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The Effects of Armed Conflict on the Incidence Rates of Infectious Diseases
Ameya Deepak Benegal,[*] Elon University '16

I. Introduction

Since 1946, there have been over 245 armed conflicts that have occurred in Asia, Africa, Latin America, the Middle East, and Europe (Themnér and Wallensteen 2014). Conflicts present as devastating shocks as they hinder growth through destruction of infrastructure, displace skilled workers, and greatly reduce any private investment into the country. Furthermore, many war-torn countries, depending on their institutional framework and level of aid, make poor recoveries and can revert back into additional cycles of conflict. Typically, the norm of post-conflict recovery is that politics, peacekeeping, and reinstating political institutions are priorities (Collier 2009b), but given the issue's complexity it is viewed though different disciplines regarding solutions, research, and proposed policies.

In much of the economic literature, the focus on armed conflict with respect to economics tends to be more on economic recovery, foreign investment and aid, democratization, social cohesion and community development, and peacekeeping (Collier et al. 2008; Collier and Rohner 2008; Collier 2009a; and Fearon et al. 2009; Addison et al 2001; Ajakaiye and Ali 2009; Akresh et al. 2012). However, there has been a lack of discussion concerning the effects on public health. While there has been research on the matter [1] discussed further in Section II, public health does not receive the same level of attention compared to other post-recovery initiatives compared to peace-keeping or foreign aid (Murray et al. 2002). Furthermore, many papers that assess conflict and public health in the economic literature tend to focus on case studies while this paper will look at the issue at a more global level. In this paper, I use a semi-logarithmic model with Country Fixed Effects analysis using panel data, and later include Year Fixed Effects, to see how armed conflict affects the fatality rates of infectious diseases.

This paper will attempt to contribute to both the economic and public health disciplines in the following ways: First, this paper will provide an additional contribution of assessing armed conflict and public health in economic studies, given that previous studies in economic literature focus more on other issues such as institutions and interventions (Collier et al. 2008; Collier and Rohner 2008; Collier 2009a; and Fearon et al. 2009; Addison et al. 2001; Ajakaiye and Ali 2009; Akresh et al. 2012). Second, this paper will provide a more rigorous statistical approach for analyzing armed conflict and public health through using panel data, Country Fixed Effects, and certain lag variables for conflict to see if they have greater effects in the following year than concurrent year. Other studies have used more provincial-level data (Mansour and Rees 2012; Akresh et al. 2012), pre and post-conflict surveys (Fürst et al 2009), general non-parametric methods (O'Hare and Southall 2007), and more qualitative and archival research methods (Tripodi and Patel 2004). Third, this paper will look at the effects of armed conflict on the death rates of the following types of diseases: Diarrheal diseases, Malaria, HIV/AIDS, specified vector-borne diseases which this paper will refer to as "Flying Vector" or Fvector diseases, [2] and

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Neglected Tropical Diseases (NTDs). While Montalvo and Reynal-Querol (2007) have looked at Malaria, Anema et al. (2008) for HIV/AIDS, and Fürst et al. (2009) for NTDs, this study does an additional comparative analysis looking at several types of diseases as well as comparing possible gender effects. Furthermore, this study focuses more on infectious diseases while other studies (Mansour and Rees 2012; Akresh et al. 2012) have addressed other public health issues such as child health. Lastly, the paper will provide possible policy implications for future post-conflict initiatives.

The remainder of this paper is organized as follows: Section II provides a literature review of the role of armed conflict, public health, post-conflict recovery, and its importance to the economic literature, along with additional discussion on conflict with respect to some of the diseases of interest. Section III provides discusses the theoretical economic effects of conflict. Section IV provides a more in-depth discussion on the data sources used along with potential limitations from the data. Section V discusses the empirical model and results. Section VI discusses the conclusion, potential policy implications for future post-conflict recovery initiatives, and suggestions for future research or replication. Lastly Section VII provides the appendices for references to the figures and model estimates

II. Literature Review

II.i. Economics and Public Health

In previous studies, economists have emphasized the importance of human development, and its impacts on economic growth (Ranis 2004). Yet during conflicts, and the brief period after, governments spend more on defense as opposed to health and education (O'Hare and Southall 2007). While this would provide some means of political stability through military action, the lack of focus on human development, specifically public health, can be a hindrance to a more effective recovery as health services are among the most crucial services needed in the aftermath of conflict (Collier 2009a, 2009b). Furthermore, Kruk et al. (2010) argue that rebuilding health services can play an essential role in promoting social cohesion in a nation's post-conflict recovery stage.

At the individual level, civilians who are consistently exposed to diseases and vectors, such as mosquitoes and worms, during conflict can become anemic or frequently ill. This in turn can affect their human capital accumulation and productivity of labor, which can compromise the productivity and innovation of firms at a larger scale. In addition, the physical and psychological impacts of conflict can have significant effects on human development. In Eritrea and Cote d'Ivoire, Akresh et al. (2012) and Minoiu and Shemyakina (2014) found that exposure to conflict greatly affected children's heights in following years. In Palestine, Mansour and Rees (2012) found that pregnant women who had longer-term exposure during the Second Intifada were more likely to have underweight children. These effects on children can have longer-lasting impacts on their cognitive development, affecting the way they enter the labor force and contribute to the economy in future years. Furthermore in a conflict situation, civilians' access to essential resources can greatly diminish, making them more susceptible to diseases. Fürst et al. (2009) found that in the aftermath of the First Ivorian Civil War, civilians' access to cemented toilets and mosquito nets significantly reduced, making them more vulnerable to NTDs and Malaria. In addition, Betsi et al. (2006) found that conflict in Cote d'Ivoire reduced civilians' access to condoms and anti-retroviral medicines to reduce HIV/AIDS.

At the macroeconomic level, Murdoch and Sandler (2002) have found that armed conflicts can have economic spillover effects as they disrupt trade networks with other countries, affecting their overall economic growth levels. This in turn can strain neighboring countries' budgets in accommodating displaced people.

The other aspects in which public health plays integral roles in the economics of conflict and post-conflict recovery include changes in various government, foreign, and military policies. Specifically a major issue is the usage of peacekeepers, where several economists have argued that peacekeepers play a role in reducing post-conflict risks during a state's transition period (Collier et al. 2008). Yet from a public health perspective, Tripodi and Patel (2004) discuss the relation of increased foreign military presence and the spread of HIV/AIDS in Sub-Saharan Africa, and in some cases using military personnel as vectors in their argument. This exposure or infection of diseases can have additional social costs, especially in the more rural and culturally-conservative regions of conflict-ridden nations. In some communities, exposure or infection to diseases, such as sexually transmitted diseases from military rape, can sometimes ostracize certain civilians from the community, particularly women and more marginalized groups. Beyrer et al. (2007) provide similar arguments on population marginalization after infection by NTDs. These instances of marginalization can be especially obstruent in various social cohesion aid programs administered by foreign governments (Fearon et al. 2009).

Lastly, conflict can affect how a government allocates its usage of resources and funds. Governments facing both internal and external violent factors will typically try to maintain control and stability using military force. As a result, a government would allot more of its spending towards military and intelligence-related matters, and potentially diverting resources from healthcare, education, sanitation, and other essential public goods necessary for human development (Murdoch and Sandler 2002; O'Hare and Southall 2007). A notable example of this is Burma, where the then-military junta spent less than 3% of national expenditures on health-related services, despite facing a heavy burden of NTDs such as Lymphatic filariasis. Yet, the government would spend over 40% on military purposes to maintain power (Beyrer et al. 2007).

II.ii. Armed Conflict and its Effects on the Burden of Disease

Throughout history, conflict has played major roles in facilitating the spread of diseases. Given that conflict has led to large-scale displacement of people, forcing them to live in refugee settlements or camps with inadequate water, sanitation, or healthcare, the susceptibility of infection greatly increases. Using a cross-country approach Montalvo and Reynal-Querol (2007) find that countries that receive refugees fleeing civil wars experience between 2,000 and 2,700 cases of Malaria for every 1,000 refugees admitted into the country. Furthermore, conflict can also result in the re-emergence of diseases thought to have been eradicated. In Syria, Polio had been eliminated in 1999, but due to the onset of civil war, numerous cases of polio have been documented in recent years (WHO Accessed 2016). Similarly, Malaria had been virtually eliminated in 1960s, but due to the civil war which occurred from 1992-1997, an estimated 29,794 cases of Malaria were reported due to refugees who returned from Afghanistan and reintroduced the diseases (Gayer et al. 2007). As a result, the influxes of refugees and other spillover effects onto neighboring countries can put strain other countries' economic and public health systems.

In addition to Malaria, Beyrer et al. (2007) discuss the rapid increases in NTD cases in responses to conflict in different parts of the developing world. Unlike Malaria and other more well-known diseases, NTDs[3] serve as burdens of forgotten populations in the developing world. Furthermore, given that the majority of conflicts throughout the late 20th Century have occurred in this region, various conflicts would have played significant roles in increased prevalence rates of such diseases. Various documented incidents have included Burmese refugees in Thailand who have had Lymphatic filariasis cases of 10%. In the Democratic Republic of the Congo, the number of cases of African trypanosomiasis peaked at 34,400 cases, the highest in the 20th Century, under the turbulent years of the Mobutu dictatorship. In Colombia, warzones in the country have experienced increased reports of Chagas Disease, Leishmaniasis, and Yellow Fever. Lastly, pre and post-conflict surveys in Cote d'Ivoire found the residents there to be at greater risk to NTDs due to crowding and the lack of protection against NTD vectors such as worms (Beyrer et al. 2007; Fürst et al. 2009).

While studies generally show a strong, positive relationship between conflict and disease burden, some studies that have shown more conflicting findings on diseases such as HIV/AIDS. Virginie et al. (2010) find that in seven Sub-Saharan African conflict affected countries, where rape is widely used as a weapon of war, mass rape could cause a median of five new HIV infections per 100,000 women per year in the Democratic Republic of Congo, South Sudan, Sierra Leone, and Somalia. The study also estimated that the HIV infection rate would be doubled in Burundi and Rwanda and quadrupled in Uganda given previous HIV epidemics and the levels of conflict. In contrast, Anema et al. (2008) looked at the same countries and found that while the transmission rate among combatants and assailants was eight times the country population prevalence, the widespread rape increased absolute HIV prevalence by around 0.023%, an insignificant level.

III. Theory

As stated earlier in Section II, the effects of armed conflict can have major effects on public health, but also that there are economic factors which might contribute as to why conflict can contribute to health-related deaths. In this section I try to model the findings by Fürst et al. (2009) and Betsi et al. (2006) through the usages of a budget constraint and indifference curves. In Figure 1 (see Appendix A in Section VII), the budget constraint is divided between the individual's choice of health-related goods, such as medicines, mosquito nets and other preventative care measures, food, and access to health education. The other axis consists of non-health goods such as luxury goods, transportation, access to education on non-health issues, etc. For the indifference curves, A is the indifference curve in a pre-conflict setting, B is A's corresponding indifference curve on the post-conflict budget constraint, and C would be the new expected indifference curve in a post-conflict setting.

When plotting this diagram, I make two major assumptions: First is that an individual is typically indifferent between health versus non-health goods and services in a pre-conflict setting. Therefore, on Figure 1, Indifference Curve A is positioned near the center of the pre-conflict constraint. The second is that individuals do not engage in black market activities such as drug trade and human trafficking to maintain or supplement income. This is an important assumption given that conflict hinders growth and investment, and individuals' incomes would greatly decrease causing entire budget constraint to shift left.[4] At the same, time, Indifference Curve B shows the corresponding position on the new budget constraint. However, in a post-conflict setting, the need for health-related goods becomes essential to maintain survival and Figure 1 shows the post-conflict Indifference Curve as C. Furthermore, given that the need for health-related goods becomes more essential in a post-conflict setting, Indifference Curve C becomes flatter as well showing the individual's increased value for the good. Though when comparing Indifference Curves A and C, the individual is seen as worse off with regard to health, despite the fact that Indifference Curve C is located nearer to the health goods axis. This is due mainly to an income effect from the loss of income due to conflict, and can show some component in how conflict can affect one's livelihood through health. Overall, Figure 1 shows that during and post-conflict, an individual's income decreases and less money is spent on goods, despite the fact that they may be necessities such as medicine.

In addition to individuals, Ghobarah et al. (2003), Murdoch and Sandler (2002), O'Hare and Southall (2007), and Beyrer et al. (2007) have discussed changes in government expenditure during conflict, specifically divestment from health and education into military and intelligence purposes. This shift is shown in Figure 2 (see Appendix A in Section VII).

Like Figure 1, I try to use budget constraints, and here I represent the budget constraint as tax revenue. However, due to conflicts, the country experiences a drastic decline in population, from emigration or death, which reduces tax revenue from income. At the same time, private firms would not invest in a conflict-ridden nation, affecting taxes from businesses. Therefore, this causes the budget constraint to shift inwards. Regarding the Indifference Curves, the first two, A and B, are similarly shown on Figure 1. Though for Figure 2, I make the assumption that during a conflict period, a government would want to maximize control of the nation through the usage of military and intelligence. Therefore, not only does Indifference Curve C shift more towards the X-axis, but it becomes steeper showing the change in the government's preferences.

To reflect the two graphical representations in this paper, I will use several controls in the regression analyses. From Figure 2 I will use government spending for health and education purposes. Though for time constraints in writing this paper, I did not include spending for defense or military purposes, and will discuss it for further suggestion in Section VI. Representing the change from Figure 1 was difficult as, due to time constraints, I was unable to find sources specifying costs of preventative healthcare measures or treatment—especially during conflict periods. However, I will use population access to sanitation as a proxy given its significance as a preventative healthcare measure.

IV. Data and Measures

IV.i. Data and Measure Description

The outcome of interest in this paper is the mean death rate for civilians from the respective disease. For this, I use data from the University of Washington's Institute for Health Metrics and Evaluation (IHME). The dataset contains causes of deaths from a wide array of diseases and health issues ranging from 1990-2013. Within the data, IHME sub-aggregates deaths by age range and by sex. For death rates, IHME provides numerous metrics of death including percentage of populations and raw counts, while also providing mean, lower bound, and upper bound estimates. For this paper, I looked at the "All Ages" category and used the mean death rate per 100,000 people as my primary measurement. I also kept relevant death causes related to infectious diseases such as Malaria, Diarrheal Diseases, and HIV, NTDs, and other vector-borne diseases.

When compiling the NTD and vector-borne disease variables, I used the Center for Disease Control (CDC Accessed 2016) to see which NTDs are listed in the IHME dataset and which specified vector-borne diseases were spread by insects such as flies and mosquitoes. For both variables, I aggregated the mean death rates of the different diseases. As stated earlier in the literature review, I wanted to look at NTDs given their prevalence in the developing world, and that the majority of armed conflicts have occurred in developing areas. I also wanted to look at other vector-borne diseases besides Malaria, but was more interested in flying vectors such as sandflies and mosquitoes given that they tend to be harder to contain in a population compared to worms or rodents. Therefore, I created a new variable for flying vector diseases, or Fvectors. The specified diseases for the NTD and Fvector variables are shown below:

> **Fvectors:** African trypanosomiasis, Dengue, Malaria, Leishmaniasis, Visceral leishmaniasis, and Yellow fever
>
> **Neglected Tropical Diseases**: African trypanosomiasis, Ascariasis, Chagas disease, Cystic echinococcosis, Cysticercosis, Dengue, Leishmaniasis, Schistosomiasis, Visceral leishmaniasis

To measure conflict, I focus on three types of armed conflicts—One-sided conflicts, Battle-related, and Non-state derived from the Uppsala Conflict Data Program/Peace Research Institute of Oslo (UCDP/PRIO), which spans the years 1989-2014—and see how they affect the fatality rates from the diseases. The UCDP/PRIO dataset has been used frequently in other conflict-related studies, including economic publications, and is a reliable source for this paper.

UCDP/PRIO defines conflicts as "a contested incompatibility that concerns government or territory or both, where the use of armed force between two parties results in at least 25 battle-related deaths in a calendar year. Of these two parties, at least one has to be the government of a state" (Themner and Wallensteen 2014). The UCDP/PRIO dataset provides several types of fatality estimates including upper and lower bound. For simplicity I only use the dataset's best estimates. The specified definitions of the three variables are as follows:

> **One-Sided Conflict**: The use of armed force by the government of a state or by a formally organized group against civilians, which results in at least 25 deaths in a year (Uppsala University 2015).
>
> **Battle-Related Conflict**: Deaths arising from the use of armed conflict between warring parties in a conflict dyad—made up of two armed and opposing actors—be it state-based or non-state. Typically, battle-related deaths are counted as "normal" warfare from battlefield fighting, guerrilla activities, and other bombardments of military units, cities, and villages. However, while the targets tend to be military and state institutions, there is

often collateral damage and thus all deaths—military and civilian—are counted (Uppsala University 2015).

Non-State Conflict: The use of armed conflict between two organized armed groups, neither of which is the government of a state, which results in at least 25 battle-related deaths in a year (Uppsala University 2015).

As stated at the end of Section III, to account for the theory used in Figures 1 and 2 (See Appendix A in Section VII) I use controls for access to sanitation from the World Health Organization (WHO) as percent of the population and government expenditures for health and education from the World Bank—all of which span the years 1995-2015 in this dataset—as having general awareness about health and having access to both healthcare and adequate sanitation are crucial to reducing health problems. Both of the World Bank variables look at the percentage of total health and government expenditures for health and education, respectively. I include this variable, as opposed to percentage of Gross Domestic Product, as countries going through conflict, or bordering countries in conflict, would face possible reductions in investment, consumption, and exports—skewing the GDP statistic—while government spending would probably increase.

When running regressions, I include Country Fixed Effects for countries, and run them separately by gender to see if there any possible gender effects. I then re-run these regressions while having all three conflict variables as lagged to see if some conflict incidents have significant effects in future, rather than concurrent years. Finally, I use the same regressions again, but also include Year Fixed Effects to control for possible yearly global trends.

While the data provides several decades of data for analysis, there are several limitations to this dataset. First, the data for health starts at 1990 at the earliest while there have been documented cases of conflict in numerous countries before then—affecting health levels, government expenditures, and other variables in the post-conflict time periods. Therefore, this might potentially skew the more accurate health results when conducting regressions. Second, all of the various dataset were merged based on the corresponding names for the IHME dataset. Therefore, certain conflicts, such as those in Yugoslavia were omitted given that there are corresponding values for former countries in IHME. Third, the effects of armed conflict on public health may not fully be representative for each country given that the effects of conflict are different for each state. For instance, violence in Philippines and India are more localized and focused on certain islands and states. On the other hand, conflicts in Liberia and Sierra Leone have devastated the entire country, affecting the overall country-level statistic. Fourth, in this dataset, I look at the effects for all age groups, and sub-aggregate it by gender. However, the overall death rate statistic can be misleading given that certain diseases, such as diarrheal diseases, can have a greater impact on certain age groups than others, such as 5 years and under versus young adults. Lastly, some of the important variables of interest during a conflict situation look at civilian access to clean water and to healthcare workers. While the World Health Organization has a dataset on health workers and access to water, the years are done on irregular intervals, and many of the countries—especially those in conflict zones—have missing values. As a result, when I ran initial regressions, hundreds of observations were lost, and only several dozen observations were used. Therefore, for this paper I omitted these variables, but given their relevance to the subject, these models will face the risk of Omitted Variable Bias. Hence, if similar research on this issue were to be replicated, other studies could better incorporate water and physician access into the data. This will be explained in more detail in the Conclusion, Policy Implication, and Future Research section.

IV.ii. Summary Statistics

The section provides summary statistics of the different conflict variables and diseases, which are sub-aggregated by gender.

Table 1. Conflict Death Summary Statistics

Conflict	Obs	Mean	Std. Dev	Min	Max
One-Sided	4512	.164	7.481	0	501.069
Battle-Related	4512	.198	1.671	0	50
Non-State	4512	.025	.174	0	4.01

In this sample, from 1990-2014, there have been over 700,000 reported deaths from numerous armed conflicts with battle-related and one-sided conflicts having the highest number of deaths on average. Though, at the same time, these two conflicts also have the highest variability in the dataset.

Table 2. Diarrheal Disease Death Rate Summary Statistics

Gender	Obs	Mean	Std. Dev	Min	Max
Male	4512	39.08	64.26	0.1	612.7
Female	4512	36.85	58.67	0.1	513.9

For diarrheal diseases, there are over 4,500 observations spanning the 15 years. When comparing gender effects, not factoring in conflicts, there appears to be greater death rates for males compared to females. When combining averages of death rates across all observations, there are about 39 deaths per 100,000 people worldwide for men and 37 deaths per 100,000 people for women.

Table 3. Malaria Death Rate Summary Statistics

Gender	Obs	Mean	Std. Dev	Min	Max
Male	2545	55.88	80.57	0	343.9
Female	2545	54.53	79.55	0	330.6

For Malaria, there are over 2,500 observations across 15 years. For gender effects, Males appear to have slightly greater death prevalence rate compared to females, not accounting for the effects of conflicts. When combining averages of death rates across all observations, there are about 56 deaths per 100,000 people worldwide for men and 55 deaths per 100,000 people for women.

Table 4. HIV/AIDS Death Rate Summary Statistics

Gender	Obs	Mean	Std. Dev	Min	Max
Male	4512	38.69	90.12	0	680.3
Female	4512	29.96	79.28	0	637.2

For HIV/AIDS, there are over 4,500 observations across 15 years. For gender effects, Males appear to have greater death prevalence rate compared to females, not accounting for the effects of conflicts. When combining averages of death rates across all observations, there are about 39 deaths per 100,000 people worldwide for men and 30 deaths per 100,000 people for women.

Table 5. FVector Disease Death Rate Summary Statistics

Gender	Obs	Mean	Std. Dev	Min	Max
Male	4512	34.81	70.32	0	344.1
Female	4512	32.99	68.1	0	330.6

For Fvector diseases, there are over 4,500 observations across 15 years. For gender effects, Males appear to have greater death prevalence rate compared to females. When combining averages of death rates across all observations, there are about 35 deaths per 100,000 people worldwide for men and 31 deaths per 100,000 people for women.

Table 6. NTD Disease Death Rate Summary Statistics

Gender	Obs	Mean	Std. Dev	Min	Max
Male	4512	3.82	9.06	0	98
Female	4512	2.73	6.47	0	80.5

Lastly, for NTDs, there are over 4,500 observations across 15 years. For gender effects, Males appear to have greater death prevalence rate compared to females. When combining averages of death rates across all observations, there are about 3.82 deaths per 100,000 people worldwide for men and 2.73 deaths per 100,000 people for women.

Overall, the summary statistic tables show that the burden of disease tends to be greater for men than for women. However, Tables 2-6 also show that there is greater variability of results among males than females. Section IV shows how conflict may have different effects on the burden of disease for the two genders.

V. The Empirical Model and Results

V.i. The Model

For the different diseases, I use a semi-logarithmic model, and run four regressions for males, and another four for females, using Country Fixed Effects for all of them—denoted as λ_c. The reason for this is that prior to setting up the regressions, the log-transformed disease rates looked more normally-distributed. Though the conflict variables did not appear as normally distributed when transformed. The regressions are shown below:

$$\ln(Y)_{c,t} = \beta_0 + \beta_1(\textit{ONE-SIDE DEATH})_{c,t} + \beta_2(\textit{BATTLE-DEATH})_{c,t} + \beta_3(\textit{NON-STATE DEATH})_{c,t} + \lambda_c + \varepsilon_{c,t} \quad (1)$$

$$\ln(Y)_{c,t} = \beta_0 + \beta\,(\textit{ONE-SIDE DEATH})_{c,t-1} + \beta_2(\textit{BATTLE-DEATH})_{c,t-1} + \beta_3(\textit{NON-STATE DEATH})_{c,t-1} + \lambda_c + \varepsilon_{c,t} \quad (2)$$

Here the Y indicates the mean death of the disease, specifically the mean number of deaths per 100,000 people. However, given that Section IV's summary statistics show that various countries do have 0 death rates of the specified diseases, various observations would be lost when running the regressions. Therefore, for all regressions in this study, I define Y as: (mean + (1 + $\text{mean}^2)^{1/2}$). This will allow for values with 0 death rates to also be included the regressions. In (1), I look only at the effects of the different conflict variables on the mean death rate of the disease, and in (2) I lag the conflict variables to see if there are different effects on disease burden in the following year.

$$\ln(Y)_{c,t} = \beta_0 + \beta_1(\textit{ONE-SIDE DEATH})_{c,t} + \beta_2(\textit{BATTLE-DEATH})_{c,t} + \beta_3(\textit{NON-STATE DEATH})_{c,t} + \Gamma\chi_{c,t} + \lambda_c + \varepsilon_{c,t} \quad (3)$$

$$\ln(Y)_{c,t} = \beta_0 + \beta_1(\textit{ONE-SIDE DEATH})_{c,t-1} + \beta_2(\textit{BATTLE-DEATH})_{c,t-1} + \beta_3(\textit{NON-STATE DEATH})_{c,t-1} + \Gamma\chi_{c,t} + \lambda_c + \varepsilon_{c,t} \quad (4)$$

For (3) and (4), I run the similar non-lagged and lagged variables of conflict, but I include χ_c which is a vector controlling for sanitation, education expenditures, and health expenditures, given that they serve as important factors for health; and Γ represents a vector of their respective coefficients. Furthermore, looking at how expenditures for health and education for conflict would be important given that for human development would especially be important given that a government expenditures would be diverted more towards military and intelligence purposes, as noted in Figure 2. For the controls population access to sanitation, or Pctpopsanitation, in the tables in Section V.iii looks at the access of the country's population with access to adequate sanitation. Government expenditures on education, or Edu Exp, look at the percentage of total government expenditures allocated towards educational purposes. Government expenditures for health-related issues, or Health Exp, look at percentage of total expenditures for health-related purposes.

I also re-run the similar regressions but include Year Fixed Effects as many of these diseases are vector-borne, and whose trends vary on climatic factors. Therefore, given recent trends of increasing global temperatures, it has become easier for various vectors such as mosquitoes to thrive in more areas (Patz and Reisen 2001), and including Year Fixed Effects could control for a potential trend. The regressions with Year Fixed Effects are shown below with the fixed effect denoted as δ_t:

$$\ln(Y)_{c,t} = \beta_0 + \beta_1(\textit{ONE-SIDE DEATH})_{c,t} + \beta_2(\textit{BATTLE-DEATH})_{c,t} + \beta_3(\textit{NON-STATE DEATH})_{c,t} + \lambda_c + \delta_t + \varepsilon_{c,t} \quad (5)$$

$$\ln(Y)_{c,t} = \beta_0 + \beta_1(\textit{ONE-SIDE DEATH})_{c,t-1} + \beta_2(\textit{BATTLE-DEATH})_{c,t-1} + \beta_3(\textit{NON-STATE DEATH})_{c,t-1} + \lambda_c + \delta_t + \varepsilon_{c,t} \quad (6)$$

$$\ln(Y)_{c,t} = \beta_0 + \beta_1(\textit{ONE-SIDE DEATH})_{c,t} + \beta_2(\textit{BATTLE-DEATH})_{c,t} + \beta_3(\textit{NON-STATE DEATH})_{c,t} + \Gamma\chi_{c,t} + \lambda_c + \delta_t + \varepsilon_{c,t} \quad (7)$$

$$\ln(Y)_{c,t} = \beta_0 + \beta_1(\textit{ONE-SIDE DEATH})_{c,t-1} + \beta_2(\textit{BATTLE-DEATH})_{c,t-1} + \beta_3(\textit{NON-STATE DEATH})_{c,t-1} + \Gamma\chi_{c,t} + \lambda_c + \delta_t + \varepsilon_{c,t} \quad (8)$$

V.ii. Hypotheses

When running these regressions, I make the following hypotheses:

H_1: The incidents of conflict have more significant effects on the incidence rates of disease in the following year than in the concurrent year.

H_2: The effects of conflict have stronger disease burdens affect women greater than they do men.

My hypotheses are derived from the assumption that the incidence of conflict displaces groups of people and many are dispersed to camps or refugee settlements, where incidence rates of diseases tend to be greater. In more culturally conservative societies, especially in Sub-Saharan Africa, Asia, and the Middle East, women tend to be more marginalized compared to men. Therefore in the event of conflict, men are more likely to receive the necessary treatment compared to women.

V.iii. Results for Diarrheal Diseases (see Tables 7 and 8 in Appendix B for specifics)

When assessing how conflict affects diarrheal disease death rates, an increase in 1000 battle related increase diarrheal disease death rate by about 1% and 1.1% (See Appendix Table 7). When adding controls for access to sanitation and government expenditures for health and education, battle-related deaths lose their significance. Though regarding one-sided deaths, the results show that an increase in 1000 one-sided deaths increases the diarrheal disease death rates for men by about 12.4% and 12.2% for women, but the other conflict variables lose their significance. With regard to the other human development indicators, Table 7 suggests that while government expenditures on education don't have significant effects, expenditures on healthcare do, and more so for women than men by 0.7% and 0.6% respectively.

When including Year Fixed Effects, the results are similar to Table 7 in that only one-sided conflicts in concurrent year remain significant (see Appendix B Table 8). Though what is interesting is the change in coefficients. In Table 7, they show the effects slightly greater for males compared to females. When including Year Fixed Effects it appears that the one-sided conflicts affect the diarrheal disease death rates for men and women by about 11.6% and 12.7%, respectively.

V.iv. Results for Malaria (see Tables 9 and 10 in Appendix B for specifics)

Like Diarrheal Diseases, Battle related deaths appear to be significant, but when including controls, they lose their significance (see Appendix B Table 9). Table 9 also shows that both One-sided conflicts and Non-state conflicts impact disease death rates in both concurrent and the following years (see Appendix B Table 9). However, the level of affect varies by gender based on the timeline. For One-sided conflict, an increase in 1000 deaths increases the death rates by 16.8% and 16.9% for males and females in concurrent year. Yet, in the following year the effect appears to be slightly greater for males instead with 11.9% and 11.4%.

For Non-state conflicts, the effects of the conflict are more apparent across concurrent versus the following year. Specifically in the concurrent year, an increase in 1000 Non-state deaths increases the Malaria death rate for males and females by 0.8% each. Yet, in the following year, it increases the rates for males and females by 13.8% and 14% respectively.

When including Year Fixed Effects, the coefficients remain the same for most instances (see Appendix B Table 10). Though for One-sided deaths, the overall conflict effect for males and females decreases by about 50% when including Year Fixed Effects. Yet what remain consistent are the overall gender effects. In both tables 9 and 10, females have a greater effect from conflict in the concurrent year while men have a greater one in the following year. For Non-state conflicts, the effects appear be more in reversal. In the concurrent year, the effects are greater for males than females, by 10.6% and 10.1%. Though for lagged years, it is greater for females than males by 14% and 13.8% respectively.

The other interesting observation here is the effect of health expenditures. In the previous tables, government health expenditures showed overall negative effects on diseases rates, meaning increased government expenditures led to a decrease in death rates. Yet in Table 10, the effects only appear to be significant for women after including Year Fixed Effects. This might suggest that, from the literature and theory sections, that under household constraint, men would be favored and such government expenditures would greatly benefit women more.

V.v. Results for HIV/AIDS (see Tables 11-14 in Appendix B for specifics)

The results for HIV/AIDS look puzzling as it appears that conflict seems to reduce the conflict levels (see Appendix B Table 11). Though when including controls, conflict does not appear to have any significant effects on death rates from HIV/AIDS, which appears to be consistent with Anema et al’s (2008) findings. Yet, the coefficients show that sanitation and education expenditures actually increase the death rates from HIV/AIDS. While it appears counter-intuitive, this metric does not show specified subjects learned, including more culturally sensitive issues such as sex education. Furthermore, as this looks at countries at the aggregate level, the ranges of subject content can range from more culturally conservative schools that tend to refrain from teaching sex education, to more liberal schools that do teach such programs.

The other bizarre finding for this model was the model argues if the population access to sanitation increases by 1%, then the death rate of HIV increases by about 1.8% for men and 1% for women. In other studies, Kamminga et al (2003) have argued the opposite, in that adequate sanitation would be crucial to curbing HIV levels. Though given the issue discussed earlier of rape used during times of conflict, and that sanitation is highly related with diseases, this could be an incidence of multicollinearity. The other major result for this table, government health expenditures, shows more consistent results in that a 1% increase in expenditures could reduce HIV death rates for men by about 0.7% and women 0.5%.

Like Table 11, the signs of the coefficients remain negative for non-state deaths even when including Year Fixed Effects, and only expenditures in Health show significant declines in HIV/AIDS-related deaths (see Appendix B Table 12). Like Table 11, this could possibly due to the issue of multicollinearity. To test for multicollinearity, Variance Inflation Factor (VIF)s were calculated and variables with VIFs of 10 or greater were omitted. For the Country Fixed Effects, government expenditure on health was omitted (see Appendix B Table 13) and for the model with Year Fixed Effects, both education and health expenditures were omitted (see Appendix B

Table 14). However, the results still appeared puzzling. Tables 13 and 14 showed similar results in that conflict variables, in this case non-state conflicts, appeared to reduce HIV/AIDS deaths while education expenditure in Table 13, and access to sanitation increased HIV/AIDS-related deaths. Overall, this disease would require further analyses in future studies.

V.vi. Results for Fvector Diseases (see Tables 15 and 16 in Appendix B for specifics)

Like the previous tables, only One-sided and Non-state conflicts appear to have significant relationships for Fvector diseases when including controls (see Appendix B Table 15). What is also interesting here is that for One-sided conflicts, the effects are greater for women in the concurrent year than for men, specifically by 12.75% and 12.41%, respectively. However, the effect is greater for men than for women in the following year by about 7.68% and 7.57%, respectively. However for Non-state conflicts, the effects are greater for men than for women both in the concurrent and following years. Specifically every 1000 deaths in Non-state conflicts increases the death rates for men and women by 9.3% and 8.65% in the concurrent year, and by about 14.91% and 14.23% in following year. Furthermore, these results are consistent with Malaria and Diarrheal Disease ones in that One-sided conflicts tend to have a greater impact in the concurrent year and Non-state conflicts in the following year.

After I include Year Fixed Effects, the overall effects of the conflict variables decrease (see Appendix B Table 16). These results might also be consistent with the argument mentioned in Section V that the increased rise in global temperatures in the recent years would allow for vectors such as mosquitoes to infect more people over a greater period of time. Furthermore, the gender effects slightly change when including Year Fixed Effects. For One-sided conflicts, the effects tend to be greater for women compared to men in both concurrent and following years. Though for Non-state conflicts, the effects are greater for men in concurrent and following years.

V.vii. Results for Neglected Tropical Diseases (see Tables 17 and 18 in Appendix B for specifics)

Unlike previous diseases, the results for NTDs show that battle related deaths have some level of impact in affecting disease death rates when including various controls (see Appendix B Table 17). Overall, every 1000 Battle-related deaths increase the death rate of NTDs by about 0.6% for men and women in the following year only. Non-state conflicts show a greater impact, by about 7.14% and 8.44% for men and women, but only for the following years as well.

When I include Year Fixed Effects, Battle related deaths affect females more than men by a marginal amount in the following year (see Appendix B Table 18). The other interest result is that Non-state conflicts have only significant effects for females in the following year, and the coefficient for males loses its significance. Overall, the results in both Tables 17 and 18 appear to be surprising as One-sided conflicts were not seen as significant despite the fact that during that time, there have been various prominent Non-state and One-sided conflicts across Africa, Latin America, and Asia. This could be due to the limited list of NTDs that were aggregated in the dataset, but overall assessing the impact of NTDs would certainly be an issue of interest for future research.

VI. Conclusion, Policy Implications, and Future Research

VI.i. Conclusions

With the exception of HIV, these models have shown that overall, at least one of the types of conflicts show that they significantly increase the incidence rates of infectious diseases for men and women. Furthermore, the conflict variables tended to have higher effects on women than on men. Though there were some exceptions such as Fvector diseases that affect men more. A possible reason could be that, depending on the lifestyle, culture, and geographic location, men might be outdoors more doing tasks such as hunting, farming, fishing, etc while it is expected women might remain more at home doing activities such as cooking[5] and helping to raise children. Therefore, men might be more exposed when being in the outdoors.[6]

Regarding specified conflicts, Non-state conflicts generally appeared to have larger effects on respective disease death rates when lagged while One-sided conflicts tend to have higher effects in the concurrent year. When including Year Fixed Effects, there appear to be major changes across the different diseases.[7] For diarrheal diseases, only One-sided conflicts appear to be significant, but the results also show that they have greater impacts on increasing the mean diarrheal disease death rates among men and women. For Malaria death rates, One-sided and Non-state conflicts show significant effects when controlling for sanitation access, education expenditures, and healthcare expenditures. Furthermore, all the significant conflict variables show greater impact for females than males, and only during the following year than the concurrent year. For Fvectors, only Battle-related deaths showed some impact, but only in the following year. Those Fvector results were also similar with Non-state deaths but only for women. Lastly NTDs, similar to HIV/AIDS, have shown an unusual result. Table 16 shows that battle deaths appear to reduce NTD death rates, but this could also be due to a merging error when the different NTDs were combined as a new variable.

The other major findings across these different disease categories were the effects that health expenditures and access to sanitation had on reducing these death rates. With the exception of HIV, both increased access to sanitation and increased government expenditures for health had significant effects on the reduction of the death disease rates. For sanitation, a 1% increase in access to sanitation reduced the effects of the disease incidence rates for males and females by between 1% and 6.2% depending on the disease. For health expenditures, a percentage increase of government health expenditures during such conflict reduced these disease incidence rates for males and females by between 0.1% and 0.7% depending on the type of disease. Though overall, the results show that the investments in health and sanitation have greater effects in reducing the disease rates for women compared to men.

VI.ii. Policy Implications

As stated earlier in this paper, Collier (2009a, 2009b) has argued that the rebuilding of health systems is one of the crucial steps towards post-conflict recovery. This is especially vital given that many refugees who return to their country of origin likely carry the disease with them having lived in more squalid conditions, as documented in Burma and Tajikistan (Beyrer et al. 2007). However, with regards to foreign interventions, governments, international organizations, and various UN agencies have been slow to adapt to changes and implement effective programs

(Spiegel et al. 2010). Furthermore, Spiegal et al (2010) argue that as the profile of conflict-affected population changes over time, so does the different burden of disease. Specifically, an increased number of intrastate conflicts have occurred in recent decades increasing the numbers of internally displaced people (IDPs) as opposed to refugees. In conflict situations, IDPs are less likely to end up in camps or settlements and more likely in more informal urban environments. In these urban environments, IDPs tend to be more at risk given that urbanization plays a major role as a disease risk factor and that many of these informal areas lack formal health systems. At the same time, certain foreign interventions can also exacerbate public health situations as peacekeepers and foreign aid workers can contract these diseases and spread them when travelling (Gayer et al. 2007).

Regarding specific changes which could be implemented in post-conflict aid, Spiegal et al. (2010) and Gayer et al. (2007) suggest three major interventions:

First, reducing risk through providing adequate sanitation, as shown earlier in this paper, would have tremendous effects in risk reduction. Furthermore, this should be complemented with the supply of personal hygienic items such as soap, disinfectants, and sterilizing materials. This can especially have an effect in reducing diarrheal disease rates, which have the greatest impact for young children and infants. This is further supported by a study in the Nyamithithu Refugee Camp in Malawi which found that presence of soap in a household reduced diarrheal incidence by 25% over a four-day lag (Peterson et al. 1998).

Second, the establishment of early warning and response systems is essential in order to anticipate potential outbreaks in more densely populated regions. Here surveillance systems are weakened mainly through limited coverage of healthcare services, poorly trained staff, and difficult logistics. Following the study of Montalvo and Reynal-Querol (2007), refugees can be screened prior to entering a refugee camp and providing judgment on whether certain people should be temporarily quarantined.

Third, the creation of more mobile health teams would be highly effective given that large dispersions of displaced civilians lack access to adequate health and often do not have the logistical means to receive the necessary treatment, as some may be in refugee settlements while others in urban areas. Having more mobile teams would alleviate part of this coverage issue.[8]

In addition, another cost-effective treatment, mainly for combating diarrheal disease, would be vaccination for the Rotavirus, which is responsible for severe vomiting and diarrhea. Rheingans et al. (2007) conducted a study in eight Latin American and Caribbean countries. Using a baseline price of US$ 24[9] per course for a two-dose vaccine, they found that the vaccination would prevent US$ 43.4 million in health care treatment costs and additional US$ 16.8 million in societal costs, which include nonmedical costs and productivity losses. Therefore, including vaccination for the Rotavirus would be an aid effective program in refugee settlements.

Finally, to reiterate the first intervention point by Spiegal et al. (201) and Gayer et al. (2007), providing adequate sanitation is a crucial factor in reducing the burden of disease for displaced groups, which has been further supported by the numerous regression outputs. One of the key criteria for sanitation implementation is the issue of a baseline assessment of not only environmental and logistic factors, but also major cultural and sociological components to consider. Fenner et al. (2007) provides a basic assessment which could be used to create a flow chart shown on Table 19.

Table 19. Assessment for Excreta-Disposal Solutions

Present Capacity	Is there a solution already in place? Can it be upgraded?
Scenario	Is the use of pit latrines culturally acceptable and legal? Is it an urban scenario?
Excavatability	Does the soil allow the burying of tank, the digging of pits?
Ground Permeability	Is the soil able to accept typical infiltration rates?
Contamination	Is there a risk of chemical or bacterial pollution of a water source?
Cultural Norm	Are the units intended for communal or family use?
Anal Cleansing	Is the custom to use solid and dry materials or water for anal cleansing?

In addition to this assessment, Garfi et al. (2009) looked at four possible waste collection and management methods in the Saharawi refugee camps in Algeria. In their paper, they found two main solutions to have been the most effective: The use of Waste Collection by using seven dumpers and disposal in a landfill; and/or seven dumpers and three tipper tricks and disposal in a landfill.

VI.iii Future Research

Earlier in this paper, I discussed some of the limitations of the study used as well as some of the issues connecting the theory in Figures 1 and 2 (see Appendix A in Section VII) to the empirical analyses. These were issues I was not able to address given the limitations of the data, difficulty in acquiring certain types of data, or time constraints in writing this paper—all of which can be addressed in future research. I offer several suggestions and possible models for analyses in which future research could be further improved.

First is to include other major controls such as population access to potable water and civilian access to physicians. The former is clearly an important control as many common diseases are water-borne, and many vectors such as mosquitoes breed in stagnant water. The latter is also important as a major reason why conflict contributes to increased disease death rates could be that many physicians have been displaced or killed in conflict, which greatly limits civilians' access to needed care. As stated earlier in Section IV, I tried to use data from the World Health Organization, but lost many observations when running the regressions. Therefore, I omitted these variables.

Second, the disease metric for this paper is mean death rate per 100,000 people used at all ages. One of the major limitations is that certain diseases, such as diarrheal diseases, tend to greatly affect certain demographic groups more than others, such as children under the age of five years, and especially infants. Therefore, future studies could look more at the share of specific populations with regards to burdens of diseases.

Third, future studies could look more at neighboring countries and spillover effects. While this paper shows the major relationships, it does not show if the diseases occur in the countries of conflict themselves, or it could be spillover effects as neighboring countries accommodate influxes of refugees.

Fourth, regarding the issue of HIV/AIDS, a possible limitation for the paper was that it only looked at one year lag. For future research, a model could incorporate additional lagged years given that certain illnesses such as HIV/AIDS tend to take longer periods of time to kill the host.

Fifth, one of the possible issues in the model of consideration is the issue of autocorrelation. A possible issue is misspecification for the conflict variables. Here the deaths were simple scaled so the interpretation would be 1000 increases. However, for conflicts that occur over long periods of time, it is possible that civilians would emigrate from a conflict zone, causing the change in conflict-related casualties to eventually taper off over a longer period of time. Therefore to account to possible autocorrelation, similar models could include clustering. Alternatively, using the natural logarithm or root of the conflict variable might account for autocorrelation.

Sixth, as stated earlier in the Theory section, I was only able to use controls for sanitation and government expenditures for human development. What would also be useful is if future research incorporated defense spending, as well as variables that could predict possible healthcare measures at the individual level such as price of basic food items and medicines. Additionally, what could be interesting is factoring in government defense spending to see if that exacerbates public health-related matters or not.

Finally, this paper has used only Fixed Effects regressions, but the data looks only at 1990 to 2014. A possible limitation for this time era is that there may have been major conflicts, such as those in Latin America, that occurred more in the 1970's and 1980's, but have disappeared from this dataset. In other instances, there might be conflicts which are only partially captured in this time span. Therefore, using Random Effects in a future model would allow for such a study to look at the effects of armed conflict on public health at a wider range of global conflicts.

VII. Appendices

Appendix A: Figures

Figure 1: Impact of Conflict on Individual's Budget Constraint

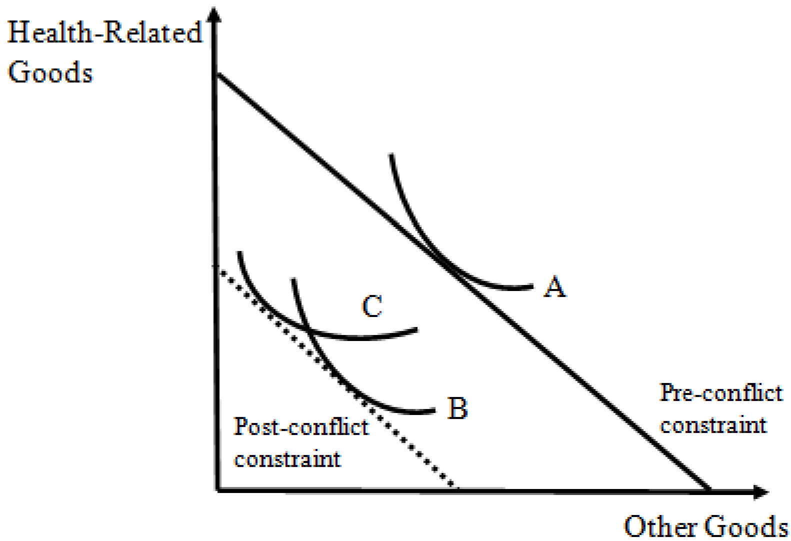
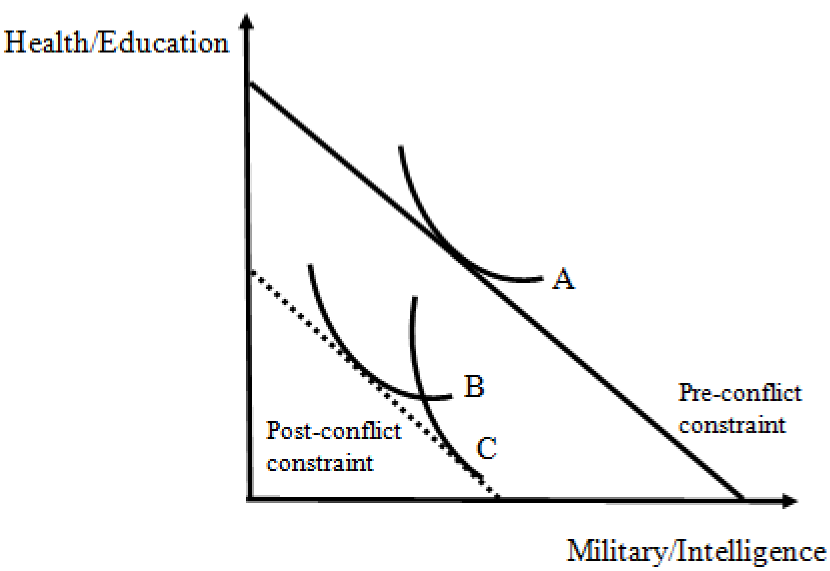


Figure 2: Impact of Conflict on Government Expenditures



Appendix B: Model Output

The following are tables discussed in the results section. Conflict variables that have been lagged are denoted with an "L."

Table 7. Armed Conflict Effects on Diarrheal Disease Death

	(Males)	L.(Male)	(Females)	L.(Females)	(Males)	L.(Male)	(Females)	L.(Female)
One-sided death	0.001	0.001	0.001	0.001	0.117**	0.055	0.115**	0.052
	(0.00)	(0.00)	(0.00)	(0.00)	(0.05)	(0.03)	(0.05)	(0.04)
Battle deaths	0.004	0.010*	0.004	0.010**	0.003	0.002	0.003	0.002
	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)
Non-state deaths	0.025	0.038	0.023	0.038	-0.020	0.019	-0.009	0.033
	(0.05)	(0.05)	(0.05)	(0.05)	(0.05)	(0.06)	(0.05)	(0.06)
Pctpopsanit					-0.060***	-0.060***	-0.058***	-0.058***
					(0.00)	(0.00)	(0.00)	(0.00)
Edu Exp					-0.003	-0.003	-0.003	-0.003
					(0.00)	(0.00)	(0.00)	(0.00)
Health Exp					-0.006***	-0.006***	-0.007***	-0.007***
					(0.00)	(0.00)	(0.00)	(0.00)
Constant	2.836***	2.811***	2.842***	2.819***	7.101***	7.108***	7.043***	7.051***
	(0.01)	(0.01)	(0.01)	(0.01)	(0.15)	(0.15)	(0.16)	(0.16)
No. of Obs.	4512	4324	4512	4324	1499	1499	1499	1499
R-Squared	0.942	0.946	0.939	0.943	0.989	0.989	0.988	0.988

Note: Numbers in parentheses are standard errors
="* p<0.10 ** p<0.05 *** p<0.010."

Table 8. Armed Conflict Effects on Diarrheal Disease Death with Year Fixed Effects

	(Males)	L.(Male)	(Females)	L.(Females)	(Males)	L.(Male)	(Females)	L.(Female)
One-sided death	0.000	0.000	0.000	0.000	0.110**	0.047	0.120**	0.054
	(0.00)	(0.00)	(0.00)	(0.00)	(0.05)	(0.03)	(0.05)	(0.04)
Battle deaths	-0.002	0.001	-0.001	0.002	0.002	0.001	0.003	0.001
	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)
Nonstate deaths	-0.030	-0.017	-0.026	-0.011	-0.030	0.003	-0.022	0.020
	(0.04)	(0.04)	(0.04)	(0.04)	(0.05)	(0.06)	(0.05)	(0.06)
Pctpopsanit					-0.054***	-0.054***	-0.058***	-0.058***
					(0.00)	(0.00)	(0.00)	(0.00)
Edu Exp					-0.003	-0.003	-0.003	-0.003
					(0.00)	(0.00)	(0.00)	(0.00)
Health Exp					-0.005***	-0.005***	-0.007***	-0.007***
					(0.00)	(0.00)	(0.00)	(0.00)
Constant	3.385***	3.334***	3.336***	3.288***	6.438***	6.435***	6.787***	6.784***
	(0.03)	(0.03)	(0.03)	(0.03)	(0.29)	(0.29)	(0.30)	(0.30)
No. of Obs.	4512	4324	4512	4324	1499	1499	1499	1499
R-Squared	0.967	0.969	0.960	0.963	0.989	0.989	0.988	0.988

Note: Numbers in parentheses are standard errors
="* p<0.10 ** p<0.05 *** p<0.010."

Table 9. Armed Conflict Effects on Malaria

	(Male)	L.(Male)	(Female)	L.(Female)	(Male)	L.(Male)	(Female)	L.(Female)
One-sided death	0.001	0.001	0.001	0.001	0.155***	0.112***	0.156***	0.108***
	(0.00)	(0.00)	(0.00)	(0.00)	(0.05)	(0.04)	(0.05)	(0.03)
Battle deaths	0.005	0.008**	0.006**	0.009***	0.001	0.003	0.003	0.003
	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)
Non-state deaths	0.042	0.050	0.034	0.041	0.080*	0.129**	0.080**	0.131***
	(0.03)	(0.03)	(0.03)	(0.03)	(0.05)	(0.06)	(0.04)	(0.05)
Pctpopsanit					-0.037***	-0.037***	-0.034***	-0.034***
					(0.00)	(0.00)	(0.00)	(0.00)
Edu Exp					0.000	0.000	-0.001	-0.001
					(0.00)	(0.00)	(0.00)	(0.00)
Health Exp					-0.005***	-0.005***	-0.006***	-0.006***
					(0.00)	(0.00)	(0.00)	(0.00)
Constant	2.741***	2.733***	2.677***	2.670***	4.703***	4.698***	4.536***	4.533***
	(0.01)	(0.01)	(0.01)	(0.01)	(0.13)	(0.13)	(0.11)	(0.11)
No. of Obs.	2545	2438	2545	2438	797	797	797	797
R-Squared	0.984	0.984	0.986	0.986	0.994	0.994	0.996	0.996

Note: Numbers in parentheses are standard errors
="* p<0.10 ** p<0.05 *** p<0.010."

Table 10. Armed Conflict Effects on Malaria with Year Fixed Effects

	(Male)	L.(Male)	(Female)	L.(Female)	(Male)	L.(Male)	(Female)	L.(Female)
One-sided death	0.000	0.001	0.000	0.001	0.076*	0.112***	0.096**	0.108***
	(0.00)	(0.00)	(0.00)	(0.00)	(0.04)	(0.04)	(0.04)	(0.03)
Battle deaths	0.004*	0.008**	0.006**	0.009***	-0.001	0.003	0.002	0.003
	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)
Non-state deaths	0.030	0.050	0.023	0.041	0.101***	0.129**	0.096***	0.131***
	(0.02)	(0.03)	(0.02)	(0.03)	(0.04)	(0.06)	(0.04)	(0.05)
Pctpopsanit					-0.004	-0.037***	-0.010***	-0.034***
					(0.00)	(0.00)	(0.00)	(0.00)
Edu Exp					-0.001	0.000	-0.002	-0.001
					(0.00)	(0.00)	(0.00)	(0.00)
Health Exp					-0.000	-0.005***	-0.002	-0.006***
					(0.00)	(0.00)	(0.00)	(0.00)
Constant	2.908***	2.733***	2.825***	2.670***	2.882***	4.698***	3.128***	4.533***
	(0.02)	(0.01)	(0.02)	(0.01)	(0.16)	(0.13)	(0.15)	(0.11)
No. of Obs.	2545	2438	2545	2438	797	797	797	797
R-Squared	0.991	0.984	0.992	0.986	0.996	0.994	0.997	0.996

Note: Numbers in parentheses are standard errors
="* p<0.10 ** p<0.05 *** p<0.010."

Table 11. Armed Conflict Effects on HIV/AIDS

	(Male)	L.(Male)	(Female)	L.(Female)	(Male)	L.(Male)	(Female)	L.(Female)
One-sided deaths	-0.000	0.000	-0.000	-0.000	-0.012	-0.021	-0.035	-0.049
	(0.00)	(0.00)	(0.00)	(0.00)	(0.06)	(0.04)	(0.06)	(0.04)
Battle deaths	-0.006	-0.005	-0.011*	-0.010*	0.001	0.003	-0.001	0.001
	(0.01)	(0.01)	(0.01)	(0.01)	(0.01)	(0.01)	(0.01)	(0.00)
Non-state deaths	-0.206***	-0.181***	-0.238***	-0.209***	-0.072	-0.115	-0.044	-0.061
	(0.06)	(0.05)	(0.06)	(0.05)	(0.06)	(0.07)	(0.05)	(0.07)
Pctpopsanit					0.008***	0.008***	-0.001	-0.001
					(0.00)	(0.00)	(0.00)	(0.00)
Edu Exp					0.006**	0.006**	0.007***	0.007***
					(0.00)	(0.00)	(0.00)	(0.00)
Health Exp					-0.005***	-0.005***	-0.004***	-0.004***
					(0.00)	(0.00)	(0.00)	(0.00)
Constant	2.426***	2.462***	1.872***	1.909***	2.172***	2.172***	2.094***	2.099***
	(0.01)	(0.01)	(0.01)	(0.01)	(0.19)	(0.19)	(0.18)	(0.18)
No. of Obs.	4512	4324	4512	4324	1499	1499	1499	1499
R-Squared	0.921	0.936	0.921	0.937	0.985	0.986	0.988	0.988

Note: Numbers in parentheses are standard errors
="* p<0.10 ** p<0.05 *** p<0.010."

Table 12. Armed Conflict Effects on HIV/AIDS with Year Fixed Effects

	(Male)	L.(Male)	(Female)	L.(Female)	(Male)	L.(Male)	(Female)	L.(Female)
One-sided deaths	0.000	0.001	0.000	0.000	-0.016	-0.026	-0.045	-0.057
	(0.00)	(0.00)	(0.00)	(0.00)	(0.06)	(0.04)	(0.06)	(0.04)
Battle deaths	0.001	0.003	-0.003	-0.002	0.002	0.004	0.001	0.002
	(0.00)	(0.00)	(0.00)	(0.00)	(0.01)	(0.01)	(0.01)	(0.00)
Non-state deaths	-0.143***	-0.131***	-0.170***	-0.154***	-0.061	-0.108	-0.032	-0.056
	(0.05)	(0.05)	(0.05)	(0.04)	(0.06)	(0.07)	(0.05)	(0.07)
Pctpopsanit					0.006*	0.006*	-0.003	-0.003
					(0.00)	(0.00)	(0.00)	(0.00)
Edu Exp					0.004	0.004	0.005**	0.005**
					(0.00)	(0.00)	(0.00)	(0.00)
Constant	1.566***	1.730***	0.997***	1.148***	3.897***	3.886***	2.654***	2.646***
	(0.03)	(0.03)	(0.03)	(0.03)	(0.36)	(0.36)	(0.34)	(0.34)
No. of Obs.	4512	4324	4512	4324	1499	1499	1499	1499
R-Squared	0.946	0.953	0.948	0.957	0.986	0.986	0.988	0.988

Note: Numbers in parentheses are standard errors
="* p<0.10 ** p<0.05 *** p<0.010."

Table 14. Armed Conflict Effects on HIV/AIDS with Year Fixed Effects after VIF Checks

	(Male)	L.(Male)	(Female)	L.(Female)
One-sided deaths	0.000	0.001	0.000	0.000
	(0.00)	(0.00)	(0.00)	(0.00)
Battle deaths	0.001	0.003	-0.003	-0.001
	(0.00)	(0.00)	(0.00)	(0.00)
Non-state deaths	-0.177***	-0.162***	-0.204***	-0.197***
	(0.05)	(0.04)	(0.05)	(0.04)
Pctpopsanit	0.020***	0.019***	0.008***	0.008***
	(0.00)	(0.00)	(0.00)	(0.00)
Edu Exp	0.005*	0.005*	0.007***	0.007***
	(0.00)	(0.00)	(0.00)	(0.00)
Constant	0.361***	0.558***	0.536***	0.717***
	(0.13)	(0.13)	(0.12)	(0.12)
No. of Obs.	4229	4081	4229	4081
R-Squared	0.950	0.956	0.953	0.961

Note: Numbers in parentheses are standard errors
="* p<0.10 ** p<0.05 *** p<0.010."

Table 15. Armed Conflict Effects on Fvector Diseases

	(Male)	L.(Male)	(Female)	L.(Female)	(Male)	L.(Male)	(Female)	L.(Female)
One-sided deaths	0.001	0.001	0.001	0.001	0.117***	0.074***	0.120***	0.073***
	(0.00)	(0.00)	(0.00)	(0.00)	(0.03)	(0.02)	(0.03)	(0.02)
Battle deaths	0.003	0.007***	0.005**	0.008***	0.001	0.004	0.003	0.004
	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)
Non-state deaths	0.058**	0.068***	0.049**	0.059***	0.089***	0.139***	0.083***	0.133***
	(0.02)	(0.02)	(0.02)	(0.02)	(0.03)	(0.04)	(0.03)	(0.04)
Pctpopsanit					-0.032***	-0.033***	-0.032***	-0.032***
					(0.00)	(0.00)	(0.00)	(0.00)
Edu Exp					-0.000	-0.000	-0.001	-0.001
					(0.00)	(0.00)	(0.00)	(0.00)
Health Exp					-0.003***	-0.003***	-0.003***	-0.003***
					(0.00)	(0.00)	(0.00)	(0.00)
Constant	1.829***	1.824***	1.716***	1.711***	4.072***	4.073***	3.960***	3.962***
	(0.00)	(0.00)	(0.00)	(0.00)	(0.11)	(0.11)	(0.10)	(0.10)
No. of Obs.	4512	4324	4512	4324	1499	1499	1499	1499
R-Squared	0.990	0.990	0.990	0.990	0.996	0.996	0.997	0.997

Note: Numbers in parentheses are standard errors
="* p<0.10 ** p<0.05 *** p<0.010."

Table 16. Armed Conflict Effects on Fvector Diseases with Year Fixed Effects

	(Male)	L.(Male)	(Female)	L.(Female)	(Male)	L.(Male)	(Female)	L.(Female)
One-sided deaths	0.000	0.000	0.000	0.000	0.086***	0.050**	0.098***	0.056**
	(0.00)	(0.00)	(0.00)	(0.00)	(0.03)	(0.02)	(0.03)	(0.02)
Battle deaths	0.002	0.004*	0.004**	0.006***	0.001	0.003	0.003	0.004
	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)
Non-state deaths	0.050**	0.057***	0.042**	0.049**	0.096***	0.129***	0.088***	0.126***
	(0.02)	(0.02)	(0.02)	(0.02)	(0.03)	(0.04)	(0.03)	(0.04)
Pctpopsanit					-0.020***	-0.020***	-0.023***	-0.024***
					(0.00)	(0.00)	(0.00)	(0.00)
Edu Exp					-0.001	-0.001	-0.001	-0.001
					(0.00)	(0.00)	(0.00)	(0.00)
Health Exp					-0.001*	-0.001*	-0.002**	-0.002**
					(0.00)	(0.00)	(0.00)	(0.00)
Constant	1.921***	1.924***	1.799***	1.801***	3.038***	3.048***	3.243***	3.252***
	(0.01)	(0.01)	(0.01)	(0.01)	(0.19)	(0.19)	(0.19)	(0.19)
No. of Obs.	4512	4324	4512	4324	1499	1499	1499	1499
R-Squared	0.993	0.993	0.993	0.993	0.997	0.997	0.997	0.997

Note: Numbers in parentheses are standard errors
="* p<0.10 ** p<0.05 *** p<0.010."

Table 17. Armed Conflict Effects on Neglected Tropical Diseases

	(Male)	L.(Male)	(Female)	L.(Female)	(Male)	L.(Male)	(Female)	L.(Female)
One-sided deaths	0.000	0.000	0.000	0.001	0.047	0.017	0.057	0.018
	(0.00)	(0.00)	(0.00)	(0.00)	(0.03)	(0.02)	(0.04)	(0.02)
Battle deaths	0.003	0.005**	0.002	0.006**	0.001	0.006**	0.001	0.006**
	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)
Non-state deaths	0.055**	0.065***	0.057**	0.068***	0.028	0.069*	0.038	0.081*
	(0.02)	(0.02)	(0.02)	(0.02)	(0.03)	(0.04)	(0.03)	(0.04)
Pctpopsanit					-0.021***	-0.021***	-0.022***	-0.023***
					(0.00)	(0.00)	(0.00)	(0.00)
Edu Exp					-0.001	-0.001	-0.003*	-0.003*
					(0.00)	(0.00)	(0.00)	(0.00)
Health Exp					-0.003***	-0.003***	-0.002***	-0.002***
					(0.00)	(0.00)	(0.00)	(0.00)
Constant	1.063***	1.056***	0.917***	0.909***	2.542***	2.547***	2.537***	2.543***
	(0.00)	(0.00)	(0.00)	(0.00)	(0.10)	(0.10)	(0.11)	(0.11)
No. of Obs.	4512	4324	4512	4324	1499	1499	1499	1499
R-Squared	0.964	0.966	0.952	0.954	0.986	0.986	0.980	0.980

Note: Numbers in parentheses are standard errors
="* p<0.10 ** p<0.05 *** p<0.010."

Table 18. Armed Conflict Effects on Neglected Tropical Diseases with Year Fixed Effects

	(Male)	L.(Male)	(Female)	L.(Female)	(Male)	L.(Male)	(Female)	L.(Female)
One-sided deaths	-0.000	-0.000	0.000	0.000	0.022	0.001	0.039	0.006
	(0.00)	(0.00)	(0.00)	(0.00)	(0.03)	(0.02)	(0.04)	(0.02)
Battle deaths	0.001	0.003	0.001	0.004	-0.000	0.005*	0.000	0.006**
	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)
Non-state deaths	0.042**	0.051**	0.043*	0.052**	0.031	0.061	0.041	0.073*
	(0.02)	(0.02)	(0.02)	(0.02)	(0.03)	(0.04)	(0.03)	(0.04)
Pctpopsanit					-0.010***	-0.010***	-0.014***	-0.014***
					(0.00)	(0.00)	(0.00)	(0.00)
Edu Exp					-0.001	-0.001	-0.003*	-0.003*
					(0.00)	(0.00)	(0.00)	(0.00)
Health Exp					-0.001*	-0.001*	-0.001*	-0.001*
					(0.00)	(0.00)	(0.00)	(0.00)
Constant	1.210***	1.187***	1.073***	1.056***	1.658***	1.666***	1.833***	1.842***
	(0.02)	(0.01)	(0.02)	(0.02)	(0.19)	(0.19)	(0.21)	(0.21)
No. of Obs.	4512	4324	4512	4324	1499	1499	1499	1499
R-Squared	0.972	0.973	0.963	0.964	0.987	0.987	0.981	0.981

Note: Numbers in parentheses are standard errors
="* p<0.10 ** p<0.05 *** p<0.010."

VIII. References

Addison, Tony, Philippe Le Billon, and S. Mansoob Murshed. "Finance in conflict and reconstruction." *Journal of International Development* 13, no. 7 (2001): 951-964.

Ajakaiye, Olu, and Ali Abdel Gadir Ali. "Managing post-conflict recovery in Africa: an overview." *Journal of African economies* 18, no. suppl 1 (2009): i3-i11.

Akresh, Richard, Leonardo Lucchetti, and Harsha Thirumurthy. "Wars and child health: Evidence from the Eritrean–Ethiopian conflict." *Journal of development economics* 99, no. 2 (2012): 330-340.

Anema, Aranka, Michel R. Joffres, Edward Mills, and Paul B. Spiegel. "Widespread rape does not directly appear to increase the overall HIV prevalence in conflict-affected countries: so now what." *Emerging Themes in Epidemiology* 5, no. 11 (2008): 1742-1776.

Betsi, Nicolas Alain, B. G. Koudou, Guéladio Cissé, A. B. Tschannen, A. M. Pignol, Y. Ouattara, Z. Madougou, M. Tanner, and Jürg Utzinger. "Effect of an armed conflict on human resources and health systems in Côte d'Ivoire: prevention of and care for people with HIV/AIDS." *AIDS care* 18, no. 4 (2006): 356-365.

Beyrer, Chris, Juan Carlos Villar, Voravit Suwanvanichkij, Sonal Singh, Stefan D. Baral, and Edward J. Mills. "Neglected diseases, civil conflicts, and the right to health." *The Lancet* 370, no. 9587 (2007): 619-627.

Chen, Siyan, Norman V. Loayza, and Marta Reynal-Querol. "The aftermath of civil war." *The World Bank Economic Review* 22, no. 1 (2008): 63-85.

Collier, Paul, and Dominic Rohner. "Democracy, development, and conflict."*Journal of the European Economic Association* 6, no. 2-3 (2008): 531-540.

Collier, Paul. "Post-conflict recovery: How should strategies be distinctive?."*Journal of African Economies* 18, no. suppl 1 (2009): i99-i131.

Collier, Paul, Anke Hoeffler, and Måns Söderbom. "Post-conflict risks." *Journal of Peace Research* 45, no. 4 (2008): 461-478.

"Diseases." Centers for Disease Control and Prevention. 2011. Accessed February 09, 2016. http://www.cdc.gov/globalhealth/ntd/diseases/index.html

Fearon, James D., Macartan Humphreys, and Jeremy M. Weinstein. "Can development aid contribute to social cohesion after civil war? Evidence from a field experiment in post-conflict Liberia." *The American Economic Review*(2009): 287-291.

Fenner, R. A., P. M. Guthrie, and E. Piano. "Process selection for sanitation systems and wastewater treatment in refugee camps during disaster-relief situations." *Water and Environment Journal* 21, no. 4 (2007): 252-264.

Fürst, Thomas, Giovanna Raso, Cinthia A. Acka, Andres B. Tschannen, Eliezer K. N'Goran, and Jurg Utzinger. "Dynamics of socioeconomic risk factors for neglected tropical diseases and malaria in an armed conflict." *PLoS Negl Trop Dis* 3, no. 9 (2009): e513.

Garfi, Marianna, Simona Tondelli, and A. Bonoli. "Multi-criteria decision analysis for waste management in Saharawi refugee camps." *Waste management* 29, no. 10 (2009): 2729-2739.

Gayer, Michelle, Dominique Legros, Pierre Formenty, and Maire A. Connolly. "Conflict and emerging infectious diseases." *Emerging infectious diseases*13, no. 11 (2007): 1625.

Ghobarah, Hazem Adam, Paul Huth, and Bruce Russett. "Civil wars kill and maim people—long after the shooting stops." *American Political Science Review* 97, no. 02 (2003): 189-202.

Institute for Health Metrics and Evaluation. GBD 2013 Protocol: global burden of diseases, injuries, and risk factors. 2013. http:// www.healthdata.org/gbd/about/protocol (accessed Nov 3, 2014)

Kruk, Margaret E., Lynn P. Freedman, Grace A. Anglin, and Ronald J. Waldman. "Rebuilding health systems to improve health and promote statebuilding in post-conflict countries: A theoretical framework and research agenda." *Social Science & Medicine* 70, no. 1 (2010): 89-97.

Mansour, Hani, and Daniel I. Rees. "Armed conflict and birth weight: Evidence from the al-Aqsa Intifada." *Journal of Development Economics* 99, no. 1 (2012): 190-199.

Montalvo, Jose G., and Marta Reynal-Querol. "Fighting against malaria: prevent wars while waiting for the “miraculous” vaccine." *The Review of Economics and Statistics* 89, no. 1 (2007): 165-177.

Murdoch, James C., and Todd Sandler. "Economic growth, civil wars, and spatial spillovers." *Journal of conflict resolution* 46, no. 1 (2002): 91-110.

Murray, Christopher JL, Gary King, Alan D. Lopez, Niels Tomijima, and Etienne G. Krug. "Armed conflict as a public health problem." *BMJ: British Medical Journal* 324, no. 7333 (2002): 346.

Minoiu, Camelia, and Olga N. Shemyakina. "Armed conflict, household victimization, and child health in Côte d'Ivoire." *Journal of Development Economics* 108 (2014): 237-255.

O'Hare, Bernadette AM, and David P. Southall. "First do no harm: the impact of recent armed conflict on maternal and child health in Sub-Saharan Africa."*Journal of the Royal Society of Medicine* 100, no. 12 (2007): 564-570.

Patz, Jonathan A., and William K. Reisen. "Immunology, climate change and vector-borne diseases." *Trends in immunology* 22, no. 4 (2001): 171-172.

Peterson, F. Anne, Leslie Roberts, Michael J. Toole, and Dan E. Peterson. "The effect of soap distribution on diarrhoea: Nyamithuthu Refugee Camp."*International Journal of Epidemiology* 27, no. 3 (1998): 520-524.

Ranis, Gustav. "Human development and economic growth." *Yale University Economic Growth Center Discussion Paper* 887 (2004).

Rheingans, Richard D., Dagna Constenla, Lynn Antil, Bruce L. Innis, and Thomas Breuer. "Potential cost-effectiveness of vaccination for rotavirus gastroenteritis in eight Latin American and Caribbean countries." *Revista Panamericana de Salud Pública* 21, no. 4 (2007): 205-216.

Spiegel, Paul B., Francesco Checchi, Sandro Colombo, and Eugene Paik. "Health-care needs of people affected by conflict: future trends and changing frameworks." *The Lancet* 375, no. 9711 (2010): 341-345.

"The Data Repository." World Health Organization. Accessed February 13, 2016. http://www.who.int/gho/database/en/.

Themnér, Lotta, and Peter Wallensteen. "Armed conflicts, 1946–2013." *Journal of Peace Research* 51, no. 4 (2014): 541-554.

"Transcript of "New Rules for Rebuilding a Broken Nation"" Paul Collier: New Rules for Rebuilding a Broken Nation. June 1, 2009. Accessed September 23, 2015. http://www.ted.com/talks/paul_collier_s_new_rules_for_rebuilding_a_broken_nation/transcript?language=en.

Tripodi, Paolo, and Preeti Patel. "HIV/AIDS, peacekeeping and conflict crises in Africa." *Medicine, Conflict and Survival* 20, no. 3 (2004): 195-208.

Uppsala University Department of Peace and Conflict Research. “Definitions.” http://www.pcr.uu.se/research/ucdp/definitions/ (accessed November 10, 2015).

Virginie, Supervie, Halima Yasmin, and Blower Sally. "Assessing the impact of mass rape on the incidence of HIV in conflict-affected countries." *AIDS (London, England)* 24, no. 18 (2010): 2841.

"WHO EMRO | Syrian Arab Republic | Countries | Polio Eradication Initiative." WHO EMRO | Syrian Arab Republic | Countries | Polio Eradication Initiative. Accessed February 09, 2016. http://www.emro.who.int/polio/countries/syrian-arab-republic.html.

VIV. ENDNOTES

[1] Montalvo and Reynal-Querol (2007), Chen, et al (2008), O'Hare and Southall (2007), Fürst, et al (2009), Akresh, et al. (2012), and Mansour and Rees (2012)

[2] These are vector borne diseases which can be spread by mosquitoes, sandflies, and other vectors that fly. This would be in contrast to vectors such as worms.

[3] When aggregated, NTDs consist of over a dozen diseases which include: Buruli Ulcer, Chagas Disease, Dengue fever, Dracunculiasis (Guinea Worm Disease), Leishmaniasis, and Schistosomiasis (CDC Accessed 2016).

[4] This relates to the assumption in that individuals who do resort to black market activities might not have as big changes in budget constraints as they might maintain, or even increase, their income levels by entering black market activities.

[5] Women, on the other hand, do activities such as collecting water and farming in many cultures.

[6]This is a major generalization given the aggregate-level data and country observations. However, it is prevalent across many rural areas in Asia and Africa.

[7]This is with the exception for HIV/AIDS where, as stated earlier, there appear to be unusual trends in the data and possible signs of multicollinearity.

[8] The last two interventions recommended by Spiegal et al. (2010) and Gayer et al. (2007) could be done in conjunction with notable groups such as Doctors Without Borders and the International Medical Corps.

[9] This is in US$ for the year 2003.