

# Do Health Programs Reduce Conflict and Violence? A Case-Control Study

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## Research article

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# Do Health Programs Reduce Conflict and Violence?

## A Case-Control Study

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## Abstract

**Background:** Health programs are often implemented in conflict zones in hopes of ‘winning hearts and minds’ and preserving the peace. We find no scientific evidence for this policy, but hypothesize that programs to mitigate health problems have a role in keeping the peace in conflict states. The evidence for our theory to date is anecdotal.

**Methods:** We carefully examined hundreds of conflicts in a robust international database (NAVCO 2.0) for the presence of health programs by warring parties, and were unable to demonstrate a statistical correlation between the presence of a health program and the subsequent peaceful resolution of conflict. Using this empirical analysis and the Global Burden of Disease (GBD), a comprehensive international database of health conditions, we performed a matched case-control analysis of the association between the GBD prevalence of 254 different health conditions and NAVCO database conflict status. We identified 14 countries with new-onset conflict as our cases and 42 similar countries without conflict during the same year as our controls.

**Results:** None of the 254 common health conditions had changes in prevalence that correlated with the subsequent conflict status of that nation.

**Conclusions:** We were unable to show that any of the health conditions we analyzed is a predictive ‘leading indicator’ of conflict. Without such an association or causal link, the role of health programs in reducing conflict and violence remains unconvincing and ambiguous. We believe this work is a novel insight into ways the international community might reliably mitigate conflict, and should provoke more research on this topic.

## Introduction

Does better health increase the likelihood of peace, just as peace clearly contributes to better population health? To be more scientific, is there a bi-directional, causal linkage between health and peace?

All over the world, international security and nongovernmental health organizations intervene in potential conflict zones, in the hopes that their health programs will stabilize the situation and keep the peace. Is there any scientific data to support this hope? While peace certainly increases access to healthcare and the opportunities to improve individual and public health, we wonder if programs to enhance health likewise keep the peace, stabilize security situations, and reduce the likelihood of conflict and violence.

Our research theory is that these programs do in fact produce peace and stability. As a humanitarian eye surgeon, the author has taught and performed gratis eye surgery extensively in both developed and developing countries, in hopes that his efforts extend beyond the impact on the individual patients and in fact 'lift all boats' toward peace and prosperity. This study attempts to create a scientific foundation for such a hope.

**Review of the literature:** The role of public health programs in establishing and maintaining peace is rarely considered by government leaders. Immanuel Kant, in *Perpetual Peace: A Philosophical Sketch* (Kant 1795), ignores the role of health and health programs in preserving peace. Diplomats and scientists who have grappled with the nature of international peace since 1795 often also neglect the health factor.

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4 Max Boot, in his comprehensive, 700-page analysis of low-intensity conflict since the  
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6 beginning of recorded history (Boot 2013), notes the impact of diseases like yellow fever on  
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8 Haiti's war of independence in 1798 and malaria in the Burma campaign of World War II.  
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10 But he cites no instances where health programs by either insurgents or government forces  
11  
12 contributed to stabilizing a conflict situation or preserving a peaceful outcome. Likewise,  
13  
14 health issues and the programs that address them are rarely considered significant in  
15  
16 predicting the breakdown of civil society into violence, or as a 'leading indicator' that can be  
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18 used to anticipate conflict.  
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26 War and conflict have profound impacts on human health. So-called 'kinetic operations'  
27  
28 involve shooting bullets and exploding bombs, with the goal of killing or injuring human  
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30 beings and destroying infrastructure. War shreds the social fabric of nations, causes  
31  
32 enormous environmental damage, and diverts resources from essential governance tasks  
33  
34 like public health and education. The direct and indirect consequences of war on health  
35  
36 resonate for generations, long after the repair of bodies and buildings are finished. Eckhardt  
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38 (1989) has estimated that 50% of wartime deaths occur among non-combatant civilians, in  
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40 spite of broadly-accepted international treaties designed to protect non-combatants.  
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42 Others (James 2014) have cited that an even higher percentage of deaths during war among  
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44 non-combatant civilians. Long-term deleterious health effects, such as amputation and  
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46 blindness, are the expected consequences of warfare. Psychological impacts, such as  
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48 traumatic brain injury and post-traumatic stress disorder, have been recognized after  
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50 conflicts in recent centuries. They were likely been prevalent but ignored after earlier wars.  
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Infectious diseases often thrive in the chaos of warfare. A classic example is the destruction of Napoleon's invading force in Russia in 1814. His invincible army left Europe with 400,000 soldiers and robust support, but infections and hypothermia killed the vast majority of the soldiers, and only a handful returned to France with their brilliant general the following year. The 'scorched earth' that they encountered in the wake of the Russian retreat undoubtedly destroyed the lives and livelihoods of many noncombatants. This has been the story of warfare since the beginning of history. To hypothesize that warfare impacts public health of a nation is simple. Can we causally link the reverse impact, that changes in public health might cause or prevent war? Is it possible to anticipate conflict, or avoid it, by monitoring specific health conditions ('leading indicators' of war) in a nation at risk for conflict?

**Terms of reference:** A logical place to begin this analysis is with the definition of terms. Both "health" and "security" have many definitions. A widely-recognized, comprehensive definition of health from the World Health Organization, better known as the WHO, is "a state of complete physical, mental, and social well-being and not merely the absence of disease or infirmity" (WHO 1946). Others would say that health can mean access to competent healthcare, adequate nutrition, and an appropriate life expectancy. Although complex, there are numerous well-documented factors that correlate with health, including security, economics, human rights, and governance. These broad 'determinants of health' break down during conflict and violence. (Bennett, Marshall, Gjelsvik et al. 2015; Wise and Darmstadt 2015; Jack, Masterson, and Khoshnood 2014; Center for Strategic and International Studies 2012; Barrang-Ford, Lundine, and Breau 2011; de Waal 2010). For the

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4 purposes of this work, we will focus on population health, rather than access to care or  
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7 individual metrics of good health.  
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10 Careful observers point out the close correlation between conflict and ‘demography’, the  
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12 study of human populations and how those populations change in size, composition, and  
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14 distribution across space. A number of articles have associated high rates of birth, death,  
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16 and migration with war. (Brunberg and Urdal 2005; Li and Wen 2005)  
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21 Another main term to define is peace, or ‘security’ as it is often called by politicians,  
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23 diplomats, and generals. Abraham Maslow rated physiological needs, like good health, as  
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25 fundamental, with safety slightly higher up his pyramid. (His hierarchy had no basis in  
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27 experimental science.) Security is broadly considered a key ‘determinant of health’, and has  
28  
29 been re-defined in recent years. In military circles, it often means ‘stability operations,’  
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31 those military actions that mitigate or end combat and conflict.  
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38 Global security efforts include public health and human rights and extend the security  
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40 agenda in scale. (Ban 2003). The United Nations Security Council Charter sorts security  
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42 activities into Chapter 6 actions, “peacekeeping”, and Chapter 7 actions, “peace  
43  
44 enforcement.” The former happens at the invitation of the warring parties, with the goal of  
45  
46 preserving a cease-fire. The latter happens at Security Council direction without consent of  
47  
48 the warring parties, with the goal of limiting conflict and avoiding spillover of fighting and  
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50 refugees into adjacent states. Neither comes with an explicit health program for the conflict  
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52 zone.  
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4 With the Human Development Report (United Nations Development Programme 1994),  
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7 the term 'human security' entered the security literature. The concept arose from the  
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9 human rights tradition and is analogous to well-being and overall quality of life. The  
10  
11 individual 'human security' concept was a modification of 'national security' and a collective  
12  
13 perspective. It was based a multi-disciplinary perspective of seven different types of  
14  
15 security: economic, environmental, political, community, personal, food, and health. The  
16  
17 concept was clarified in 2008 with a Human Security Index (HSI). The HSI 'version 2.0', new  
18  
19 and improved, was released in 2010. ([www.humansecurityindex.org](http://www.humansecurityindex.org)) The latter version is  
20  
21 based on three factors: Economic, Environmental, and Social Fabric indexes. It is meant to  
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23 imitate the 'triple bottom line' ("people-planet-profit"), used in assessment of modern  
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25 corporate responsibility.  
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33 Some have argued that changes in a nation's health status have both direct and indirect  
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35 effects on national security and may lead to political unrest, civil disorder or deterioration of  
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37 the economy of a country. (Price-Smith 2002). In 2008, the US National Intelligence Council  
38  
39 issued its strategic assessment of the importance of global health factors on US national  
40  
41 security. The document cites twelve case study countries, chosen for a combination of health  
42  
43 factors and strategic importance to the US. The analysis does not include the contribution of  
44  
45 health programs to keeping the peace, but implies that a strategic perspective requires  
46  
47 consideration of health systems and programs in nations of key strategic value to US interests.  
48  
49 (National Intelligence Council 2008). A subsequent study found scientific support for a parasite-  
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51 stress model of health factors contributing to intrastate armed conflict. (Letendre, Fincher, and  
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53 Thornhill 2010)  
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4 The Pan-American Health Organization, the Western Hemisphere regional operation of  
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6 the WHO, made some of the earliest efforts to use health programs as a tool for peace.  
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8 Their “Days of Tranquility” immunization program in El Salvador and Nicaragua in the 1980’s  
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10 was a model for later humanitarian cease-fires and safe corridor programs around the  
11  
12 world (Arya 2017). The WHO website cites these efforts as now part of the “Health as a  
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14 Bridge to Peace” program.  
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19 ([http://www.who.int/hac/techguidance/hbp/comparative\\_analysis/en/](http://www.who.int/hac/techguidance/hbp/comparative_analysis/en/)) At least nineteen  
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21 countries in Africa, Asia, and Latin America have utilized this program to improve public  
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23 health in the past thirty years.  
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28 United Nations Secretary General Boutros-Ghali has noted that drought and disease kill  
29  
30 no less mercilessly than the weapons of war. (United Nations 1992) A former senior US  
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32 military commander in the US Pacific Command, Admiral Samuel J. Locklear, has said that  
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34 climate change and its effects on health, economic stability, and security, is the top threat  
35  
36 to peace in the Asia-Pacific region of the world. (Center for Climate and Security 2015)  
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38 Affected countries may undertake efforts to address health issues through foreign policy,  
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40 thereby enhancing the likelihood of peace. (Katz and Singer 2008)  
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47 Others have suggested that health programs play a negative role in keeping the peace.  
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49 Menocal, in a working paper for the Overseas Development Institute, points out that rapidly  
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51 building health programs with outside groups in an effort to create peace, while failing to build  
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53 state institutions simultaneously, can have a negative impact on long-term stability. (Menocal  
54  
55 2009.) The success of the Hezbollah health programs in Lebanon, filling a vacuum left by a  
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57 dysfunctional national government while winning ‘hearts and minds’ of indigent citizens, is a  
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4 successful demonstration project for this point. (Flanigan 2017)  
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7 Bourdeaux and co-workers (Bourdeaux 2015) performed a study of the relationship  
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9 between international security forces and health programs in four fragile nations: Haiti, Kosovo,  
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11 Afghanistan, and Libya. Using an extensive series of interviews of all sectors of society, they  
12  
13 found opinions about both positive and negative impacts of the presence of peacekeeping  
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15 forces on public health. They did not address specific health programs that demonstrated a  
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17 stabilizing effect on keeping the peace.  
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22 Ho and colleagues (Ho 2017) developed a health system scorecard for use in the conflict  
23  
24 zone in the Congo, and studied its use in a small number of health facilities. Transparency  
25  
26 and fairness were valued by the citizenry, but there was no examination of the impact of  
27  
28 specific diseases as a predictor of peace or increased conflict.  
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33 To date, no metrics of evaluation exist for predicting where and to what extent conflict  
34  
35 may occur based on health deficits of a country. The US National Library of Medicine's  
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37 Medical Subject Headings (MeSH) has few search terms useful for finding any scientific  
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39 investigations of the link between peace and health. Current MeSH terms include 'altruism',  
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41 but not 'humanitarianism'; and 'warfare', but not 'conflict' or 'peace'.  
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46 If 'leading indicators' for war existed, diplomats, humanitarians, and military personnel  
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48 involved in peace and stability operations and planning global health partnerships would be  
49  
50 better able to utilize health programs to reduce those threats to peace. In this study, we  
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52 hypothesize that the collapse of specific health indicators in a nation can be used to predict  
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54 threats to its peace and stability.  
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4 **Methods:** When addressing health and security, what categories of security may be  
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7 important to the health of a nation? There are studies that linked health and various forms  
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9 of security (Lo and Thomas, 2010), though the body of research correlating health  
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11 (specifically infectious diseases) with national or human security is neither extensive nor  
12  
13 compelling. Our research aim was to close this knowledge gap with objective evidence.  
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18 We chose the Nonviolent and Violent Campaigns and Outcomes (NAVCO) Database for  
19  
20 our investigation of these issues. The NAVCO Project is a robust international database that  
21  
22 covers 250 ‘civil resistance campaigns’ - nonviolent and violent conflicts and mass  
23  
24 movements for regime change, anti-occupation, and secession. (Chenoweth and Lewis  
25  
26 2013). These events occurred in every corner of the world from 1945 to 2006. The database  
27  
28 documents nearly 50 features of each individual campaign, such as use of violence as a  
29  
30 tactic, participant numbers and diversity, the behavior of regime elites, and the effects of  
31  
32 repression on the campaign. Health conditions and public health metrics are not among the  
33  
34 features of the NAVCO database. Personal communication with the senior author of the  
35  
36 NAVCO article confirmed this limitation. We believe that health-related data may provide  
37  
38 better understanding of the relationships among the factors in the NAVCO database, as well  
39  
40 as the role of health programs in keeping peace.  
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50 We utilized the NAVCO database to perform an extensive analysis of the correlations  
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52 between national security and health programs (Waller and Chu, 2015). For purposes of our  
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54 study, we defined a “health program” as an established medical system, sustained non-  
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56 governmental organization medical presence, and/or medical counterinsurgency efforts by  
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4 the government side of the conflict. We then performed an open source analysis utilizing a  
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7 series of online search strategies (MEDLINE®, Lexus Nexus®, Google Scholar®, Google  
8  
9 Books®) to examine each NAVCO campaign for the presence of any type of health program.  
10  
11 An intentional effort by a health program to assist or deter the civil resistance campaign  
12  
13 was determined to be present when there was reliable documented evidence of its  
14  
15 existence. We also considered a health program to be present when, despite an absence of  
16  
17 internet evidence, parallel social welfare institutions were documented. Finally, health  
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19 programs were considered to be “not present” when there was compelling research  
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21 evidence of an absence of any associated health program during the civil resistance  
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23 campaign.  
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31 To analyze the results, we evaluated the presence of health programs in countries with  
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33 ongoing civil resistance campaigns, and judged the quality our work by the robust  
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35 agreement between the three investigators (kappa statistic = 0.40). Our analysis found that  
36  
37 36% of the NAVCO campaigns used health programs to supplement their civil resistance  
38  
39 efforts, while the remainder had no documented evidence of a health component to the  
40  
41 campaign. The campaigns that had health programs were more likely ( $p < 0.05$ ) to be non-  
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43 violent and to ultimately be successful, often years later. We performed chi-squared testing  
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45 to determine whether there were statistically significant differences between presence or  
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47 absence of a health program and each of the other campaign characteristics, and found  
48  
49 none. However, the use of the robust databases and the good investigator agreement lend  
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51 strength to our analysis, and to our efforts to establish a statistical – perhaps even a  
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53 predictive - relationship between the security in a society and its health programs.  
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4 Building upon this work, we next sought to combine our data from the credible  
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6 international database on conflict in nations around the world (NAVCO) with a very  
7  
8 comprehensive public health database to identify predictive indicators of conflict. We chose  
9  
10 the Global Burden of Disease (GBD) Study, a large international database that quantifies the  
11  
12 comparative magnitude of diminished health due to diseases and injuries. (Smith 2015) GBD  
13  
14 considers the risk factors such as age, sex, and geography for specific points in time. It is  
15  
16 compiled and published by the Institute of Health Metrics and Evaluation (IHME) at the  
17  
18 University of Washington in Seattle, USA. The 254 medical conditions within the GBD  
19  
20 database are categorized as communicable diseases (type I), non-communicable diseases  
21  
22 (type II), or injuries (type III). The IHME produces annual estimates of metrics, using their  
23  
24 innovative combined morbidity-mortality metric, the disability-adjusted life year (DALY). By  
25  
26 combining death rates with injuries and disease rates, the DALY permits a more robust  
27  
28 determination of aggregate 'health' in a society, detailed as the burden of hundreds of  
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30 specific health conditions on that country. (Institute of Health Metrics and Evaluation 2015).  
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41 Our analysis sought to combine the strengths of the GBD and NAVCO databases to  
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43 determine if there are "leading (early, predictive) indicators" that correlate health metrics  
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45 with the presence of a subsequent civil resistance campaign or conflict in that country. We  
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47 had two main objectives in answering this research question. The first was to explore the  
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49 existing, highly credible, and comprehensive databases to identify qualifying conflict events,  
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51 as well as health-specific characteristics. The second objective was to identify health  
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53 metrics or surrogates of health as potential predictive indicators of conflict.  
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4 We performed a matched case-control study that utilized countries experiencing an  
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7 onset of conflict as our cases, while controls were selected from similar countries that were  
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9 not experiencing conflict during same time periods. The study compared the prevalence of  
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11 disease and premature mortality for 254 health conditions for each case and control country.  
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15 Both the health and the conflict databases used were updated in both 1990 and 2000,  
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17 and these were the only two years in which both the health and conflict data sets were  
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19 published in the same years. For these reasons, 1990 and 2000 were the two study years  
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21 chosen for the research study. The Uniformed Services University Office of Research and  
22  
23 Investigative Review Board approved this study.  
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26  
27 We combined data from the two large databases, the NAVCO database and the GBD  
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29 Study database. By utilizing data from the NAVCO database to determine the presence of  
30  
31 conflict within a country and comparing health data from the GBD during that same time  
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33 period, we hypothesized that we would find an association between some health conditions  
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35 and simultaneous conflict and violence. In light of the fact that so many international and  
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37 nongovernmental organizations seek to provide healthcare in conflict zones, this theory  
38  
39 seemed quite plausible.  
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45 From the NAVCO database, we identified 14 case countries that experienced the onset of  
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47 a civil resistance campaign, either violent or nonviolent, during the study years. We used  
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49 the presence of such a campaign as a proxy for conflict. For each case country, we selected  
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51 three control countries in peace, using the same WHO region as the case country. (WHO  
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56 2016)  
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First we determined the five countries with Gross National Income ranking (GNI) in the year of interest nearest to the case country to be our potential controls. (Encyclopedia of the Nations 2011). Of the five potential controls, the three whose total DALYs were closest to the case country were chosen as the three control nations. A country that met these criteria was excluded as a control if the NAVCO database showed that a conflict was already ongoing or began during the study year. Because we selected countries from the entire database, with regard only to eligibility and to no other factors, we believe the study countries are representative of ‘conflict nations’. The countries that were selected as cases and controls are shown in Table 1, and have been published on the open access Harvard Dataverse repository website at <https://doi.org/10.7910/DVN/DKHZEF> .

**Results:** The data in Table 1 shows the sum total DALYs of all 254 health conditions for each country, as well as that country’s worldwide GNI ranking. For the three 1990 case countries denoted with a caret (Kyrgyzstan, Russia, and Slovenia), we used the GNI ranking from 1992. These countries were not established in 1990, and 1992 was the first year that their GNI data was available.

**Table 1.** Case countries and three selected controls for each case.

Year	Country	GNI Ranking	DALYs (per 100,000 population)
1990	Guyana	128	38,637.38
	Honduras	110	39,193.98
	Bolivia	107	59,606.26
	Dominican Republic	100	33,360.37

1990	Kenya	125	57,658.98
	Ghana	122	67,419.58
	Togo	126	80,365.52
	Guinea	121	122,174.62
1990	Kyrgyzstan ^	128	44,749.77
	Uzbekistan	123	38,429.52
	Moldova	127	37,580.09
	Tajikistan	143	53,748.89

1990	<i>Mali</i>	137	139,327.68
	Burundi	143	113,113.03
	Niger	135	167,588.66
	Democratic Republic of the Congo	142	106,901.66
1990	<i>Nigeria</i>	138	105,878.79
	Equatorial Guinea	131	105,937.71
	Democratic Republic of the Congo	142	106,901.66
	Burundi	143	113,113.03
1990	<i>Russia^</i>	58	37,943.75
	Turkey	63	39,913.69
	Hungary	56	42,070.52
	Croatia	62	33,572.89
1990	<i>Slovenia^</i>	44	31,528.75
	Portugal	37	32,382.81
	Greece	34	28,467.19
	Malta	39	23,720.94
1990	<i>Nepal</i>	144	75,869.68
	Bhutan	112	70,097.16
	Timor-Leste	151	62,728.69
	Thailand	79	31,406.53
1990	<i>Rwanda</i>	127	101,612.37

	Equatorial Guinea	131	105,937.91
	Gambia	130	90,164.61
	Burkina Faso	129	115,670.52
1990	<i>Zambia</i>	119	105,123.17
	Central African Republic	117	114,239.21
	Togo	126	80,365.52
	Comoros	115	71,347.48
2000	<i>Egypt</i>	102	33,816.96
	Morocco	107	29,993.17
	Iran	94	27,531.32
	Jordan	90	24,949.93
2000	<i>Ghana</i>	150	60,160.08
	Comoros	145	56,915.39
	Gambia	151	73,340.68
	Benin	147	75,216.46
2000	<i>Peru</i>	85	28,718.35
	Dominican Republic	79	28,233.70
	Belize	75	29,704.19
	El Salvador	82	30,580.18
2000	<i>Senegal</i>	135	69,420.13
	Kenya	140	67,398.64
	Zimbabwe	138	78,608.85
	Mauritania	137	58,966.09

After consultation with a statistical expert, we performed data analysis using SPSS, version 22 (IBM®). Because the data lacked normality, we utilized the Mann-Whitney nonparametric test. This statistical analysis was employed to identify a possible association between conflict status and the prevalence of each health condition among both cases and controls. Descriptive statistics were used to quantify the median numbers of DALYs between the case and control nations for each condition. From our computations, we predict that the available sample size



of 14 case countries and 42 control countries had 80% power to detect differences in mean prevalence of 0.88 standard deviations with a 5% two-sided alpha.

The results of our additional study are shown in Tables 2, 3, and 4. The median DALY value is shown for the three control countries. The p-value for the comparison of each disease between the case country value and the median value of the three control countries is also shown.

Of the 254 disease or injury comparisons, only one condition, a Type III condition (see Table 4) called 'collective violence and legal intervention', was correlated with conflict in a statistically significant way, though it had counter-intuitively decreased to zero in the conflict (case) countries. As shown in Table 2, none of the Type I health conditions were found to correlate with conflict. Dermatitis is the only Type II condition that nearly reached statistical significance ( $p=0.051$ ), as shown in Table 3.

**Table 2.** Analysis of DALY differences between case (conflict) and control (non-conflict) countries for type I conditions, as defined by the Global Burden of Disease study. No condition was significantly different between the conflict and the non-conflict countries.

Type I			
Condition	Case/Control	DALYs	P-value
Tuberculosis	case	1136.3	0.92
	controls	1266.7	
HIV/AIDS resulting in Myco-bacterial infection	case	16.39	0.65
	controls	29.30	

HIV/AIDS resulting in Other Diseases	case	172.56	0.69
	controls	302.69	
Diarrheal Diseases	case	5901.0	0.69
	controls	5031.1	
Typhoid Fever	case	183.95	0.94
	controls	187.25	
Paratyphoid Fever	case	50.56	0.94

	controls	51.76	
Other Intestinal Infectious Diseases	case	22.66	0.60
	controls	28.75	
Lower Respiratory Infection	case	6503.7	0.88
	controls	6930.4	
Upper Respiratory Infection	case	46.60	0.15
	controls	73.41	
Otitis Media	case	38.02	1.00
	controls	44.20	
Pneumo-coccal Meningitis	case	259.54	0.91
	controls	310.74	
Hemophilus influenza Type B Meningitis	case	292.93	0.88
	controls	275.05	
Meningo-coccal meningitis	case	169.76	0.98
	controls	141.59	
Other meningitis	case	224.83	0.81
	controls	216.05	
Encephalitis	case	70.27	0.61
	controls	67.95	
Diphtheria	case	9.39	0.96
	controls	7.29	
Whooping Cough	case	172.08	0.75
	controls	109.59	
Tetanus	case	273.97	0.76
	controls	167.75	
Measles	case	1165.9	0.65

	controls	1275.1	
Varicella & Herpes Zoster	case	8.55	0.75
	controls	6.48	
Malaria	case	3080.7	0.84
	controls	3129.7	
Chagas Disease	case	0.00	0.70
	controls	0.00	
Visceral Leishmaniasis	case	3.59	0.88
	controls	7.96	
Cutaneous Leishmaniasis	case	0.07	0.85
	controls	0.07	
African trypanosomiasis	case	0.00	0.94
	controls	0.00	
Schistosomiasis	case	22.66	0.48
	controls	214.26	
Cysticercosis	case	8.38	0.68
	controls	7.56	
Cystic echinococcosis	case	7.36	0.34
	controls	7.86	
Lymphatic filariasis	case	2.24	0.57
	controls	44.42	
Onchocerciasis	case	0.00	0.44
	controls	0.00	
Trachoma	case	0.00	0.14
	controls	2.94	
Dengue	case	6.77	0.56
	controls	5.36	
Yellow	case	0.00	0.80

Fever			
	controls	0.12	
Rabies	case	26.84	0.75
	controls	35.01	
Ascariasis	case	29.15	0.54
	controls	39.70	
Trichuriasis	case	0.12	0.83
	controls	0.39	
Hookworm Disease	case	16.39	0.90
	controls	17.02	
Food-Borne trematodiasis	case	0.00	0.28
	controls	0.00	
Other Neglected Tropical Diseases	case	81.81	0.60
	controls	70.96	
Maternal hemorrhage	case	138.30	0.72
	controls	110.27	
Maternal sepsis	case	71.37	0.60
	controls	54.36	
Maternal Hypertensive Disorders	case	79.43	0.65
	controls	75.31	
Obstructed Labor	case	72.38	0.84
	controls	59.41	
Complications of Abortion	case	152.27	0.78
	controls	127.33	
Indirect Maternal Deaths	case	77.47	0.75
	controls	50.30	

Late Maternal Deaths	case	95.13	0.61
	controls	69.36	
Maternal Deaths aggravated by HIV	case	0.12	0.79
	controls	1.18	
Other Maternal Disorder	case	152.58	0.76
	controls	174.73	
Preterm Birth Complications	case	2880.8	0.56
	controls	2535.2	
Neonatal encephalopathy due to birth asphyxia and trauma	case	2134.3	0.46
	controls	2621.2	
Neonatal sepsis and other neonatal infections	case	1017.7	0.45
	controls	1582.8	
Hemolytic Disease and other neonatal jaundice	case	90.02	0.76
	controls	93.39	
Other Neonatal disorders	case	618.79	0.62
	controls	590.36	
Protein-	case	1256.7	0.58

Energy Malnutrition			
	controls	1545.9	
Iodine Deficiency	case	48.34	0.23
	controls	30.54	
Vitamin A Deficiency	case	3.60	0.91
	controls	4.06	
Iron Deficiency Anemia	case	1073.8	0.94
	controls	1204.4	
Other Nutritional Deficiencies	case	15.60	0.94
	controls	17.51	
Syphilis	case	377.75	0.55
	controls	274.77	
Chlamydial infection	case	11.22	0.43
	controls	10.03	
Gonococcal Infection	case	7.45	0.58
	controls	6.25	
Trichomo-	case	1.83	0.14

niasis			
	controls	2.22	
Genital Herpes	case	4.29	0.36
	controls	4.44	
Other Sexually Transmitted Disease	case	4.35	0.51
	controls	3.24	
Hepatitis A	case	14.95	0.60
	controls	17.17	
Hepatitis B	case	48.81	0.61
	controls	52.54	
Hepatitis C	case	1.10	0.20
	controls	2.15	
Hepatitis E	case	14.06	0.66
	controls	17.50	
Leprosy	case	0.31	0.73
	controls	0.22	
Other Infectious Diseases	case	181.88	0.99
	controls	193.27	

**Table 3.** Results of analysis for significant difference in DALY totals for the type II medical conditions. There were no qualified statistical associations found.

Note: Dermatitis was the only condition that nearly qualified as an association by the standard definition of statistical significance. It is highlighted with a Y mark in the table.

Type II			
Condition	Case/ Control	DALYs	P value
Esophageal Cancer	case	42.23	0.762
	controls	76.60	
Stomach Cancer	case	139.39	0.970
	controls	121.80	
Liver Cancer due to Hepatitis B	case	35.93	0.985
	controls	33.66	
Liver Cancer due to Hepatitis C	case	24.38	0.955
	controls	24.19	
Liver Cancer due to Alcohol Use	case	37.93	0.865
	controls	36.07	
Liver Cancer due to Other Causes	case	29.77	0.733
	controls	32.77	
Larynx Cancer	case	13.40	1.000

	controls	14.42	
Trachea, Bronchus, Lung Cancer	case	128.36	0.461
	controls	92.96	
Breast Cancer	case	119.19	0.532
	controls	132.64	
Cervical Cancer	case	176.85	0.985
	controls	169.13	
Uterine Cancer	case	12.98	0.508
	controls	11.72	
Prostate Cancer	case	29.90	0.820
	controls	24.09	
Colon and Rectum Cancer	case	93.82	0.691
	controls	76.09	
Lip and Oral Cavity Cancer	case	23.59	0.910
	controls	18.64	
Naso- pharynx Cancer	case	11.10	0.384
	controls	9.68	
Other Pharynx Cancer	case	9.90	0.970
	controls	8.01	
Gallbladder and Biliary	case	27.40	0.719

Tract Cancer			
	controls	21.65	
Pancreatic Cancer	case	27.91	0.865
	controls	29.37	
Malignant Skin Melanoma	case	7.06	0.364
	controls	5.17	
Non-Melanoma Skin Cancer	case	5.49	0.298
	controls	3.87	
Ovarian Cancer	case	30.23	0.777
	controls	28.15	
Testicular Cancer	case	3.11	0.910
	controls	2.96	
Kidney Cancer	case	22.50	0.748
	controls	26.51	
Bladder Cancer	case	26.81	0.955
	controls	27.14	
Brain and Nervous System Cancer	case	40.86	0.850
	controls	38.69	
Thyroid Cancer	case	7.16	0.520
	controls	9.10	
Meso-thelioma	case	2.53	0.880
	controls	2.14	
Hodgkin's Lymphoma	case	15.80	0.150
	controls	13.15	
Non-Hodgkin's	case	90.46	0.583

Lymphoma			
	controls	94.03	
Multiple Myeloma	case	10.38	0.427
	controls	7.85	
Leukemia	case	76.55	0.791
	controls	102.62	
Other Neoplasms	case	191.37	0.449
	controls	177.81	
Rheumatic Heart Disease	case	160.31	0.636
	controls	178.12	
Ischemic Heart Disease	case	1332.08	0.636
	controls	927.81	
Ischemic Stroke	case	470.15	0.449
	controls	541.00	
Hemorrhagic Stroke	case	731.32	0.496
	controls	640.53	
Hypertensive Heart Disease	case	191.93	0.733
	controls	165.25	
Cardiomyopathy and Myocarditis	case	205.26	0.438
	controls	198.88	
Atrial Fibrillation	case	3.30	0.955
	controls	2.73	
Aortic Aneurysm	case	21.80	0.940
	controls	23.66	
Peripheral Vascular	case	1.67	0.940

Disease			
	controls	1.62	
Endocarditis	case	51.21	0.705
	controls	49.20	
Other Cardiovascular and Circulatory Diseases	case	456.31	0.219
	controls	303.96	
Chronic Obstructive Pulmonary Disease	case	666.14	0.733
	controls	604.02	
Silicosis	case	7.64	0.484
	controls	5.11	
Asbestosis	case	3.52	0.405
	controls	2.55	
Coal Workers Pneumoconiosis	case	5.77	0.663
	controls	4.39	
Other Pneumoconiosis	case	14.67	0.910
	controls	12.36	
Asthma	case	322.77	0.281
	controls	278.15	
Interstitial Lung Disease and Pulmonary Sarcoidosis	case	34.90	0.078
	controls	42.06	
Other Chronic Respiratory Diseases	case	152.53	0.970
	controls	145.98	

Cirrhosis due to Hepatitis B	case	151.35	0.416
	controls	160.17	
Cirrhosis due to Hepatitis C	case	105.09	0.461
	controls	99.35	
Cirrhosis due to Alcohol use	case	139.26	0.405
	controls	163.07	
Cirrhosis due to Other Causes	case	79.83	0.198
	controls	102.13	
Peptic Ulcer Disease	case	167.96	0.955
	controls	163.92	
Gastritis and Duodenitis	case	75.02	0.623
	controls	78.38	
Appendicitis	case	63.21	0.985
	controls	62.17	
Paralytic Ileus and Intestinal Obstruction	case	133.88	0.609
	controls	138.35	
Inguinal, Femoral, and Abdominal Hernias	case	23.15	0.762
	controls	20.51	
Inflam-	case	65.50	0.910

matory Bowel Disease			
	controls	76.67	
Vascular Intestinal Disorders	case	6.64	0.925
	controls	7.86	
Gallbladder and Biliary Diseases	case	33.10	0.307
	controls	37.45	
Pancreatitis	case	41.07	0.307
	controls	44.32	
Other Digestive Diseases	case	74.27	0.374
	controls	59.17	
Alzheimer and Other Dementias	case	94.06	0.461
	controls	67.32	
Parkinson Disease	case	2.98	0.705
	controls	2.36	
Epilepsy	case	252.68	0.910
	controls	274.07	
Multiple Sclerosis	case	3.27	0.955
	controls	4.03	
Migraine	case	244.19	0.520
	controls	350.31	
Tension- Type Headache	case	19.11	0.910
	controls	22.15	
Medication Overuse Headache	case	73.26	0.596
	controls	76.72	
Other Neuro- logical	case	54.58	0.140

Disorders			
	controls	47.56	
Schizo- phrenia	case	143.09	0.484
	controls	133.69	
Alcohol Use Disorders	case	131.77	0.583
	controls	153.66	
Opioid Use Disorders	case	68.79	0.384
	controls	62.99	
Cocaine Use Disorders	case	8.30	0.289
	controls	7.39	
Amphet- amine Use Disorders	case	21.34	0.570
	controls	20.97	
Cannabis Use Disorders	case	3.60	0.820
	controls	3.89	
Other Drug Use Disorders	case	70.21	0.835
	controls	64.89	
Major Depressiv e Disorder	case	758.45	0.650
	controls	750.93	
Dysthymia	case	96.39	0.762
	controls	98.39	
Bipolar Disorder	case	114.44	0.762
	controls	115.96	
Anxiety Disorder	case	258.65	0.650
	controls	258.45	
Anorexia Nervosa	case	3.80	0.335



	controls	3.73	
Bulimia	case	21.06	0.955
	controls	21.15	
Autism	case	74.66	0.748
	controls	75.15	
Asperger Syndrome	case	44.00	0.583
	controls	43.86	
Attention Deficit/ Hyper-activity Disorder	case	8.75	0.719
	controls	8.96	
Conduct Disorder	case	126.64	0.596
	controls	131.79	
Idiopathic Intellectual Disability	case	94.58	0.364
	controls	81.43	
Other Mental and Substance Use Disorders	case	95.22	0.762
	controls	96.41	
Diabetes Mellitus	case	461.67	0.374
	controls	423.48	
Acute Glomerulo-nephritis	case	9.66	0.705
	controls	13.39	
Chronic Kidney Disease due to Diabetes Mellitus	case	26.24	0.344
	controls	19.29	
Chronic	case	100.04	0.835

Kidney Disease due to Hyper-tension			
	controls	97.55	
Chronic Kidney Disease due to Glomeru-lonephritis	case	155.23	0.545
	controls	144.38	
Chronic Kidney Disease due to Other Causes	case	93.45	0.835
	controls	97.75	
Interstitial Nephritis and Urinary Tract Infections	case	113.25	0.865
	controls	103.85	
Urolithiasis	case	7.68	0.557
	controls	8.38	
Benign Prostatic Hypertrophy	case	20.81	0.609
	controls	23.94	
Male Infertility due to Other causes	case	4.03	0.985
	controls	3.66	
Other Urinary Diseases	case	22.37	0.130
	controls	15.86	

Uterine Fibroids	case	25.94	0.264
	controls	28.34	
Polycystic Ovarian Syndrome	case	14.67	0.850
	controls	14.87	
Female Infertility due to Other Causes	case	2.01	0.636
	controls	2.43	
Endometriosis	case	14.22	0.508
	controls	13.85	
Genital Prolapse	case	11.50	0.850
	controls	11.46	
Premenstrual Syndrome	case	29.31	0.484
	controls	30.28	
Other Gynecological Diseases	case	10.42	0.583
	controls	10.51	
Thalassemias	case	9.30	0.850
	controls	7.74	
Thalassemia Trait	case	28.44	0.762
	controls	18.77	
Sickle Cell Disease	case	128.45	0.806
	controls	189.17	
Sickle Cell Trait	case	32.19	0.650
	controls	20.55	
G6PD Deficiency	case	4.26	0.940

	controls	4.40	
G6PD Trait	case	0.69	0.663
	controls	0.62	
Other Hemaglobinopathy and Hemolytic Anemia	case	52.60	0.748
	controls	47.52	
Endocrine, Metabolic, Blood, and Immune Disorders	case	193.39	0.806
	controls	159.84	
Rheumatoid Arthritis	case	47.38	0.880
	controls	47.67	
Osteoarthritis	case	111.63	0.636
	controls	119.73	
Low Back Pain	case	536.81	0.532
	controls	520.57	
Neck Pain	case	317.60	0.777
	controls	302.06	
Gout	case	0.50	0.663
	controls	0.39	
Other Musculoskeletal Disorders	case	175.84	0.940
	controls	180.26	
Neural Tube Defects	case	347.60	0.449
	controls	209.31	
Congenital Heart Anomalies	case	676.18	0.691

	controls	710.09	
Orofacial Clefts	case	11.11	0.970
	controls	12.29	
Down Syndrome	case	137.46	0.970
	controls	123.48	
Turner Syndrome	case	0.04	0.791
	controls	0.04	
Klinefelter Syndrome	case	0.02	0.405
	controls	0.02	
Chromosomal Unbalanced Rearrangements	case	63.02	0.298
	controls	54.31	
Other Congenital Anomalies	case	462.00	0.374
	controls	398.72	
Y Dermatitis	case	132.81	0.051
	controls	122.75	
Psoriasis	case	53.15	0.663
	controls	52.89	
Cellulitis	case	33.75	0.910
	controls	41.91	
Pyoderma	case	25.18	0.910
	controls	20.81	
Scabies	case	28.41	0.733
	controls	28.83	
Fungal Skin Disease	case	60.60	0.777
	controls	48.27	
Viral Skin Disease	case	64.30	0.733
	controls	62.79	
Acne Vulgaris	case	56.35	0.496

	controls	64.91	
Alopecia Areata	case	2.95	0.405
	controls	2.92	
Pruritus	case	0.00	0.880
	controls	0.00	
Urticaria	case	35.33	0.925
	controls	42.64	
Decubitus Ulcer	case	3.67	0.705
	controls	3.56	
Other Skin or Subcutaneous Disease	case	32.75	0.835
	controls	33.26	
Glaucoma	case	7.37	0.272
	controls	8.04	
Cataract	case	26.62	0.140
	controls	35.13	
Macular Degeneration	case	4.15	0.335
	controls	5.29	
Uncorrected Refractive Error	case	142.44	0.748
	controls	141.05	
Other Hearing Loss	case	335.44	0.438
	controls	379.97	
Other Vision Loss	case	20.17	0.289
	controls	24.82	
Other Sense Organ Diseases	case	62.57	0.985
	controls	62.70	
Deciduous Caries	case	3.57	0.865

	controls	3.68	
Permanent Caries	case	28.96	0.970
	controls	27.83	
Periodontal Disease	case	39.05	0.496
	controls	41.41	
Edentulism and Severe Tooth Loss	case	55.91	0.895
	controls	55.61	

Other Oral Disorders	case	43.31	0.985
	controls	43.92	
Sudden Infant Death Syndrome	case	21.23	0.925
	controls	19.82	

**Table 4.** Results of analysis for significant difference between type III condition DALY totals in case country and control countries. \*  $p < 0.05$ . The condition 'collective violence and legal intervention' was the only condition that was significantly different between case and control countries, although it was counter-intuitively lower in the case (conflict) countries. It is highlighted with an asterisk in the table.

Type III				Injuries			
Condition	Case/Control	DALYs	P-value		controls	42.24	
Pedestrian Road Injuries	case	458.18	0.806	Unintentional Suffocation	case	36.85	0.850
	controls	430.93			controls	50.50	
Cyclist Road Injuries	case	93.83	0.985	Other Exposure to Mechanical Forces	case	196.62	0.820
	controls	94.90			controls	220.74	
Motorcyclist Road Injuries	case	133.36	0.583	Adverse Effect of Medical Treatment	case	128.67	0.865
	controls	116.54			controls	139.56	
Motor Vehicle Road Injuries	case	563.02	0.636	Venomous Animal Contact	case	35.10	0.609
	controls	660.21			controls	38.16	
Other Road Injuries	case	36.65	0.335	Non-Venomous Animal Contact	case	17.95	0.449
	controls	58.41			controls	22.93	
Other Transport Injuries	case	105.01	0.596	Pulmonary Aspiration and Foreign Body in Airway	case	243.43	0.508
	controls	107.36			controls	222.04	
Falls	case	343.51	0.940	Foreign Body in Eyes	case	0.56	0.609
	controls	302.36			controls	0.65	
Drowning	case	825.78	0.791	Foreign Body in Other Body Part	case	6.05	0.762
	controls	706.75					
Fire, Heat, Hot Substances	case	460.73	0.777				
	controls	365.93					
Poisonings	case	159.21	0.791				
	controls	155.06					
Unintentional Firearm	case	42.33	0.557				

	controls	5.74		Other Means			
Other Unintentional Injury	case	146.92	0.791		controls	143.42	
	controls	152.51		Exposure to Forces of Nature, Disaster	case	0.00	0.969
Self-Harm	case	54.41	0.410				
	controls	68.31			controls	0.03	
Assault by Firearm	case	44.16	0.910	Collective Violence and Legal Intervention			
	controls	48.47					
Assault by Sharp Object	case	25.66	0.219				
	controls	38.44					
Assault by	case	82.59	0.461		controls	7.02	

**Discussion:** If the health metrics data were independent, we would anticipate that 12 of the 254 health conditions would be significantly different between case and control countries, based on chance alone. That is certainly not the situation with our data. We understand that the .05 standard for significance is arbitrary, and one GBD health condition (dermatitis) nearly met that standard. We cannot rule out the possibility that the GBD health metric condition of ‘collective violence and legal intervention’ is correlated with conflict, as a positive change in this parameter makes sense in times of conflict. However, we found the opposite of the expected increase in collective violence in the countries that were experiencing conflict. The prevalence of collective violence in the case (conflict) countries was counter-intuitively reported by the GBD to be zero. Violent conflicts often lead to the collapse of data collection efforts, such as vital statistics systems and censuses. (Tabeau and Bijak 2005) Other methods used to estimate mortality data are less satisfactory.

Our explanation for this finding is that health data quality is poor leading up to a new-onset conflict, stemming from decreased governance, poor record-keeping, and reduced

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4 accountability of public health personnel. As a WHO document in 2009 stated, “the  
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7 strongest indicator of crisis is lack of data.” (Pavignani 2009) Another WHO report tells us  
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10 that violent groups responsible for violence and conflict often hide the evidence of the death  
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12 and destruction for which they are responsible. (WHO 2002)  
13

14  
15 Mortality, injuries and permanent disabilities may exponentially increase during times of  
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17 collective violence, highlighting the importance of using a combined morbidity and mortality  
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19 metric, such as the DALY, to capture relevant data. An inaccurate account of DALYs due to  
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21 collective violence may also not reflect the impact that violence has on other aspects of a  
22  
23 society. Further exploration of health conditions that may correlate with conflict could reveal  
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25 indicators that reduce the negative effects of conflict, or are predictive of threats to peace in  
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28 a nation.  
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32  
33 Based on chance alone, we would have predicted that there would be a dozen conditions  
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35 that showed a correlation ( $p\text{-value} < .05$ ). Because our results found so few conditions that  
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37 met that standard, there may not be a correlation that can be derived from the interface of  
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39 these two peerless databases, based on the study parameters that we chose. Also likely is  
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41 that the data are not independent, but follow trends as a group or groups.  
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45 We realize there are limitations to our analysis. Correlation, whether it reaches arbitrary  
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47 levels or not, is not causation. It can give clues for the direction of future research. It may  
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49 also merely reflect the weakness of the data that was studied. However, the study  
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51 parameters in the GBD and the NAVCO databases are the most robust, credible, and relevant  
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53 sets of data in their fields.  
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4 We believe that using three control nations per case should allow this research to more  
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6 accurately find potential leading indicators. We did encounter some challenges in identifying  
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8 controls. The South-East Asia WHO region had so much conflict as a whole that identifying  
9  
10 control (non-conflict) nations to closely resemble the case country of Nepal was difficult. Out  
11  
12 of the 10 other countries in the region, five were engaged in conflict and had to be  
13  
14 discounted as a potential control. Thus, the controls selected did not as closely match the  
15  
16 case country as in the situation the other case nations and their controls.  
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22 In moving forward, the GBD is now being continually updated, and we expect the NAVCO  
23  
24 database will be revised in the future. If so, future studies could answer some questions that  
25  
26 have risen from this study. For example, could there be a difference in DALY prevalence if  
27  
28 comparing a country in conflict to itself the year or two years prior to the conflict? The GBD  
29  
30 publishers are doing more sub-national analysis each year. Analysis of DALY trends within the  
31  
32 conflict country, using other sub-national regions as control, could allow investigators to  
33  
34 determine a possible correlation between health and security. These are questions that the  
35  
36 author or other investigators may be able to address in future studies with data from future  
37  
38 revisions of these and other databases.  
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45 These negative results are disappointing and counter-intuitive to the author, who is  
46  
47 invested in using health as a tool for international peace. However, the publication of  
48  
49 negative findings may help others in hypothesis generation, or to avoid repeating the same  
50  
51 efforts while using this work as a foundation for further studies.  
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56 **Conclusion:** This study takes a novel approach in analyzing the robust data from two extensive  
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58 international databases in an attempt to detect a quantifiable connection between the health  
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4 and peace in a nation. Based on our limited results, we find no health indicators that provide  
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6  
7 predictive value (no 'leading indicator') between any health condition and threats to peace. We  
8  
9 expected to find statistically significant increases in more than a dozen GBD conditions, based  
10  
11 on chance alone. Instead, we have only negative results to report.  
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14  
15 More research may build upon our findings or, by incorporating different variables into the  
16  
17 selection of controls, find the elusive 'leading indicator' health condition correlation. Our data  
18  
19 and work are available as a foundation for future research in this important area. Future  
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21 humanitarians may one day be able to rest assured in the evidence that their efforts have  
22  
23 contributed to local and regional peace, beyond the benefits to individual patients that can be  
24  
25 objectively measured.  
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33 The datasets analyzed during the current study are available in the Harvard Dataverse  
34 repository at: <https://doi.org/10.7910/DVN/DKHZEF>  
35  
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39

#### 40 Declarations:

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42 \*Ethics approval and consent to participate – ethics committee approved as stated in text. I  
43 consent to participate.

#### 44 **Consent for publication – I consent to publication**

45 Availability of data and material – data available in text and at Harvard Dataverse

46 \*Competing interests – I have none

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48 \*Authors' contributions – I am sole author.

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50 \*Authors' information (optional) – submitted in text of work  
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