in the 1990's to that of the 2000's. Empirical there is a need to understand whether civil wars are having more or less of a legacy impact on conflict afflicted countries and whether improved healthcare through improvements in the DALY have decreased civil conflicts effect on the health system.

3 Measuring Public Health

WHO's measure of a country's over health status (DALY) looks to assess the burden of disease from mortality and morbidity. This is measured as time (number of years) lost through premature death and time lived in states of less than optimal health (disability). It was developed in the early 1990's as a way of comparing overall health and life expectancy in different populations or countries. Recently, it has become a common measure in the field of public health and health impact assessment.

One DALY can be thought of as one lost year of healthy life, and according to the WHO, the sum of these DALY's across a country's population (e.g. burden of disease) can be thought of as a measurement of the gap between a country's current health status and an ideal health situation where the entire population is disease and disability free. This DALY is calculated as the sum of the years of life lost (YLL) due to premature mortality and the years lost due to disability (YLD) for people living with health

condition or its consequences (WHO, 2013). Where the equation is given as follows:

$$DALY(c, s, a, t) = YLL(c, s, a, t) + YLD(c, s, a, t) \quad (1)$$

where c is for cause, s is for sex, a stands for age and t is year. The YLL corresponds to the number of deaths multiplied by the standard life expectancy at the age which death occurs for a given cause, age and sex. The YLL is generally written as:

$$YLL(c, s, a, t) = N(c, s, a, t) * L(s, a) \quad (2)$$

Since YLL measures years of life lost due to deaths, an incidence from years lost from disease is also needed which is in the form of YLD. Years lost to disability is estimated for a particular cause in a particular point in time where the number of incidents in a given period is multiplied by the average duration of the disease and a weighting factor that reflects the severity of the disease on a scale of 0 (perfect health) to 1 (dead).

$$YLD(c, s, a, t) = I(c, s, a, t) * DW(c, s, a) * L(c, s, a, t) \quad (3)$$

where I is the number of incidences controlling for cause, age and gender at time t ; DW is the weighting matrix for cause, age and sex; and L is the average duration of the case until either remission or death (Murray, 1996; WHO, 2013). The DALY data is available for 171 WHO member countries over two fixed time periods of 2000 and 2012. Since the two cross section datasets are surveyed following the same methods, the two databases are directly comparable. Both data sets covers all geographical, income and epidemiological regions as defined by the World Bank, WHO and United Nations.

The dependent variable, DALY, measures the effect of death and disability on population groupings comprised of each gender and age group (0-4, 5-14, 15-44, 45-59, 60 and older). Differentiating the age groups and gender is important since disease vary widely by age and gender. Start-

ing with the number of deaths in a year from more than 100 categories of disease, estimates of the years of healthy life lost due to disability from the incidence of the condition and the estimated number of new cases in the period are added. The DALY for 2000 and 2012 are thus aggregated into 22 major disease categories for analysis and reflects the life-years lost due to deaths from a particular condition contacted during the year plus the expected disability to be incurred by other people who suffer from the same condition.

4 Theoretical Framework

For the legacy effects of civil war on public health, we follow from Ghobarah et al. (2003) and the general framework for studying the causes of public health. Theoretically, there are main influences on public health in societies, with political processes and economic conditions important causes on each of the major health influences. The four major factors that influence public health are as follows:

Heterogeneity Across Geography and Population

Generally speaking, populations across and within regions are exposed in varying degrees to the risk of disease, injury and death. Levels of income and different geographical locations are basic factors. For example, people in tropical climates are at greater risk to contracting infectious diseases, while in poorer countries, most of the population live in rural areas where there is limited access to healthcare and the quality is substantially lower than urban areas (Ghobarah et al., 2003). As a result, preventative healthcare is less readily available and treatment of disease is less extensive or effective. Moreover, most poorer countries experience rapid population growth which would result in greater risk to a variety of health problems (Foege, 2000; Garrett, 2001).

Financial and Human Resources

With higher levels of income and development, larger pools of resources become available to draw from. Public and private actors are able to afford more on health care. This will enable greater investment of human

resources (training doctors) and technology (e.g. medical equipment). In this case, political and economic process will have major influence on the availability of resources for public health expenditure. During times of economic or political instability, there may be disruptions to economic growth and thus affect the funds available for healthcare.

Level of Resource Allocation

There exists great competition for resources and political power can have a substantial influence on the area and amount of resource allocation. As Ghobarah et al. (2003) argues, political parties wish to retain power and thus, they must look to distribute resources (public goods) to the population in order to win support. There are however, vast differences in the way resources are allocated in a democracy versus autocracy. In a democracy, since there is a wider range of people to satisfy, the government would have an incentive to supply more public goods to the population than an authoritarian leader (Olsen, 1993; Lake and Baum, 2001). This assertion is supported by Przeworski et al., (2000) where they found there to be a strong effect of democracy lowering infant mortality through health expenditure.

Degree of Resource Allocation and Utilisation

While allocating resources to the population is important for rulers who want to stay in power, the goods and services provided by government may not be directed to groups with the greatest need. In the case of healthcare, it is agreed upon that low income groups are often at the highest risk of health problems and therefore in need of public health care the most. But in reality healthcare services are often skewed in favour of wealthier groups of the population, which on average are healthier, less at risk to disease and require less healthcare (Ghobarah et al., 2003).

The theoretical linkages between politics, economics and public health offers a chance to test another linkage, one of civil war and long-term public health. The central channel of effect is that civil conflict produces adverse legacy costs for public health that extend well beyond the end of the fighting. There are three related hypotheses that we posit:

H1: The occurrence and increased severity of civil wars leads to more

DALY's being lost within a country.

H2: The legacy of civil wars on public health are so severe that it has an effect on the DALY more than 20 years after the fighting has stopped.

H3: Civil wars spillover onto contiguous states, leading to more DALY's being lost.

The rationale behind these hypotheses are related to the four major influences on public health as related to political and economic conditions.

Civil war increases the exposure of the civilian population to conditions that can cause disease, injury or death. Prolonged civil wars are shown to displace people either internally or as refugees (Salehyan and Gleditsch, 2006). Take the case of Rwanda, following the genocide over 1.4 million people were displaced internally and another 1.5 million into the neighbouring Democratic Republic of Congo (DRC). As in the case of the DRC, most of these people do not return to their country after the war, but remain behind in makeshift camps for years. The result is the likely emergence and spread of epidemic diseases from overcrowding, bad sanitation and malnutrition such as tuberculosis, cholera and typhoid. Toole (2000) found that following the arrival of refugees into a civil war ravaged area, crude mortality rates were between 5 and 12 times higher than the normal rate, with children particularly vulnerable to infection.

There is also increased health risk for non-displaced people since refugee camps become centres for disease transmission to other areas. Treatment and prevention centres that are already weakened by civil conflict become even more overburdened. Moreover, violence post-war is likely to rise with significant rises seen in rape, homicides, suicides and other unintentional injuries (Gerosi and King, 2002; Dunne, 2013). The cause of this increased violence is down to social and psychological changes, and this is potentially magnified by the availability of small firearms postwar.

Civil war also creates a long-term negative consequence on public health through the reduction of resources used to spend on the healthcare system. Many consider civil conflict to be the most extreme form of instability and this leads to severe reductions in economic performance and cutting the revenue

government can use to finance health care. As suggested by Collier (1999), civil war has a profound impact of decrease economic growth by over 2% for each year it is fought. The depletion of resources is not only in the form of financial and physical capital, but also human capital. People die as a result of fighting potentially reducing the human resources needed for the healthcare system.

As mentioned before, even during times of no conflict governments face a fight to allocate resources, this even worse during and after a civil conflict. Following a war, there are often a multitude of demands where a government needs to allocate resources. The end of a civil war often requires a need for economic and social restructuring, rebuilding of infrastructure and security spending (e.g. military spending) in response to any current or future military threats. As Dunne et al., (2004) states, there is always a trade-off between military and non-military spending. Where while one may feel safe due to increased military security, there are opportunity costs such as sacrifices in education, healthcare and other areas of development.

To empirically measure the theoretical underpinnings of the causal relationship between war and health, the main explanatory variable in the regression is the experience of civil war. This variable is measured in a variety of different forms; deaths from civil war, civil war prevalence, civil war incidence and civil war duration. To test for the 1st hypothesis *H1*, deaths from civil war in the 10 years preceding the year 2000 and 2012 is used. This represents a measure of both the existence and severity of civil conflict. While some studies define civil war as having battle related deaths of over 1 000, this paper will use the 100 battle death threshold and classify those over 1 000 battle deaths as intense civil conflicts. This will serve as a lag to the DALY rates for the years 2000 and 2012, while battle deaths in the year and one preceding the DALY year would serve as non-lagged or current war deaths. The lagged battle death numbers would measure the legacy costs of civil war on public health, while the non-lagged will control for the immediate civil war effects on the DALY. For *H1* the main cause of indirect civil war death will be infectious diseases such as tuberculosis, cholera and typhoid.

For *H2* in order to measure the extent of civil wars legacy on public

health, the battle related deaths from the years 1990 to 1998 will be used as a dependent variable for the 2012 DALY statistics. The purpose here is to consider whether civil wars fought more than 20 years ago have an affect on a country's public health two decades after the fighting has ended. The main health effect will be through communicable diseases such as STD's and HIV/AIDS that stay with the person for life. Typically, the transmission of such disease would be through rapes that occurred during or in the aftermath of a civil war. Since the disease stays with the person for life and often leads to the contraction of other diseases (reduced immune system), this would have a severely effect on the DALY even 20 years after the end of the war.

As for the directly and indirect spillover effects of civil war on neighbours, a weighting based on the border distance between contiguous countries will be created to capture the spillover effect of civil conflict on neighbour countries healthcare system. As discussed earlier the theoretical channel hypothesis three (*H3*) works to influence public health is migration of refugees across borders (de Groot, 2010; Salehyan and Gleditsch, 2006).

Although the main focus is the impact civil war has on public health there are several other factors that needs to be controlled for. Factors that economists and public health scientist have agreed to have important causes of cross-country variation in public health. These range from economic, political, social, to geographical factors.

From an economics perspective, the higher the level of total health expenditure, the fewer DALYs are lost. Income is considered to improve health through public and private decisions such as money spent on healthcare, sanitation or nutrition. Due to data availability, total healthcare expenditure has not been well measured, documented or widely available and thus rather than using it we use total income as a proxy and total health expenditure as a robustness test. Due to the high correlation (0.9) between income and health expenditure, this proxy is considered an appropriate one.

Another factor that affects health care is education. It is commonly agreed upon that the more education the population, the fewer DALYs lost. High levels of education are associated with better health in children

and adults in both rich and poor countries (Ghobarah et al., 2003). As the population becomes better educated, they will demand better health care, be more knowledgeable in disease prevention and treatment and lead to an overall healthier society. Education is measure by the proportion of the population that has attained at least secondary education.

Rate of urbanisation is another factor that potentially hampers the level of public health. The faster the rate of urbanisation, the more DALYs are lost. As more people move to cities, residents are increasingly exposed to new disease vectors while more people will put pressure on existing health systems to cater for the increasing population. Moreover, the high urbanisation rate often reflects the movement of poor and marginalised people from poorer rural areas. These people are not only poorest represented politically, but also economically and leads to a large service gap between health need and health delivery (e.g. availability and access). The rate of urbanisation measure is taken directly from the World Bank World Development Indicators.

In mentioning the unequal distribution of income, inequality is another important factor that can affect the number of DALYs lost in a given year. The more unequal the the income distribution, the fewer resources will be committed to healthcare and the more unequal will be the access to health facilities. Income inequality can lead to the economically advantaged groups to dominate the political system and influence the way government resources are spent, biasing the privileged harming the mass majority. It must be noted that healthcare in these countries can be of high quality (e.g. South Africa), but is only available to a select segment of the population who can afford it. Income inequality is measured through the Gini coefficient, while a second measure (positive and negative horizontal inequality) for robustness is used. This measure is taken from Buhaug et al. (2014) and measures the relative income gap the mean national income group and the income of the poorest and richest groups.

In geographic terms, some have argued that countries in tropical areas will lose more DALYs than those in more temperate climates. Many infectious diseases (e.g. tuberculosis) are more endemic to tropical countries where there are favourable conditions to help not only grow but also

spread the disease. However, as climate change affects all regions of the world, some of these diseases are now also found in non-tropical conditions (e.g. the emergence of Malaria in Nairobi, a previously Malaria free region). There is still much debate on whether civil wars are more likely to occur in tropical areas and thus there is no theoretical underpinning of misidentifying civil wars as the main cause of disease rather than the tropical climate itself. The tropical term is measured in the regression as a dummy variable, given a value of 1 if it is within the tropical region and 0 otherwise.

Finally, from a political and social perspective, it has already been mentioned that a more democratic nation will spend more on healthcare and thus lose less DALYs. The political system not only affects the level of government spending on healthcare but also influences the probability of civil war (Dunne and Tian, 2016). There are also two general control variables that are included in the regression, population and initial income. Controlling for population helps address the concerns that larger states will have more disaffected groups which are able to not only mount a war effort but also have worse average health. Initial income will be important to capture the starting point of a country and thus have a direct link to the stage of development and the condition of its health system.

5 Empirical Analysis

To test the hypothesis that civil war decreases the state of public health, we use cross-section ordinary least squares regression analysis on data for 171 countries. The estimated general cross-sectional model will take the form:

$$DALY_i = \beta_0 + \beta_1 CivilW_i + \beta_2 W_{pri} CivilW_{pri,i} + \beta_i X_i + \epsilon_i \quad (4)$$

where $DALY$ is the number of DALYs lost per year, $CivilW$ is the explanatory variable for civil war which takes the form of either the number of battle related deaths, a dummy variable of 1 or 0 or months of civil war (e.g. duration measure). W_{pri} is the weight attached to each neighbour of

the host country, while the variable $CivilW_{pri,i}$ is the experience of civil war in a contiguous neighbour. X is a set of control variables as identified in the previous section and this includes measures of education, healthcare spending, rate of urbanisation, income inequality, geography and political affiliation. Since DALYs represent the number of healthy life years lost, variables that improve healthcare will have a negative coefficient, while those that worsen the health system (e.g. civil war) will be of a positive sign.

Table 1: Descriptive Statistics - Means

	2000		2012	
	Mean	Std Dev	Mean	Std Dev
DALY (000's)	16655.8	55918.68	15902.1	52106.2
Battle Related Deaths	2035.6	1846.1	1187.3	1320.4
Civil War Prevalence	0.17	0.38	0.15	0.36
Healthcare Spending (% of GDP)	5.82	2.57	6.78	2.83
Education (%)	50.88	42.19	64.02	53.14
Rate of Urbanisation	52.86	23.99	57.20	23.58
Polity IV (-10 to 10)	3.52	6.34	4.47	5.89
NHI	1.20	0.42	1.20	0.43
PHI	1.21	0.85	1.21	0.85
Population (000's)	41896.5	144021.7	48657.3	161329.4

Table 1 offers the descriptive statistics of the above mentioned dependent and independent variables with a breakdown by the two periods for which the DALY is available, 2000 and 2012. These results show a clear improvement in global public health between the years 2000 and 2012. On average the number of years lost of death and disability decreased by a three-quarters of a million. A decrease against the backdrop of increased population and increase rate of urbanisation. Potential factors behind this improvement could be the higher healthcare spending in 2012 versus 2000, the improvement in education attainment, political freedom or the decrease in civil war incidence and less battle related deaths. With improved health-

care, a key point of interest is the comparison between civil wars impact on public health for the years 2000 and 2012. In other words, whether civil conflict creates an increased opportunity cost on healthcare in 2012 or thanks to the improve overall healthcare, its effect on the health system is less compared to a decade ago.

The starting point of comparison is to regress the number of civil war deaths on the 2000 DALY figure, while controlling for the above mentioned variables (Table 2). Table 2 shows the empirical results separated into 10 rows. The dependent variable for all 10 equations is the DALY for deaths and disabilities from all causes, with the rows disaggregated by age group and gender. Explanatory variables are listed in the top row, with each column giving the estimate coefficient and its corresponding standard error. Evaluating the results shows a strong effect between an earlier civil war (1990 to 1998 - *CW90*) and the increased loss of healthy life. Experiencing a civil conflict worsened public health in 8 of the 10 age categories, with only the oldest age group showing no effect. Four of the six largest and most significant effects are among children and the impact is most severe for the two youngest groups, males and females under the age of five.

Even living in a country adjacent to a country that experienced a civil war led to increased losses of healthy life-years. Similar to that of a home country civil war, an civil war fought in a contiguous state (*CCW*) seems to affect people between all people between the ages of 0 and 59. This effect can be considered to be over and above the negative effects one would experience if there had also been a civil war in their own country. Overall, the loss of healthy life-years on those between the ages of 0 and 59 are staggering and the significant economic implications. Ages 0 to 59 encompass the majority of the productive labour force (e.g current and in future) and disruptions to this group will have profound economic consequences not only in the immediate civil war aftermath, but for years or generations to come. The youngest age group (0-4) make up the future labour force and losing healthy life-years there will mean loss of future productivity and hence development. It seems that past and future fighting, through disruptions in the health system, will have significant consequences to future generations.

Table 2: DALYs Lost to All Disease Categories in 2000

Gender	Age	DALY	CW90	CCW	Health	Urban	Edu	Inequ	Geog	Polity	AdjR ²
Male	0-4	159.4	5.3** (1.7)	2.3* (1.1)	-31.1** (3.4)	0.7* (0.3)	-62.8** (8.1)	10.4 (6.2)	-8.3 (7.7)	-0.7* (0.3)	0.63
Female	0-4	150.5	4.2** (1.2)	2.2* (1.1)	-29.6** (4.5)	1.1* (0.5)	-60.3** (7.8)	7.4 (7.0)	-8.1 (6.3)	-0.5* (0.2)	0.63
Male	5-14	17.6	2.2** (0.9)	0.8* (0.4)	-4.9** (1.2)	0.8* (0.4)	-7.2** (1.3)	9.4 (8.0)	-0.2 (0.2)	-0.3* (0.2)	0.62
Female	5-14	17.0	2.3** (1.0)	0.9* (0.4)	-5.1** (1.4)	1.0† (0.6)	-7.1** (1.2)	9.3 (8.1)	0.2 (0.2)	-0.3* (0.2)	0.61
Male	15-29	23.7	3.6** (1.4)	4.2** (2.0)	-4.7** (1.6)	3.1* (1.5)	-5.2 (3.8)	22.7* (10.6)	4.6 (4.1)	0.4 (0.4)	0.54
Female	15-29	21.1	3.5** (1.4)	4.4** (1.9)	-3.9* (2.0)	5.0* (2.4)	-7.9 (6.5)	21.8** (9.7)	4.3 (3.7)	0.1 (0.1)	0.53
Male	30-59	40.5	1.8** (0.8)	3.7* (2.0)	-7.1** (1.2)	4.2** (1.0)	-2.4 (2.1)	11.3* (5.7)	2.0 (2.2)	0.6 (0.5)	0.58
Female	30-59	31.1	1.8** (0.7)	2.8* (1.4)	-5.4* (2.6)	3.9* (1.9)	-4.1* (2.1)	8.3 (6.2)	3.1 (3.0)	-0.1 (0.2)	0.61
Male	60+	116.8	0.9 (0.8)	1.2 (1.1)	-3.9** (1.3)	2.1* (1.5)	-6.4 (5.1)	7.0 (6.8)	3.2 (2.6)	-0.8 (0.7)	0.41
Female	60+	90.8	1.6 (1.4)	0.9 (0.8)	-7.2** (2.6)	1.9* (0.9)	-8.1* (3.7)	10.3 (9.4)	1.8 (2.0)	-0.6* (0.3)	0.44

The substantive impact of an earlier civil war on a country's public health system is in addition to the impact of all the other social, political and economic variables in the model. Higher health spending as a share of GDP (*Health*) has strong and statistically significant impact in reducing the loss of health life-years (significant across all age and gender groups). The size of the coefficient is in line with most studies on public health that expenditure on the health systems seems to mostly benefit the very young or the very old.

On average, higher education attainment (*Edu*) is also seen to decrease the number of years lost to death or disability, with the effect most prevalent in the youngest age groups. Rapid urbanisation (*Urban*) is another variable that is shown to consistently and significantly increase the loss of health life years, while income inequality (*Inequ*) is seen to worsen the DALY figure for the 15 to 29 age group and males aged between 30 and 59. Interestingly, living in a tropical area (*Geog*) shows absolutely no discernible impact on the public health system, while the direct impact of democracy (*Polity*) on the health system is marginal and only significant for the youngest two age groups.

Following from the initial empirical estimates, the next step is to repeat Table 2's estimation process, but on the new 2012 DALY data. Here an additional civil war variable will be included. Instead of having civil wars from a decade earlier (e.g. battle deaths between 2000 and 2010), the regression will also include battle deaths between the period 1990 and 1999. This variable will test our second hypothesis (*H2*), if a civil war fought almost two decades ago can still leave a legacy on the public health system.

Proceeding to estimate the impact of an earlier civil war on the loss of health life-years for the new 2012 DALY data, the results are displayed in Table 3. Initial observation suggests remarkable similarities between civil war's impact on the DALY irrespective of the time period chosen. Just like in Table 2, for the 2012 DALY data set (Table 3, Column 4), experiencing a civil war earlier in the 2000s (*CW00*) is strongly associated with a subsequent increased loss of healthy life-years for all but the oldest age group. The same can be said about neighbouring civil conflicts where for all but the female 15-29 age group and the oldest age group, a contiguous

civil war worsened the DALY.

A further illustration of the long-term or legacy effects of civil war on public health is the effect of civil wars fought almost two decades ago on the current health system. As shown in Table 3, column 6, a civil war in the 1990s (*CW90*) is estimated to have a substantially increased effect on DALYs in 2012. Whereas before, civil wars were not seen to have an impact on healthy life-years of the oldest group, in this case, the impact felt across all age groups and genders. A civil war fought in the 1990s is estimated to have increased the loss of healthy life expectancy more than 20 years after the war ended, irrespective of age group or gender. Of the control variables, we find that again increased health care spending and education seemed to lower the number of healthy life years lost, while a more democratic country, one with less income inequality or slower urbanisation rate saw marginal improvements in the public health system. Finally, it seems that geography or being in a tropical area remains unrelated to the public health system.

Although the above two tables offer a great amount of analysis on the impact civil war has on the health life-years and thus the public health system, the DALY dependent variable remains one of the all disease category. Another point of interest is to look at the impact civil wars have on the incidence of specific diseases and assess which type of diseases incidence most increases as a result of an earlier civil conflict. The disease will be divided into the 22 major disease categories such as infectious diseases, neonatal conditions, respiratory diseases, intentional or unintentional injuries. Again the sample will be divided by age and gender to assess if the results conform to the theoretical framework that civil wars potentially worsen a country's healthcare system through over capacity, inflow of refugees, the destruction of sanitation and infrastructure which all increase the risk of infectious diseases. The reason for identifying infectious diseases as one of the biggest indirect causes of civil war worsening the health care system and loss of healthy life-years is the ease at which these disease can spread during times of extreme political instability.

Table 3: DALYs Lost to All Disease Categories in 2012

Gender	Age	DALY	CW00	CCW	CW90	Health	Urban	Edu	Inequ	Geog	Polity	AdjR ²
M	0-4	101.3	6.1** (2.0)	2.2* (1.1)	3.4** (1.5)	-27.3** (4.1)	0.6* (0.3)	-54.6** (7.3)	8.9 (5.6)	-7.6 (5.8)	-1.0* (0.5)	0.65
F	0-4	93.7	4.3**	1.9*	2.9**	-24.4**	0.7*	-51.3**	7.1	-8.0	-0.9*	0.65
M	5-14	15.8	3.0** (1.1)	0.9* (0.9)	1.6** (1.3)	-4.4** (3.6)	1.0 (0.3)	-6.6** (5.4)	6.0 (6.6)	-0.8 (6.1)	-0.4 (0.4)	0.63
F	5-14	15.2	2.3** (1.3)	1.1* (0.4)	1.5** (0.3)	-5.3** (1.1)	1.1 (0.8)	-6.4** (1.4)	7.1 (6.2)	-0.6 (0.5)	-0.4 (0.3)	0.63
M	15-29	20.5	3.2** (1.0)	5.7** (0.5)	1.9** (0.3)	-4.0** (1.4)	2.9 (0.9)	-5.0* (1.1)	18.1* (5.3)	3.7 (0.4)	-0.1 (0.4)	0.57
F	15-29	17.9	3.3** (1.3)	5.5 (2.1)	2.4* (0.7)	-3.7* (1.4)	3.1 (1.8)	-7.6* (2.6)	18.3** (9.3)	3.3 (4.0)	-0.2 (0.2)	0.56
M	30-59	35.8	2.0** (1.2)	4.1* (3.7)	2.6* (1.3)	-8.2** (1.7)	3.8** (2.4)	-2.4* (3.7)	10.6* (6.5)	2.1 (2.9)	-0.8* (0.1)	0.59
F	30-59	27.8	2.3** (0.9)	3.0* (2.1)	2.3* (1.3)	-6.0* (1.2)	3.7* (1.1)	-4.3* (1.2)	9.7* (5.1)	3.4 (2.2)	-1.1* (0.4)	0.61
M	60+	103.8	1.1* (0.5)	0.7 (0.5)	3.0** (1.1)	-9.1** (2.8)	2.3† (1.8)	-8.8** (2.2)	7.4* (4.9)	4.1 (3.3)	-0.7 (0.5)	0.50
F	60+	82.2	0.9* (0.4)	0.5 (0.5)	2.7* (1.4)	-8.1** (3.1)	1.6† (0.9)	-8.6* (3.9)	9.3 (5.1)	1.6 (1.2)	-0.7* (0.3)	0.53

Table 4 shows the effects of these individual disease categories for the most updated DALY data of 2012. Due to the amount of regressions that needs to be run for 22 major disease groups, 5 age groups and 2 genders (220 equations), Table 4 will only show those of statistical significance. Moreover, for ease of analysis, the table will only show the coefficients and its standard error of a civil war experience in the 1990s (*CW90*) and 2000s (*CW00*).

By far the most common impacts civil war influences healthy life-years is through communicable diseases such as infectious and parasitic disease and Respiratory infections. It seems that every group, except males over 60, are affected by infectious diseases. The impact from civil war seems to be significant for wars fought both in the 1990s and the 2000s. It seems that the substantial effect found in infectious diseases is down to a few infectious diseases such as that of STD's (e.g. Syphilis, Chlamydia, HIV/AIDS) and Parasitic and vector diseases (e.g. Malaria, Tuberculosis). Theoretically, most of these infectious disease stay with the infected for life and thus would significantly decrease the number of healthy life-years for decades to come. The effects of a civil war fought in the 1990s (e.g. Rape, mass migration of refugees, destruction of sanitary facilities etc.) led to increased incidence of these infectious diseases that seems to still plague the health system decades after the fighting ends.

As for the coefficients, it seems that the impact of war on infectious diseases are on average higher than other DALY causes such as malignant neoplasms, cardiovascular diseases and maternal conditions. Other large category through which civil war may affect DALYs is injuries, both intentional and unintentional. Within the intentional category is that of self-harm (suicide), interpersonal violence (e.g. violence between partners, within family, rape, violence at work or schools etc.) and collective violence (e.g. conflict, organised crime, genocide, terror etc.) This intentional effect, found in 3 of the 5 age categories, may reflect what Dunne (2013) refers to as conflict creating an environment whereby all forms of violence are possible.²

²Civil conflict is expected to increase the stress of civil population as well as breaking down law and order in post-war societies.

Unintentional injuries is an interesting one since it covers a wide range of potential causes such as road injury, falls and drowning. Of these the most logical link between a civil war and unintentional injuries would be through road injury or drownings. Road accidents would partly reflect the deterioration and destruction of roads, but also the deterioration of vehicles that use those roads. Together with bad driving (e.g. People who know how to drive may either have died or migrated) would lead to an increased loss of healthy life-years that was initially caused by a civil war. As for drownings, this may relate to refugees who take to water in order to escape a conflict zone (e.g. migrants around the Mediterranean Sea) and perish as a result to poor quality boats.

Table 4: Civil War and Public Health: DALYs Lost by Disease - 2012

Disease	Gender	Age	CW Deaths (1990-98)		CW Deaths (2000-09)	
			Coeff	SE	Coeff	SE
Infectious Disease	M	0-4	2.61**	(0.77)	2.29**	(0.40)
Infectious Disease	F	0-4	2.48**	(0.59)	2.11**	(0.38)
Infectious Disease	M	5-14	0.97*	(0.46)	0.88*	(0.41)
Infectious Disease	F	5-14	0.71*	(0.36)	0.52*	(0.24)
Infectious Disease	M	15-29	0.56**	(0.24)	0.52**	(0.18)
Infectious Disease	F	15-29	0.49**	(0.14)	0.47**	(0.14)
Infectious Disease	M	30-59	0.62**	(0.21)	0.59**	(0.20)
Infectious Disease	F	30-59	0.60*	(0.28)	0.59*	(0.27)
Infectious Disease	F	60+	0.38*	(0.17)	0.32 [†]	(0.17)
Resp. Infections	M	5-14	0.16**	(0.04)	0.14*	(0.06)
Resp. Infections	F	5-14	0.12**	(0.03)	0.12**	(0.04)
Resp. Infections	M	15-29	0.09*	(0.03)	0.08	(0.06)
Resp. Infections	F	15-29	0.09*	(0.03)	0.10*	(0.05)
Resp. Infections	M	30-59	0.06**	(0.01)	0.05 [†]	(0.03)
Resp. Infections	F	30-59	0.05**	(0.02)	0.03	(0.03)
Maternal Cond.	F	15-29	0.77**	(0.21)	0.49*	(0.23)
Maternal Cond.	F	30-59	0.16*	(0.07)	0.15*	(0.07)
Malignant N.plasm	F	5-14	0.12*	(0.05)	0.11*	(0.05)

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Table 4 – Continued from previous page

Disease	Gender	Age	CW Deaths (2000-09)		CW Deaths (1990-98)	
			Coeff	SE	Coeff	SE
Malignant N.plasm	F	15-29	0.09**	(0.02)	0.07*	(0.03)
Malignant N.plasm	F	30-59	0.07*	(0.03)	0.10	(0.08)
Malignant N.plasm	M	30-59	0.11**	(0.04)	0.09*	(0.04)
Cardiovascular	F	14-29	0.03*	(0.01)	0.03 [†]	(0.02)
Cardiovascular	F	30-59	0.03*	(0.01)	0.02	(0.02)
Unintentional	M	15-29	0.65*	(0.33)	0.66	(0.40)
Unintentional	M	30-59	0.59*	(0.29)	0.48*	(0.22)
Unintentional	F	30-59	0.23*	(0.11)	0.26	(0.21)
Intentional	M	5-14	1.12**	(0.41)	0.85*	(0.43)
Intentional	F	5-14	0.71*	(0.34)	0.66	(0.45)
Intentional	M	15-29	1.39**	(0.53)	1.21*	(0.58)
Intentional	M	30-59	0.96*	(0.44)	0.77*	(0.38)

Notes: Standard errors in parenthesis; Significance Levels: ** $p < 0.01$, * $p < 0.05$, [†] $p < 0.1$.

Following from the above analysis, the next logical step is to test for the robustness of the results through replacing the key explanatory variable from number of civil war deaths to a civil war incidence and duration indicator and also testing the reliability of other variables such as health care spending, education, democracy and income inequality.

Indeed, civil war, seems to be not only a tax on the current populace but, also the future as well.

6 Conclusion

This paper has developed the argument that civil wars lead to a long-term damage of the public health care systems that extends well after the fighting has ended. This claim is supported after controlling for numerous

economic, social and political variables. The effect of a civil conflict is so severe that one which is fought in a neighbouring country is felt on the home country. Using the updated 2012 DALYs give us a comparison of the impact civil war has on the public health system between the initial set of DALY estimates published for the year 2000 and now. The results show thanks to improved healthcare and education, the number of DALYs lost to civil war have decreased in the 2000s compared to the 1990s, but interestingly, the effect of a civil conflict fought in the 1990s is still felt in the country over two decades later. A civil war in the 1990s has a significant effect in increasing the loss of health life-years of people in 2012.

Civil war affects health life-years mostly through it increasing the incidence of is communicable diseases such as STDs, Malaria, Tuberculosis and Respiratory infections. There are also evidence to suggest that civil war worsens the social environment in a country whereby it increases the chances the risk of intentional and unintentional injuries. The results offered in this paper seems to support that of earlier by Ghobarah et al. (2003) where civil war definitely seems to affect long-term public health. There are however, various improvements that can be carried out with this work as different diseases take different time periods to take affect and a simple lag of civil war deaths in the past 10 years can be considered not nuanced enough. Moreover, country heterogeneity may mean substantial differences in results once we look at developed versus developing or high-income versus low-income, thus taking this into account over and above age and gender controls are important improvements. Finally, a better understanding of the epidemiology of the diseases progress may help enlighten not only the indirect impact civil conflict has on health life-years, but also the overall effect such diseases and disabilities can have on the economy.

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