The Epidemiologic Challenge to the Conduct of Just War: Confronting Indirect Civilian Casualties of War

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Abstract: Most civilian casualties in war are not the result of direct exposure to bombs and bullets; they are due to the destruction of the essentials of daily living, including food, water, shelter, and health care. These "indirect" effects are too often invisible and not adequately assessed nor addressed by just war principles or global humanitarian response. This essay suggests that while the neglect of indirect effects has been longstanding, recent technical advances make such neglect increasingly unacceptable: 1) our ability to measure indirect effects has improved dramatically and 2) our ability to prevent or mitigate the indirect human toll of war has made unprecedented progress. Together, these advances underscore the importance of addressing more fully the challenge of indirect effects both in the application of just war principles as well as their tragic human cost in areas of conflict around the world.

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Health workers are the ultimate inheritors of failed social order. Sooner or later, a breakdown in the bonds that define collective peace, indeed that ensure social justice, will find tragic expression in the clinic, on the ward, or in the morgue. This reality has always given health workers the opportunity, if not the responsibility, to provide a human narrative of suffering in addition to the technical requirements of care and comfort. Yet, for the most part, this narrative has not been adequately crafted or at least advanced in the deliberation of what has always been the most extreme challenge for health workers: the human consequences of war.

This discussion attempts to translate a health worker's narrative of war into a format that directly addresses the moral framework that justifies and constrains a just war. This narrative is told not by anecdote but by epidemiology, a story whose contours are shaped not by individual histories but by

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patterns of illness and death in large civilian populations. While these patterns have been noted since at least the time of Thucydides, there have been two essentially technical developments that challenge traditional appraisals of just war: 1) our ability to count the dead and injured has improved dramatically and 2) our capacity to intervene and prevent the medical consequences of war has advanced at an unprecedented rate. Technical progress permits more capable documentation, revealing a reality that was long sensed but rarely quantified. Technical progress has also generated an expanding capability to uncouple what war ultimately conveys to human suffering. This discussion suggests that together, these dual technical capabilities – documentation and efficacy – not only permit but compel a more comprehensive accounting of war's human impact. My argument is that while technical innovation has clearly altered both the power and precision of the tools of war, it has also altered our understanding of the human impact of war and, significantly, the moral requirements for its mitigation in the real world.

The central human consequence of war has always been violent death. The destruction of human life through direct exposure to combat has long been the dominant preoccupation of both generals and philosophers. However, war also generates death, illness, and hardship through the destruction of the means of human survival. As noted in the U.S. Army's *Civilian Casualty Mitigation Manual*: "In addition to the inherent risks from combat, a society disrupted by armed conflict will have other vulnerabilities, particularly if large numbers of civilians lack food, water, shelter, medical care, and security. Disease, starvation, dehydration, and the climate may be more threatening to civilians than casualties from Army operations."[1] The fact that this manual exists is in itself worthy of note. However, its inclusion of these "indirect" mechanisms of impact also underscores the relevance of events that lie more distally along the causal chain between war and human suffering.[2]

If the protection of innocent life is a fundamental ambition of a just war, it is useful to first consider the fate of the modern embodiment of innocence, the newborn infant, in societies plagued by war. Table 1 presents 2013 neonatal mortality data for the twenty countries in the world with the highest neonatal mortality rates (NMRs). Neonatal mortality (defined as the number of deaths of live-born children at less than twenty-eight completed days after birth divided by the number of live births occurring in the same population over the same time period) remains a critical threat accounting for almost three million deaths annually, which in turn represents nearly half (44 percent) of all deaths of children under five globally. Angola and Somalia are estimated to have the highest NMRs in the world at forty-seven and forty-six deaths per thousand live births, respectively. For context, Japan has an NMR of one and the United States has an NMR of four deaths per thousand live births. Also presented in Table 1 are the percentile ranks of each country in a measure of political stability and the absence of violence/terrorism. The data suggest that while Lesotho and Equatorial Guinea fall near the middle of all countries globally, the remaining countries in the table are characterized by profound political instability and violence, much of which is the product of current or recent violent conflict.[3]

Specific estimates of the indirect effects of war have varied.[4] (Table 2 summarizes estimates of recent conflicts for which any data are available.) Much of this variation has been due to the difficulties in ascertaining mortality and morbidity data in areas of poor security and highly mobile popu-

Table 1
Percentile Rank, by Country, of Neonatal Mortality Rates, Total Number of Neonatal Deaths, and Political Stability and Absence of Violence/Terrorism

Country	Neonatal Mortality Rate (per Thousand Live Births)	Total Number of Neonatal Deaths	Political Stability & Absence of Violence/ Terrorism (Percentile Rank: 0 – 100)
Angola	47	43,000	34
Somalia	46	21,000	1
Sierra Leone	44	9,000	41
Guinea-Bissau	44	3,000	17
Lesotho	44	9,000	58
Central African Republic	43	7,000	3
Pakistan	42	194,000	1
Mali	40	28,000	6
Chad	40	23,000	15
Zimbabwe	39	17,000	25
Democratic Republic of the Congo	38	105,000	2
Côte d'Ivoire	38	28,000	17
Nigeria	37	262,000	4
Afghanistan	36	37,000	1
Mauritania	35	4,000	18
Equatorial Guinea	33	1,000	50
Guinea	33	14,000	11
South Sudan	31	16,000	5
Sudan	30	37,000	3
Burundi	30	13,000	10

Countries profiled are those with the highest neonatal mortality rates worldwide as of 2013. Percentile rank (column 4) spans 0 – 100 with a lower rank representing lower political stability and the presence of violence/terrorism. Source: The World Bank, "Worldwide Governance Indicators," http://info.worldbank.org/governance/wgi/index.aspx#home (accessed October 22, 2015).

Table 2
Estimates of Indirect Deaths for Select Conflicts

Country	Indirect Deaths as Percentage of Total Excess Deaths	Ratio of Indirect to Direct Deaths	Total Conflict Deaths (Direct and Indirect)
Angola, 1975 – 2002[5]	89	8.1	1,500,000
Burundi, 1993 – 2000[6]	78	3.5	300,000
Congo-Brazzaville, Pool Region, 2003[7]	83	4.8	n/a
Darfur, Sudan, 2003 – 2005[8]	69	2.3	142,000
Democratic Republic of the Congo, 1998 – 2002[9]	90+	9.0	3,300,000
East Timor, 1974 – 1999[10]	82	4.6	103,000
Iraq, 1991 (Gulf War)[11]	77	3.3	144,500
Iraq, 1990 – 1998 (Sanctions and Gulf War)[12]	95	9.5	450,000*
Iraq,† 2003 – 2004[13] 2003 – 2006[14] 2003 – 2011[15]	85 60 30	5.7 1.5 0.43	98,000 433,000 461,000
Liberia, 1989 – 1996[16]	86	6.1	175,000
Northern Uganda, 2005[17]	85	5.6	26,000
Sierra Leone, 1991 – 2002[18]	94	15.7	462,000
South Sudan, 1999 – 2005[19]	90+	9.0	427,000

* Children only
† Only studies that report nonviolent, indirect, excess mortality are included

There remain no reliable data for calculating indirect effects of the war in Afghanistan. Source: The table is a modified representation of Box 2.3 in The Geneva Declaration Secretariat, *Global Burden of Armed Violence* (Geneva: Geneva Declaration Secretariat, 2008), 40, http://www.genevadeclaration.org/fileadmin/docs/Global-Burden-of-Armed-Violence-full-report.pdf.

lations.[20] Significant numbers of indirect deaths have been documented in a variety of settings, including in Iraq, Darfur, Afghanistan, Angola, the Democratic Republic of the Congo, Kosovo, and Guatemala. One summary study reported that the indirect health consequences of civil wars between 1991 and 1997 throughout the world were twice that associated with direct, combat-related effects. A report published by the Geneva Declaration Secretariat suggested that for every violent death resulting from war between 2004 and 2007, four died from war-associated elevations in malnutrition and disease.[21] Global health scholar Amy Hagopian and her colleagues reported that approximately one-third of all deaths in Iraq were due to indirect causes.[22] Prior studies have also suggested significantly elevated rates of indirect deaths, although the precise proportion varied with different methodologies and points in time.[23] In Kosovo, overall mortality more than doubled during the height of the fighting, but most of this increase was due to direct, traumatic injury.[24] Beyond mortality considerations, indirect effects can include substantial numbers of disabilities, developmental disorders in children, and of special concern, long-standing mental health conditions. There is substantial evidence that the exposure to combat and displacement can generate severe emotional disturbances in all age groups, but particularly children. Both the severity and chronicity of these exposures are important. Posttraumatic stress disorder (PTSD) is all too common, particularly when children witness the death of a parent or loved one.[25] The failure to provide normalizing or therapeutic environments, such as access to schools or mental health services, only exacerbates long-term mental health effects.

However, recent studies have underscored the complexity of estimating indirect effects.[26] Some analyses suggest that young child mortality can actually decline during periods of conflict, reflecting a continuation of long-term trends in improving child survival;[27] though these declines were generally less steep than during the years prior to war. The variation in these estimates likely involves the inherent difficulties of accurate data ascertainment in war zones. Security can be poor and there may be a variety of disincentives to participating in a survey or responding faithfully to questions. Populations exposed to war are often highly mobile and disparities in who emigrates can result in nonrepresentative skewing of the residual populations available for surveys. In addition, exposures to violence can vary even among communities in close proximity. Therefore, a reliance on national or regional mortality figures can obscure the impact of war confined to a relatively small area.

In many ways, the variation in the estimates of indirect effects reflects less the failures than the advances in the field. The growing sophistication of the methods being employed is increasingly documenting inherent differences in how indirect effects occur in different areas of conflict. It seems clear, for example, that the impact of conflict in very-low-resource settings such as the Democratic Republic of the Congo may have very different indirect effects than in mid- to high-income locations, such as Bosnia or Kosovo. In this manner, the estimation of indirect effects is coming into line with the estimation of direct effects. Both clearly suffer from difficult logistical and political obstacles, and yet these efforts to quantify the human cost of war have improved significantly and remain essential.

Sanctions can represent a special case of warfare in which all the effects on civilians are indirect. Not all sanction regimes may be considered a type of warfare. However, it seems a bias in definition not to recognize state-enforced, crossborder deprivation resulting in mass death in an enemy popu-

lation as somehow evading the moral logic of just war theory. Ethicist Joy Gordon has documented in great detail the devastating impact of international sanctions against Iraq from 1990 – 2003.[28] Ineffective and at times corrupt oversight by United Nations personnel coupled with a blinkered U.S. fixation on weakening the Iraqi regime to create a catastrophic collapse of the Iraqi nutritional and health infrastructure, resulting in what may have been up to hundreds of thousands of excess childhood deaths. Other sanctions regimes, such as that imposed against the Mugabe regime in Zimbabwe, have also generated tragic indirect effects, despite attempts to devise mechanisms to protect the interests of civilian populations.[29]

In general, war generates significant elevations in indirect mortality and disability above prior baselines or trends. One review has suggested that a useful rule of thumb is that indirect deaths will generally total approximately twice that of direct deaths.[30] While this may be helpful in underscoring the importance of indirect effects, this kind of generalization may obscure very real differences in these effects based upon the setting, timing, and nature of combat operations. Nevertheless, I can only imagine the indirect effects occurring in Syria, Iraq, and South Sudan as I write this essay. The key point being that it should not be left up to the imagination; the capabilities to document and address these horrors exist now.

The indirect effects of war are not new. They have likely existed whenever and wherever wars have been fought. The histories of the Mongol invasions, the Thirty Years War, and the Siege of Leningrad all tell dramatic stories of indirect civilian suffering and death. But my argument regarding the importance of indirect effects is based not on its modern origins but rather its modern neglect. Norms regarding the conduct of war have changed and our capabilities to publicly account for the indirect effects of war have advanced substantially. Even if one does not accept arguments regarding changing norms or technical innovation, the continued marginalization of the indirect effects of war is still, nevertheless, unjust – a point that seems worth making in this forum.

Accordingly, my intent in elevating the nature and scale of indirect effects is not to critique or revise just war theory. Rather, my argument is aimed at extracting from just war theory more explicit guidance as to how the indirect effects of war can be avoided or at least minimized. What follows is an outline of the elements that seem most relevant in just war theory to a physician compelled to advance an epidemiologic narrative challenging current approaches to justice in war.

If just war theory must respond to the reality of war, then just war theory must respond to the indirect effects of war. While just war traditions have long acknowledged the existence of indirect effects, it seems fair to say that the moral and practical implications of these indirect effects have not received the critical scrutiny they deserve.

The principles of *jus ad bellum* speak to the "why" of war and provide an architecture for ensuring that the reasons for going to war are just. Of special interest to those concerned with indirect effects is the requirement that the initiation of war must be based on a reasonable expectation that the aims of the war can be achieved successfully (the principle of success) and that the violence employed is proportional to the established threat (the principle of proportionality). An appreciation of potential indirect effects could prove a particularly important factor in considering the dimensions of proportionality. There seems to be little rational justification for confining the human cost of war to direct effects alone.

The assessment of success and proportionality can prove more complex, however, when war's objectives are explicitly based on humanitarian concerns, such as in Kosovo or Libya. Just war theory is intended to justify war as much as confine it. When war is justified on the basis of humanitarian intervention, of "saving innocent lives," some predictive comparison must be made between the human impact of intervention – both direct and indirect – and that likely to occur were the intervention not undertaken. In this manner, a consideration of indirect effects can either create incentives to initiate or refrain from war. Philosopher Steven Lee has suggested that this dual capacity informs the analysis of proportionality as weighing the "created evil" generated by a violent intervention against the "resisted evil" that the intervention intends to avert.[31] Both considerations should involve some prediction of indirect effects. This predictive imperative cannot be dismissed by the mere assertion that the intention of the intervention was inherently well-meaning or just. As Lee states: "Proportionality limits what a state can do in the name of a just cause."

The principles of *jus in bello* provide guidance as to "how" wars should be fought. Central to these principles is the distinction between combatants and noncombatants. Although concern for civilians is predominantly expressed as protections against direct exposure to combat, some recognition of the potential for indirect effects is included in Additional Protocol I (1977) of the Geneva Conventions, advocating the "protection of objects indispensable to the survival of the civilian population."[32]

However, these protections for "objects indispensable" to civilian survival are not absolute. Rather, they are defined by military context, as neither international law nor just war tradition demands that a legitimate military target not be attacked merely because it may injure or kill noncombatants or destroy essential civilian infrastructure.[33] The insistence is that the expected damage to civilians or civilian infrastructure not be intentional but rather occur as a side effect, even if such an effect were clearly foreseen. This logical framing, known generally as the doctrine of the "double effect," has roots in Catholic moral theology and underscores the moral pivot on intentionality, rather than the foreseen consequences of any given act of war that had been deemed militarily useful.[34] The practical utility of this doctrine can be questioned on the grounds that it is too easy to justify high civilian casualties because they were not intended. Michael Walzer has argued for a more stringent set of criteria that includes not only that a combatant not intend to harm noncombatants but that the combatant take positive steps to actually minimize civilian casualties.[35] This "double intention" framework endorses a "positive commitment to save civilian lives" even if it requires combatants to assume a greater risk of harm to themselves.

This affirmative position extending civilian protection is generally consistent with a relatively new willingness to justify the use of force for explicit humanitarian purposes, such as in Kosovo and Libya. Justifying the use of force on humanitarian grounds, primarily an argument rooted in *jus ad bellum* considerations, places added pressure on the protection of civilians during the *jus in bello* conduct of war operations. It is difficult to maintain the legitimacy of war initiated for humanitarian purposes while causing widespread direct or indirect casualties in the very populations one sought to protect. This highlights the elasticity in the relationship between the direct and indirect effects of any given combat operation. For direct effects, the precision of the attack is the predominant consideration; for indirect effects, the nature of the target is as important as the precision of the attack. A

highly precise assault on an enemy power station may not directly injure any civilians, but could easily cause substantial indirect mortality through reduced hospital capacity and diminished water and food supplies.[36]

In addition to these moral considerations, the protection of civilian populations has become an important instrumental concern – about winning the war – in some armed conflicts. Both direct and indirect effects can translate into deeply felt grievance. Standard counterinsurgency doctrine has made the protection of civilian populations an explicit strategic objective.[37] Moreover, the direct provision of public goods, such as health care, has also been embraced as a means of generating tactical support and political legitimacy for combatant forces. While the emphasis and precise tactical expression of this concern for civilian casualties has differed over time and setting, the explicit goal of minimizing both direct and indirect civilian effects has remained a core principle of counterinsurgency doctrine. This has perhaps been most apparent in Afghanistan, where U.S. forces have routinely accepted greater risk to themselves in order to avoid civilian casualties, basically embracing Walzer's double intention framework.

However, regardless of whether the protection of civilians is justified on moral or instrumental grounds – indeed, regardless of whether civilian casualties were intended or not – a response to the needs of civilians experiencing both direct and indirect casualties remains essential. Even if permissible under just war principles, civilian suffering need not evade the assignment of responsibility, a level of accountability that may demand mitigation and, at times, reparation.[38]

Jus post bellum is concerned with the transition from a just war to a just peace. While *post bellum* issues have generally concentrated on the machinery of armistice, the restoration of sovereignty, reparations, and trials, the focus of concern here is to define or at least recognize the requirement inherent in a just peace to prevent continued war-related civilian death and suffering after the guns fall silent.

Theorists from Augustine ("the aim of a just war is a just peace") to Walzer ("implicit in the theory of just war is a theory of just peace") have recognized the essential relationship between *ad bellum* justification and *post bellum* performance. However, the prevention of indirect effects as a necessary element of a just peace has not been explicitly addressed, or at least not been emphasized sufficiently. This requirement seems especially vital when the initiation of hostilities is justified on humanitarian grounds. As was noted for the *in bello* conduct of a war rooted in humanitarian rescue, the prescription for the *post bellum* peace of such a war must also ensure that the health and well-being of civilian populations are a central priority.

In this context, great care should be taken when humanitarian justifications demand regime change but, in reality, also imply the destruction of the state. This is because even a murderous or potentially murderous regime may sit atop a functioning state apparatus that ensures the maintenance of daily life for much of the civilian population. Recent U.S. and allied interventions have found it far easier to eliminate a regime than to protect its civilians in the aftermath. The regimes of Saddam Hussein in Iraq and Gaddafi in Libya, while predatory and oppressive, also made general provisions for food and water supplies, public health, and hospitals. Although no one would suggest that these services were adequate or efficient, they did exist and generated health outcomes that were at least as good as surrounding states.[39] Protecting civilian objects during combat operations is critical, but so are the financial

and administrative means of keeping these objects functioning once the fighting ends. The human toll resulting from the neglect of these just peace requirements can vary, particularly in response to the prewar level of health and essential services. While the wars in Iraq and Libya have resulted in catastrophic indirect suffering, the war in Afghanistan since 2001, despite its bitter and protracted nature, may have been associated with generally improved health outcomes, particularly for women and children.[40] This may reflect skewed reporting or the extremely poor health status of the Afghan people prior to the U.S. invasion, but it may also be a testament to the efforts of Afghan, U.S., and coalition partners, as well as a number of nongovernmental organizations, to enhance health, education, and related services.

If a regime must be destroyed, there must be a concurrent obligation to protect or replace those functions of the state that assure the essentials of daily life. This is most apparent when victors become occupiers. Under this condition, just war theory most clearly shares provisions with what has come to be known as "human security," including the availability of adequate food, shelter, and access to health care. In some sense, just war traditions respond to the "freedom from fear" while human security principles include the additional element of the "freedom from want." Here, indirect effects blend into issues of development and good governance, provinces that one might suggest extend beyond the dimensions of just war. However, a pragmatic consideration of the indirect effects of war can blur the accepted boundaries between the logic of war and human rights, particularly when war is justified on humanitarian grounds. Efforts to integrate, if not reconcile, these concerns have emerged, including international law scholar Ruti Teitel's articulation of "humanity law," which could provide a conceptual basis for exploring the relationships between the direct and indirect effects of war.[41] Regardless of conceptual clarity, the reality of civilian life and civilian death in the aftermath of war demands that the victors and occupiers assume some meaningful responsibility for assuring the availability, if not the direct provision, of life's necessities. A just peace can never be indifferent to the preventable death of a three-year-old from pneumonia or a woman in childbirth when these deaths are the result of a catastrophic disruption of civilian life by war.

In many respects, just war requires attribution, an imperative that has traditionally been more clearly delineated in relation to the direct effects of combat. This has, in part, been due less to the theoretical challenges indirect effects can generate than to the difficulties inherent in defining indirect effects in the real world. Although never easy in a conflict zone, direct deaths to civilians living next to a rail station that was the target of a specific air strike can be defined and counted. But how does one define and count the indirect effects of this attack, such as the death of a child from pneumonia who did not receive life-saving medication six months after the attack because of a disrupted supply chain that had been dependent on a functioning rail station?

Distinctions between *jus ad bellum*, *jus in bello*, and *jus post bellum* phases have provided the core framework for assessing the justice of war. However, the protracted nature of some recent conflicts and the persistence of their destructive epidemiologies raise some troubling questions regarding the utility of these distinctions under certain war conditions. For example, it is not clear what *post bellum* means in the Eastern Democratic Republic of the Congo or in Gaza. Cease-fires come and go. The prospect of peace agreements come and go. While the staccato of active fighting subsides and renews, the indirect ef-

fects drone on. Periods without active combat are always better than periods with active combat. However, the protracted and intermittent nature of a conflict and the blurred distinctions between prewar, war, and postwar phases make the application of traditional just war theory to the indirect effects of war somewhat more difficult. There is a risk that an insistence on analytic templates based on wars with a definitive beginning and end, such as World War II, can relegate the civilian cost of lengthy, churning conflicts to the periphery of just war relevance or even capability.

There is a need to find ways to delimit the indirect effects in order to navigate the margins of where the human costs of unjust war give way to the human costs of unjust peace. Humanitarian strategies are helpful, as they are in all wars. Yet a critical reading of just war criteria seems most essential when war-fighting and peacemaking defy traditional boundaries, when conflict is prolonged and conceptually muddled. This may be of special concern when standoff weapons, such as high-altitude bombing or the use of armed drones, allow one side to extend combat operations over long periods of time without significant risk to their soldiers. The indirect effects of this protracted violence, in terms of both injury and mental well-being, can be profound. The failure to critically implement just war criteria when war phases are confused can create an analytic vacuum that can too often permit the chronicity of damage and time itself to obscure bonds of responsibility and permit the indirect effects of war to recede from public view.

In many respects, the relative lack of attention to the indirect effects of war reflects a discomfort with the indistinct boundaries that have traditionally characterized indirect effects. This implies a need for both definition and metrics. A lazy definition of indirect effects that includes all adverse human outcomes subsequent to violent conflict provides virtually no limits and therefore little help in navigating the intersection of indirect effects with the rules of just war. It seems essential to fix some endpoint that demarcates the termination of the period within which excess adverse health outcomes can be considered the indirect effects of war. A simple temporal definition, such as one year after the cessation of hostilities, is a possible endpoint, though this seems inherently arbitrary and morally ungrounded.

An alternative approach would be to implement a political limit to the war-related period of casualty accounting. One could demarcate the terminal boundary as the moment a functional, sovereign state has been restored. This would conform more directly to the dictates of moral responsibility and would insist upon the inclusion of an occupation or ongoing political chaos as falling within the boundaries of indirect effect accounting. Beyond issues of demarcation, there has also been a tendency to succumb to the perception that indirect effects are, in fact, impossible to quantify. This is a technical challenge that requires close examination, particularly in light of recent advances in epidemiologic and demographic measurement in field settings.

In addition to the challenge of defining and measuring indirect effects, there has also been a tendency to diminish the relevance of indirect effects because the assumed repertoire of effective responses is considered relatively limited. In some measure, the most prominent traditional approach to reducing indirect effects has been sanctioned escape. In sieges, noncombatants have "a right to be refugees" and an attacking army should provide a mechanism for civilians exiting a besieged city or active combat zone. This provision has deep historical roots, having been outlined by Maimonides and later by Grotius. While protected escape remains an important consideration, our technical abil-

ity to prevent indirect effects has grown enormously, a level of technical advancement that has been so profound that it has the ability to reshape traditional applications of just war theory to current and future conflicts around the world.

In the context of just war, technical innovation means more than the creation of more powerful and precise munitions. It also means an enhanced capacity to measure and reduce the human impact of war. Innovation in these two technical domains – measurement and mitigation – has been sufficient to rethink the application of just war theory to the indirect effects of war.

The primary basis of estimating the indirect effects of war has been to measure those health outcomes that would not have occurred if war were not present. As one report stated, "measuring war related deaths involves comparing the number of deaths that occurred due to a conflict against the counterfactual scenario of peace."[42] The indirect component comprises those deaths not due to direct combat-related injury. This approach often means that indirect effects are expressed in some form as "excess" outcomes defined by some comparative simulation. These excess outcomes are calculated as the difference between, for example, an expected number of deaths based on peacetime mortality rates and the actual observed numbers of deaths during the war-defined study period, be it *in bello* or *post bellum* in nature. Again, indirect effects relate those excess outcomes not due to direct, traumatic causes. One should note, however, that this calculation of excess adverse outcomes does not compare the predicted effects of intervention with the counterfactual of not intervening, a comparison essential to proportionality considerations.

Advances in epidemiology and the technological means of collecting health data have generated a range of new opportunities to assess the immediate and protracted effects of war. The delineation of baseline prewar rates can be problematic, particularly when prewar periods are characterized by substantial instability, as in the Democratic Republic of the Congo, or the imposition of sanctions, as in Iraq. However, enhanced sampling frameworks and statistical adjustment procedures have provided new quantitative insights into patterns of mortality, injury, illness, and displacement. Mobile technology has been used creatively to enhance both the accuracy and reach of survey protocols. The utility of these new analytic methodologies should not be obscured by the political controversies they may generate when high civilian mortality is associated with specific, and particularly U.S., interventions.[43]

This field is still young and these new technical strategies are creating an unprecedented capacity to assess the impact of war in even remote communities. With adequate support and continued critical analysis, the technical ability to define and document indirect effects will continue to strengthen. There is also the prospect that with more extensive experience, the science of indirect effects will be able to provide reliable predictive capabilities for making both *ad bellum* and *in bello* judgments. With continued progress in the field, there will be little justification for the contention that indirect effects are vague or unknowable, a perception that is inherently exculpatory, unburdening armed actors of responsibility for indirect effects.

More striking than the growth in our ability to measure indirect effects has been dramatic advances in our technical capacity to prevent them. Simply put, in most areas plagued by war and chronic conflict, the causes of death associated with the indirect effects of war look almost identical to those associated with peace. What changes, and what generates the excess mortality, are the absolute rates of these causes. For example, during the periods of intense

conflict in the Democratic Republic of the Congo and Darfur, direct trauma-related mortality accounted for less than 20 percent of all excess deaths among children under five years of age.[44] The leading causes of excess death were fever/malaria, neonatal (newborn) illnesses, measles, diarrhea, and acute respiratory infection: precisely the same spectrum of mortality that usually kills children in this age group in low-resource areas of the world.

However, what is critical to remember is that modern medicine and public health have developed highly efficacious interventions that can prevent either the occurrence or the severity of these causes of illness and death. Malaria can be prevented through the use of bed nets and mosquito control and mortality largely prevented by early diagnosis and treatment. Measles can be prevented by a safe and highly effective vaccine. Death from diarrhea and acute respiratory infections can be prevented through vaccines and treatment. Neonatal conditions present a more complex challenge, but effective interventions exist for reducing mortality from complicated births, early infections, and prematurity. A major evidence-based assessment of the technical capacity to prevent mortality among young children suggested that more than two-thirds of this under-five mortality is preventable with extant interventions.[45]

As technical efficacy grows, so too does the burden on society to provide it equitably to all those in need. This is why health insurance is more important today than it was in the nineteenth century. To be sure, the different general justice schema vary as to how the provision of efficacious health care should be treated.[46] But common to all these approaches is some recognition of the interaction between the efficacy of health interventions and the justice requirements of provision. Accordingly, the dynamic character of technical capability must at some level impart a dynamic character to the requirements of justice, and ultimately the requirements of just war.

The death of any child is always a tragedy; the death of any child from preventable causes is always unjust. This is, of course, as true in peacetime as it is in war. My argument is that the dramatic growth in our ability to prevent death and disability from the indirect effects of war generates not only humanitarian impulses but also just war demands for the provision of this capability to populations affected by war.[47] The scale of these demands is currently at the highest levels since the end of World War II. There are, of course, global mechanisms to provide succor and health services to war-ravaged communities. The United Nations High Commissioner for Refugees (UNHCR) and a variety of nongovernmental organizations have as their central mandate the provision of food, shelter, and health care to such populations. However, the support they receive – both financial and logistical – is woefully inadequate, in part contributing to the mass migration from conflict zones currently underway.[48] Worse still is the archaic global architecture for humanitarian response to war, which has remained relatively unchanged since World War II. The average length of stay in an UNHCR camp is now approaching twenty years and the funding mechanisms used to support displaced and war-ravaged populations are both intermittent and haphazard. Just war considerations seem largely disconnected from these funding mechanisms even though virtually all these humanitarian needs have been generated by the indirect effects of war. A new architecture is needed urgently and, as this discussion argues, the application of just war logic and accountability could help create the necessary moral imperatives and applied financial mechanisms for a new global commitment to address the human cost of war.

The mitigation of indirect effects has moral meaning. If innocence has any meaning, the epidemiology reveals that the victims are those with the most striking moral claims. If the scale of suffering has any meaning, epidemiology demands that indirect effects not be ignored. If the failure to act when capability exists has any meaning, the science of indirect effects testifies to a damning global complacency. There remain both conceptual and technical challenges in crafting a full embrace of the indirect effects of war. But these tasks do not seem the critical obstacles. Rather, the obstacles lie in the apparent utility of diminishing war's true human cost and the maddening acquiescence of our moral frameworks that gives license to this evasion. The essential challenge lies in renegotiating the tension between the exercise of power and the claims of the vulnerable, a tension from which, not coincidently, both epidemiology and just war theory were born.[49]

ENDNOTES

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