

Dead Wrong?

Tanisha M. Fazal

Battle Deaths, Military Medicine, and Exaggerated Reports of War's Demise

Several recent books argue that war is on the decline. In *Winning the War on War*, for example, Joshua Goldstein lauds the recent successes of the peacemaking community in countries such as Sierra Leone, Liberia, and Ivory Coast.¹ In *The Better Angels of Our Nature*, Steven Pinker writes that not only war but violence in general has become much less common, as the civilizing forces of literacy and modern government have tempered our baser instincts and allowed our “better angels” to prevail.²

The empirical claim that war is on the decline, however, is overstated.³

Tanisha M. Fazal is Associate Professor of Political Science and Peace Studies at the University of Notre Dame.

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1. Joshua S. Goldstein, *Winning the War on War: The Decline of Armed Conflict Worldwide* (New York: Dutton, 2011).

2. Steven Pinker, *The Better Angels of Our Nature: Why Violence Has Declined* (New York: Viking, 2011). See also John Horgan, *The End of War* (San Francisco: McSweeney's, 2012); and Human Security Project, *Human Security Report 2009/2010: The Causes of Peace and the Shrinking Costs of War* (New York: Oxford University Press, 2011). Additionally, scholars such as John E. Mueller have correctly observed that war between great powers has all but disappeared since 1945. See Mueller, *Retreat from Doomsday: The Obsolescence of Major War* (New York: Basic Books, 1989).

3. I am not the first to make this point. Others have focused on the shape of the curve underlying this trend, whether there really is a trend, and the comparison Pinker draws between violent tribal societies and states today, as well as the role of World War II as a possible outlier. See Anita Gohdes and Megan Price, “First Things First: Assessing Data Quality before Model Quality,” *Journal of Conflict Resolution*, Vol. 57, No. 6 (December 2013), pp. 1090–1108; Bear F. Braumoeller, “Is War Disappearing?” paper presented at the annual meeting of the American Political Science Association, Chicago, Illinois, August 29–September 1, 2013; Dougl's P. Fry, ed., *War, Peace, and Human Nature: The Convergence of Evolutionary and Cultural Views* (Oxford: Oxford University Press, 2013); Elizabeth Kolbert, “Peace in Our Time,” *New Yorker*, October 3, 2011, pp. 75–78; and Robert Jervis, “Pinker the Prophet,” *National Interest*, November/December 2011, pp. 54–64. Other responses to

Goldstein and Pinker, in particular, base their claims that the incidence of war is in decline on well-established and widely accepted datasets that form the cornerstone of much of the existing quantitative literature on civil and interstate war.⁴ In taking this approach, they are in excellent company. But like many scholars using these data, they pay scant attention to the possibility that the primary measure used to count wars—battle deaths—is itself subject to historical pressures that can create a distorted view of the changing incidence of war.

In this article, I show that major advances in military medicine have made battle deaths less likely and nonfatal battle casualties more likely over the past several centuries, particularly since 1946—the same time period that Goldstein, Pinker, and others examine to support their conclusion that war is on the decline. Because these datasets identify wars based on a battle-death threshold that is constant over the entire time period they cover,⁵ any apparent decline in war means that war has become less fatal. This observation does not necessarily mean, however, that war has become less frequent.

Shifting the focus from the number of war dead to all casualties—fatal and nonfatal—has important implications for both policy and scholarship. Insofar as a belief that the occurrence of war has declined could prompt policymakers to conclude that defense budgets could be cut, it is important to probe the underpinnings of this claim. Similarly, if a decline in war is attributable to effective peacekeeping, as Goldstein argues, then peacekeeping budgets should increase. Because the incidence of war affects decisions about how resources are distributed both within and across societies, the suggestion that war is

Pinker and Goldstein have challenged their assertion of a causal link between peacekeeping and a decline of war as well as their discussion of the civilizing tendencies of the West. See Virginia Page Fortna, “Has Violence Declined in World Politics? A Discussion of Joshua S. Goldstein’s *Winning the War on War: The Decline of Armed Conflict Worldwide*,” *Perspectives on Politics*, Vol. 11, No. 2 (June 2013), pp. 566–570; Jennifer Mitzen, “The Irony of Pinkerism,” *Perspectives on Politics*, Vol. 11, No. 2 (June 2013), pp. 525–528; Bradley A. Thayer, “Humans, Not Angels: Reasons to Doubt the Decline of War Thesis,” *International Studies Review*, Vol. 15, No. 3 (September 2013), pp. 405–411; and Jack S. Levy and William R. Thompson, “The Decline of War? Multiple Trajectories and Diverging Trends,” *International Studies Review*, Vol. 15, No. 3 (September 2013), pp. 411–416. For a rejoinder to Pinker’s critics, see Human Security Report Program, *Human Security Report 2013: The Decline in Global Violence: Evidence, Explanation, and Contestation* (Vancouver, Canada: Human Security, 2013).

4. See especially Meredith Reid Sarkees and Frank Whelon Wayman, *Resort to War: 1816–2007* (Washington, D.C.: CQ Press, 2010); Nils Petter Gleditsch et al., “Armed Conflict 1946–2001: A New Data Set,” *Journal of Peace Research*, Vol. 39, No. 5 (September 2002), pp. 615–647; and Bethany Lacina and Nils Petter Gleditsch, “Monitoring Trends in Global Combat: A New Dataset of Battle Deaths,” *European Journal of Population*, Vol. 21 (2005), pp. 145–166. For Pinker’s and Goldstein’s references to these datasets, see especially Pinker, *The Better Angels of Our Nature*, pp. 225–227, 300, 303–304; and Goldstein, *Winning the War on War*, pp. 13, 233–238.

5. For the two main datasets under discussion, the threshold is either 1,000 combatant deaths (Correlates of War [COW]) or 25 battle deaths (Uppsala Conflict Data Program [UCDP]).

on the decline requires serious scrutiny. This is so in part because the notion that war has gone out of style has been broadcast widely in the mainstream media.⁶

For scholars of war, particularly those who employ quantitative methods, knowing that the cases populating major datasets are dissimilar in important and unexpected ways is critical to assessing results based on the datasets in question. But most important, scholars' inattention to the role of the war wounded has been reflected in everyday life. With more wounded returning to the United States and other countries from the wars in Iraq and Afghanistan comes a new set of issues and costs associated with readjusting to civilian life that scholars and policymakers have been poorly equipped to address.

This article proceeds in five sections. First, I explore the logic behind the claim that war is on the decline. Next, I argue that four key improvements in military medicine have driven up wounded-to-killed ratios since the nineteenth century: advances in preventive medicine; advances in battlefield medicine; improved evacuation times; and better protective armor for military personnel. Third, I present original data on wounded-to-killed ratios to show how including these data could alter estimates of battle casualties. I then consider some of the limitations of my argument, especially as it pertains to civil conflict or less developed countries such as India and China. I conclude with a discussion of the implications of these findings for policy and scholarship, including a call for more data on those wounded in battle.

Is War on the Decline? Assessing the Empirical Claim

Several sources of data appear to support the claim that war is on the decline. Pinker draws on Lewis Richardson's argument that armed conflicts tend to follow power law distributions in their incidence and magnitude. This finding

6. Joshua S. Goldstein and Steven Pinker, "War Really Is Going Out of Style," *New York Times*, December 18, 2011; Joshua S. Goldstein, "Think Again: War," *Foreign Policy*, August 15, 2011, http://www.foreignpolicy.com/articles/2011/08/15/think_again_war; Doug Saunders, "In Most Places around the Globe, Violence Has Stopped Making Sense," *Globe and Mail*, October 21, 2012; Andrew Anthony, "Steven Pinker: The Optimistic Voice of Science," *Guardian*, September 17, 2011; Robin Marantz Henig, "Is Violence Finished?" *Newsweek*, October 3, 2011, <http://www.newsweek.com/steven-pinkers-better-angels-our-nature-review-68267>; Michael Shermer, "The Decline of Violence," *Scientific American*, September 20, 2011, <http://www.scientificamerican.com/article/the-decline-of-violence/>; Annie Maccoby Berglof, "At Home: Steven Pinker," *Financial Times*, December 14, 2012; Steven Pinker, *Colbert Report*, Comedy Central, October 18, 2011; Patrick Worsnip, "Wars Less Deadly Than They Used to Be, Report Says," Reuters, January 20, 2010; Joshua S. Goldstein, "The Worldwide Lull in War," *Christian Science Monitor*, May 14, 2002, <http://www.csmonitor.com/2002/0514/p09s02-coop.html>; and Joshua E. Keating, "Is the Decline of War Permanent?" *Slate*, March 25, 2014, http://www.slate.com/blogs/the_world_/2014/03/25/is_the_decline_of_war_permanent_the_world_is_getting_more_peaceful_but_that.html.

suggests that large, cataclysmic wars will be relatively rare.⁷ Related, Pinker refers frequently to John Mueller's finding that great powers no longer fight each other.⁸ In addition, using data from *The Great Big Book of Horrible Things*⁹—an encyclopedia of atrocities—Pinker finds that the percentage of territorial wars from 1651 to 2000 that resulted in the redistribution of territory dropped precipitously in the early to mid-twentieth century.¹⁰ In reaching their conclusions, both Goldstein and Pinker rely heavily on the Peace Research Institute Oslo (PRIO) battle deaths data.¹¹ Pinker, for example, graphs the rate of battle deaths in state-based conflicts, the number of state-based conflicts, and the deadliness of interstate and civil wars. These graphs principally cover the second half of the twentieth century and beyond.¹² Figure 1 replicates a version of Pinker's figure 6-4, which illustrates a downward trend in war fatalities. As Pinker notes, this trend is particularly stark with respect to interstate wars.¹³

In making their claims, Goldstein and especially Pinker rely heavily on the number of battle fatalities as a metric of war.¹⁴ Battle deaths are used widely by international relations scholars because death is unambiguous. Yet, what if the probability of dying from wounds sustained in war has changed over time?¹⁵

7. Lewis F. Richardson, *Statistics of Deadly Quarrels* (Pittsburgh, Pa.: Boxwood, 1960).

8. Mueller, *Retreat from Doomsday*.

9. Matthew White, *The Great Big Book of Horrible Things: The Definitive Chronicle of History's 100 Worst Atrocities* (New York: W.W. Norton, 2012). At the time when Pinker drew on White's data, the data were hosted on a website run by White and not yet published as a book.

10. Pinker, *The Better Angels of Our Nature*, p. 259, fig. 5-21.

11. Lacina and Gleditsch, "Monitoring Trends in Global Combat."

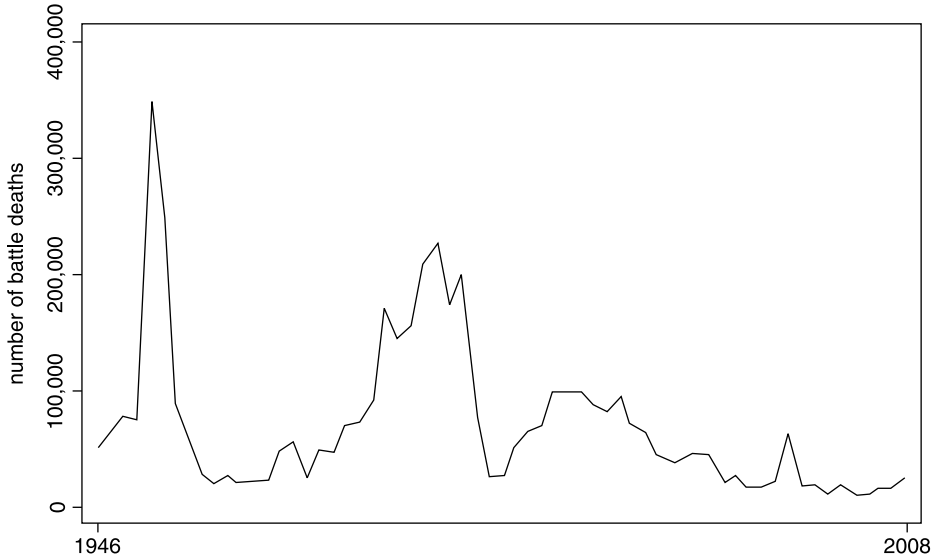
12. Pinker, *The Better Angels of Our Nature*, figs. 6-1 through 6-4; and Goldstein, *Winning the War on War*, chap. 2.

13. For the most recent presentation of the UCDP Armed Conflict Dataset, see Lotta Themnér and Peter Wallensteen, "Armed Conflicts, 1946–2012," *Journal of Peace Research*, Vol. 50, No. 4 (July 2013), pp. 509–521. For the most recent presentation of the COW dataset, see Sarkees and Wayman, *Resort to War*. Interestingly, an examination of the incidence of war and armed conflict as defined by the two major datasets in the field today does not reveal the same trend that Pinker and Goldstein describe. According to these datasets, the absolute number of wars and armed conflicts has not clearly declined over time.

14. Pinker references the PRIO battle death data and, in general, marshals significantly more quantitative data in his book than does Goldstein.

15. The authors of the PRIO battle death dataset have debated the authors of the COW dataset on this point. The main arguments in this debate have referred to incomparabilities in battle death data across different types of wars (interstate, civil, extrasystemic). The COW authors have argued that the risk of dying in battle has remained relatively constant (albeit with peaks during World Wars I and II in the early and mid-twentieth century). In contrast, the PRIO authors have argued that the risk of dying in battle is declining. Neither side of the debate brings into the discussion improvements in military medicine. See Meredith Reid Sarkees, Frank Whelon Wayman, and J. David Singer, "Inter-State, Intra-State, and Extra-State Wars: A Comprehensive Look at Their Distribution over Time, 1816–1997," *International Studies Quarterly*, Vol. 47, No. 1 (March 2003), pp. 49–70; and Bethany Lacina, Nils Petter Gleditsch, and Bruce Russett, "The Declining Risk of Death in Battle," *International Studies Quarterly*, Vol. 50, No. 3 (September 2006), pp. 673–680.

Figure 1. Battle Deaths (low estimates), 1946–2008



SOURCE: Based on data from Bethany Lacina and Nils Petter Gleditsch, “Monitoring Trends in Global Combat: A New Dataset of Battle Deaths,” *European Journal of Population*, Vol. 21 (2005), pp. 145–166.

To make a claim about the decline (or rise) of X (insert your most or least-favorite phenomenon here), one must consider the possibility of selection effects. For example, if one were to use the number of first-class letters delivered by national postal services as a measure of social cohesion within a country, it would at first seem sensible to conclude that the world’s richest states saw significant drops in social cohesion beginning in the late 1990s. The precipitous decline in postal delivery does not, however, indicate a decline in the desire to communicate as much as a shift to modern forms of communication such as email and Facebook. I illustrate this point further using two other examples from Pinker’s book.

First, prior to his discussion about the decline of war, Pinker argues that interpersonal violence has also declined. He presents some of his strongest evidence on this point in his figure 3-4, which shows a dramatic decline in homicide rates in Western Europe and nonstate societies from 1300 to 2000.¹⁶ Missing from this and Pinker’s subsequent graphs, however, is a count of at-

16. Pinker, *The Better Angels of Our Nature*, p. 64.

tempted homicides. The reason to include attempted homicides is that the likelihood of surviving a knife wound in London was dramatically lower in 1400 than the likelihood of surviving the same wound today. Significant advances in medical care make such care both more available and more effective today than in the past. Here, Pinker's decision not to define "violence" is particularly problematic in assessing his claim about its putative decline.¹⁷ If by "violence" Pinker means fatalities, then he is correct that violence is on the decline. A standard dictionary definition of violence, however, would include the attempt or threat to inflict bodily harm.¹⁸

Second, Pinker makes a similar misstep in his brief analysis of territorial conquest. Drawing on data from Mark Zacher, he illustrates a dramatic drop in the percentage of territorial wars resulting in the redistribution of territory beginning in the early to mid-twentieth century.¹⁹ But again, missing from Pinker's analysis is whether attempts at territorial redistribution also declined. Unsuccessful attempts to redistribute territory could be more violent than successful ones; scholars therefore need to examine both failed and successful efforts at territorial redistribution to determine whether such efforts are becoming less frequent. I follow Pinker and use Zacher's data to show that even though the number of territorial redistributions has declined, the number of territorial wars—that is, wars where at least one belligerent aims to redistribute territory—has actually increased over the course of the twentieth century (see figure 2).²⁰

Ignoring failed attempts at homicide, territorial redistribution, or killing in war might possibly be unproblematic for, or even supportive of, the thesis that war is on the decline. Data on attempted homicides, for example, might reveal that kind-hearted passersby are increasingly likely to intervene to save the life of a potential murder victim. Similarly, some scholars have argued that a norm against forcible territorial conquest accounts at least in part for the observed decline of such conquest.²¹ But in the realm of battle deaths, this argu-

17. Pinker acknowledges this decision on his website, stating that he defers to standard definitions of violence. See <http://stevenpinker.com/pages/frequently-asked-questions-about-better-angels-our-nature-why-violence-has-declined>.

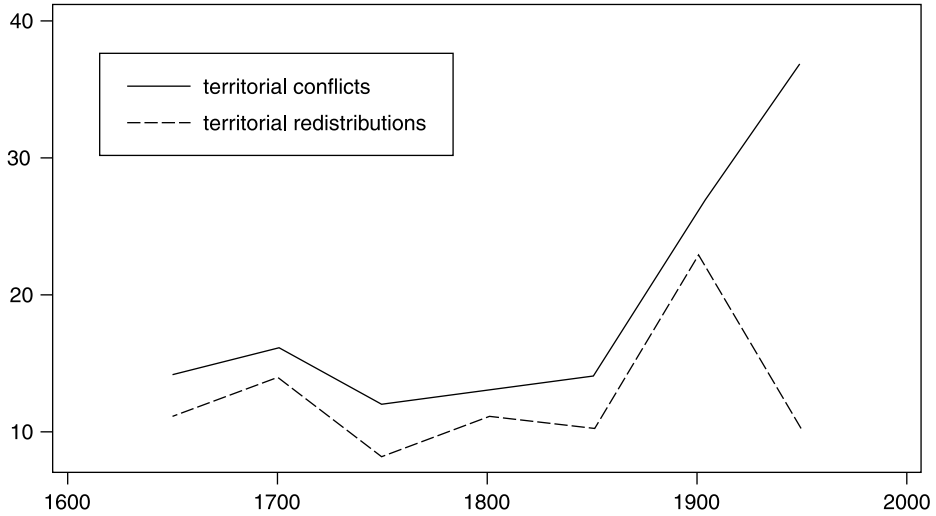
18. The *Oxford English Dictionary* defines violence as "[t]he exercise of physical force so as to inflict injury on, or cause damage to, persons or property; action or conduct characterized by this; treatment or usage tending to cause bodily injury or forcibly interfering with personal freedom." Pinker does consider other types of personal violence, such as spanking children and domestic abuse. He does not, however, bring to bear the same degree of empirical support for the decline of these kinds of violence as he does with respect to homicide.

19. Mark W. Zacher, "The Territorial Integrity Norm: International Boundaries and the Use of Force," *International Organization*, Vol. 55, No. 2 (Spring 2001), pp. 215–250.

20. Paul R. Hensel, Michael E. Allison, and Ahmed Khanani make a similar point in a critique of Zacher. See Hensel, Allison, and Khanani, "Territorial Integrity Treaties and Armed Conflict over Territory," *Conflict Management and Peace Science*, Vol. 26, No. 2 (April 2009), pp. 120–143.

21. Boaz Atzili, "When Good Fences Make Bad Neighbors: Fixed Borders, State Weakness, and In-

Figure 2. Territorial Conflicts and Redistribution, 1600–2000



SOURCE: Based on data from Mark W. Zacher, "The Territorial Norm: International Boundaries and the Use of Force," *International Organization*, Vol. 55, No. 2 (Spring 2001), table 2, pp. 225–228.

ment is more difficult to support. One would have to convincingly show that today's soldiers are more likely to try to save a severely wounded comrade or enemy than they were in the past because they have been influenced by modern humanitarian norms. The conventional wisdom suggests, however, that soldiers fight to protect one another,²² and there is no evidence to show that this motive has changed.

Guns, Germs, and Gore: The Rise of Military Medicine

Over the past two centuries, key advances in preventive care, battlefield medicine and logistics, methods of evacuation, and protective personnel equipment

international Conflict," *International Security*, Vol. 31, No. 3 (Winter 2006/07), pp. 139–173; Tanisha M. Fazal, *State Death: The Politics and Geography of Conquest, Occupation, and Annexation* (Princeton, N.J.: Princeton University Press, 2007); Ann Hironaka, *Neverending Wars: The International Community, Weak States, and the Perpetuation of Civil War* (Cambridge, Mass.: Harvard University Press, 2005); Robert H. Jackson, *Quasi-States: Sovereignty, International Relations, and the Third World* (Cambridge: Cambridge University Press, 1990); and Zacher, "The Territorial Integrity Norm."

22. Samuel A. Stouffer et al., *The American Soldier*, 2 vols. (Princeton, N.J.: Princeton University Press, 1949); and Edward A. Shils and Morris Janowitz, "Cohesion and Disintegration in the Wehrmacht in World War II," *Public Opinion Quarterly*, Vol. 12, No. 2 (Summer 1948), pp. 280–315. For a summary of the scholarship on this subject, as well as a contrasting point of view on it, see

Figure 3. Wounded-to-Killed Ratios, 1775–2008



have increased the underlying probability of a soldier surviving a wound sustained in battle. Taking into account the increased likelihood of military personnel surviving wounds that would have been fatal in the past suggests that, although war has become less fatal, it is not necessarily on the decline, at least not to the extent that Pinker and Goldstein suggest.

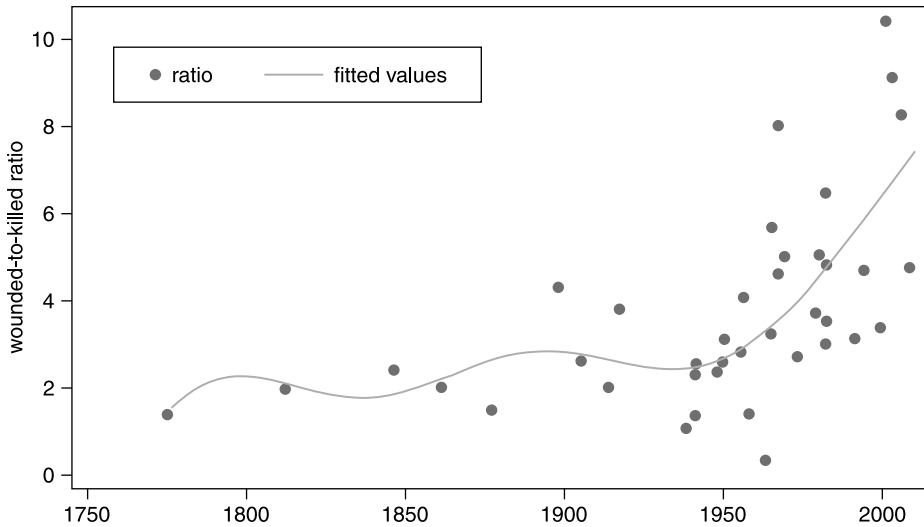
IMPROVEMENTS IN PREVENTIVE CARE

Improvements in preventive medicine are likely the most critical factor in increasing wounded-to-killed ratios over the past century for three reasons. First, soldiers in good health are more effective fighters than those in poor health. All else being equal, more effective fighters should be less likely to sustain fatal wounds in close combat compared with less effective fighters. Consider, for example, the case of dermatological conditions such as “immersion foot,” a painful and debilitating infection that can make even walking difficult. A soldier whose feet hurt so much that he cannot walk is relatively vulnerable on the battlefield.²³

Elizabeth Kier, “Homosexuals in the U.S. Military: Open Integration and Combat Effectiveness,” *International Security*, Vol. 23, No. 2 (Fall 1998), pp. 5–39.

23. Benjamin G. Withers and Stephen C. Craig discuss the debilitating effects of immersion foot as demonstrated by its impact on the U.S. 9th Infantry in Vietnam. See Withers and Craig, “The His-

Figure 4. Fitted Values for Wounded-to-Killed Ratios



Second, healthy soldiers are better able to recover from wounds that would otherwise be fatal compared with their unhealthy comrades. Preexisting conditions such as heart disease and nutritional deficiencies can stall and even prevent the healing of wounds.²⁴ Moreover, soldiers in poor health may not only have a more difficult time recovering, but also be more prone to sustaining injuries in the first place. When taken out of battle, these soldiers may be replaced by others who lack their experience and training, further eroding a unit's military effectiveness.

Third, the overall health of any military unit bears upon its battle fatality rate. Better preventive medicine is more likely to allow units to fight at (close to) their full complement, which should increase survivability. At the start of the nineteenth century, 22,000 French soldiers died of yellow fever in Haiti. Approximately 18,000 British and French soldiers died of cholera during the Crimean War. In contrast, only 29 British soldiers were hospitalized in Bagram, Afghanistan, in 2002 because they had contracted an infectious disease; not one of these soldiers died.²⁵ The relationship between good preventive care

torical Impact of Preventive Medicine in War," in David E. Lounsbury, Ronald F. Bellamy, and Russ Zajtcuk, eds., *Textbooks of Military Medicine* (Washington, D.C.: Borden Institute, Walter Reed Army Medical Center, 2003), pp. 47–50.

24. David G. Armstrong and Andrew J. Meyr, "Wound Healing and Risk Factors for Non-Healing," *UpToDate*, November 7, 2012, <http://www.uptodate.com/contents/wound-healing-and-risk-factors-for-non-healing>.

25. Matthew R. Smallman-Raynor and Andrew D. Cliff, "Impact of Infectious Diseases on War,"

and battlefield victory is well known to military historians. As written in the foreword to the British official history of World War II: "The antagonists were . . . evenly matched and any considerable unilateral manpower wastage through uncontrolled disease or through mismanagement of the facilities for treatment and repair could have turned the scale."²⁶

Three main areas of improvement in preventive medicine have made soldiers more likely to survive injuries today than in the past. First, as a result of improved childhood nutrition, soldiers now tend to be healthier prior to joining the military. Although children living on farms before the industrial revolution were frequently well nourished, a shift away from breast-feeding and toward urbanization is believed to have led to more frequent malnourishment in the nineteenth and early twentieth centuries.²⁷ The establishment of school lunch programs in the mid-twentieth century and a subsequent renewed interest in breast-feeding are considered to have dramatically improved overall childhood nutrition.²⁸ These changes in childhood nutrition reflect a broader reality that many medical "trends" tend to fluctuate widely over time.

Childhood nutrition has important implications for adult health and productivity.²⁹ It may also have implications for the likelihood of sustaining certain wounds in combat. For example, children who receive inadequate nutrition appear to be more susceptible to broken bones later in life.³⁰ This finding is particularly salient in the context of warfighting, where fractures are

Infectious Disease Clinics of North America, Vol. 18, No. 2 (June 2004), pp. 341–368, table 1. These numbers capture the effect only on military personnel; the effect on civilian populations can be orders of magnitude greater, as when Spanish soldiers brought smallpox to the Americas in the sixteenth century.

26. Quoted in Mark Harrison, *Medicine and Victory: British Military Medicine in the Second World War* (New York: Oxford University Press, 2004), p. 130, n. 131. Harrison also writes that superior military medicine "gave the British Army its crucial edge over the Germans and Italians in the Western Desert, and ultimately, over the Japanese in Burma." In addition, "[s]anitary measures in the British Army were markedly superior to those in the German and Italian armies, as were arrangements for field surgery and blood transfusion. Together, these medical provisions gave the British a crucial edge, particularly during the climactic battle at El Alamein." See *ibid.*, pp. 283, 283–284.

27. Buford Nichols, "Introduction to Symposium: Accomplishments in Child Nutrition during the Twentieth Century," *Journal of Nutrition*, Vol. 131, No. 2 (February 2001), pp. 398S–400S.

28. Eileen Kennedy and Edward Cooney, "Development of the Child Nutrition Programs in the United States," *Journal of Nutrition*, Vol. 131, No. 2 (February 2001), pp. 431S–436S; and Anne L. Wright and Richard J. Schanler, "The Resurgence of Breastfeeding at the End of the Second Millennium," *Journal of Nutrition*, Vol. 131, No. 2 (February 2001), pp. 421S–425S.

29. A.C.J. Ravelli et al., "Glucose Tolerance in Adults after Prenatal Exposure to Famine," *Lancet*, January 1998, pp. 173–177; John Hoddinott et al., "Effect of a Nutrition Intervention during Early Childhood on Economic Productivity in Guatemalan Adults," *Lancet*, February 2008, pp. 411–416; and James P. Smith et al., "The Effects of Childhood Health on Adult Health and SES in China," *Economic Development and Cultural Change*, Vol. 61, No. 1 (October 2012), pp. 127–156.

30. L.J. Paulozzi, "Does Inadequate Diet during Childhood Explain the Higher Fracture Rates in the Southern United States?" *Osteoporosis International*, Vol. 21, No. 3 (March 2010), pp. 417–423.

one of the most common forms of injury.³¹ Healthy, well-nourished children make for healthier soldiers as adults.

A second reason why soldiers are more likely to survive their injuries is improved field sanitation. In past wars, unhygienic conditions promoted the spread of disease and weakened soldiers' immune systems, making them considerably more likely to succumb to their injuries than soldiers today. The U.S. Sanitary Commission's "Rules for Preserving the Health of the U.S. Soldier," issued during the Civil War as a response to concerns about conditions on the battlefield, strongly advised washing all cookpots, relocating latrines away from camp, and ensuring that men bathed and did not sleep in wet clothing or blankets.³² During the Boer War, the British commanding general responded to the lack of potable water with rationing, leading soldiers to drink sewage-infested river water. The result was widespread typhoid fever among the British ranks, which severely impeded their military efficacy. British troops deployed to Salonika during World War I were, in theory, well prepared to deal with malaria. Their preparedness was severely undermined, however, by the relocation of these troops to an area where the mosquito population had not been eradicated by forward medical units, the overreliance on quinine (later shown to be an ineffective prophylactic), and, critically, a lack of bed nets. Consequently, up to 39 percent of British troops contracted malaria, again undermining military efficacy. And it was not unusual for poorly equipped and ill-trained U.S. troops in Alaska and Europe during World War II to lose up to 15 percent of their strength as a result of having sustained cold weather injuries.³³

Today the U.S. military and those of other states pay significant attention to preventive medicine. Given that disease and nonbattle injury (DNBI) was, until the mid-twentieth century, the major cause of death for soldiers deployed to war, this is smart planning.³⁴ Field sanitation teams are now responsible for setting up latrines, which are often prefabricated and a far cry from those used in the mid-nineteenth century. Soldiers today are typically better fed and more

31. Peter Pollack and Carolyn Rogers, "A Brief Background of Combat Injuries" (Rosemont, Ill.: American Academy of Orthopaedic Surgeons, 2007), <http://www.aaos.org/news/bulletin/marapr07/research2.asp>.

32. U.S. Sanitary Commission, "Rules for Preserving the Health of the Soldier," *Harper's Weekly*, August 24, 1861, p. 542.

33. Withers and Craig, "The Historical Impact of Preventive Medicine in War," p. 34. Heat injury was, conversely, a major issue for Allied soldiers deployed to the Persian Gulf during World War II.

34. *Ibid.*, p. 23. There are two volumes devoted to preventive medicine in the *Textbooks of Military Medicine* series, reflecting the importance of the subject to the military. Even in some World War II theaters, such as North Africa, DNBI casualties were quadruple the number of killed in action or died of wounds. See Harrison, *Medicine and Victory*, p. 131.

likely to shower; they are also likelier to be provided with clean food and potable water than in the past. These improvements in preventive medicine lower not only the DNBI rate, but also the died of wounds (DOW) rate, because a healthier soldier is more likely to survive a wound than a less healthy soldier.³⁵ For example, the U.S. 9th Infantry Division conducted research on and then implemented remedies for the dermatological conditions contracted by soldiers operating in the rice fields in Vietnam in the 1960s. As a result, the Division went from a situation where “skin disease accounted for 47% of all disease and injury, including battle injury, in maneuver battalions” to one where “Paddy strength—the number of infantrymen available for combat operations—rose from 65 to 120 men per rifle company, enabling these units to operate effectively.”³⁶

Immunization is a third element of preventive medicine that has decreased disease and, therefore, battle fatalities among military personnel. Immunizations are particularly important in militaries for at least two reasons. First, conscription brings together people from all parts of a country. Many of these individuals may have grown up in rural areas where they did not contract childhood diseases, such as measles, and therefore did not develop immunity to them. These are the recruits likely to spread infectious disease in a newly concentrated population.³⁷ Second, soldiers are frequently deployed to areas where they lack natural immunity to local diseases.

Although vaccines became widely available in the twentieth century, immunization was initially a controversial practice in both society and the military. For example, during the Boer War only 4 percent of soldiers received inoculations against typhoid. Four hundred Serbian military physicians contracted typhus during World War I.³⁸ By World War II, most major Western militaries had begun requiring T.A.B.T.D. vaccinations.³⁹ Subsequently, France saw zero cases of tetanus in properly immunized soldiers.⁴⁰ Also, the DNBI rate fell below that of killed in action (KIA) or DOW for the first time in British military history.⁴¹

35. S. Guo and L.A. DiPietro, “Factors Affecting Wound Healing,” *Journal of Dental Research*, Vol. 89, No. 3 (March 2010), pp. 219–229.

36. Withers and Craig, “The Historical Impact of Preventive Medicine in War,” pp. 47, 50.

37. Smallman-Raynor and Cliff, “Impact of Infectious Diseases on War,” p. 352.

38. H.J. Parish, *Victory with Vaccines: The Story of Immunization* (Edinburgh: E. and S. Livingstone, 1968), p. 86.

39. This acronym stands for typhoid, paratyphoid A, paratyphoid B, tetanus toxoid, and diphtheria toxoid. Britain did not require that its soldiers be immunized, although most were inoculated. Additionally, Germany’s vaccine was less effective than that of the European Allies. See Harrison, *Medicine and Victory*, pp. 92, 131.

40. Parish, *Victory with Vaccines*, p. 199.

41. Harrison, *Medicine and Victory*, p. 10.

IMPROVEMENTS IN BATTLEFIELD MEDICINE AND LOGISTICS

Battlefield medicine is as old as war itself. Ancient Mesopotamian tablets contain information about early wound care,⁴² and Homer's *Iliad* describes "Machaon, the son of Asclepius, that unfailing healer" removing an arrow that had pierced Menelaus's skin, and then treating the wound.⁴³ In the same vein, Homer wrote: "A man who can cut out shafts and dress our wounds—a good healer is worth a troop of other men."⁴⁴ Developments in military medicine make today's soldiers much more likely to survive a wound than their predecessors.

Three improvements in battlefield medicine have increased survival rates for soldiers injured in war. First, recognition that most preventable battlefield deaths were caused by hemorrhage constituted a major advancement in military medicine.⁴⁵ Exsanguination from wounds to the abdomen, extremities, or both, has been a leading cause of battlefield death. As recently as the Vietnam War, when such wounds were sustained on the battlefield, the best that could be done for the soldier was to dress the wound and administer pain medication.⁴⁶ Today, the use of modern hemostatic procedures dramatically increases the probability that a wounded soldier will reach a military medical center instead of dying on the battlefield.⁴⁷ In a landmark article, Ronald Bellamy found that the application of pressure or a tourniquet, or sometimes both, could have saved hundreds of lives during the Vietnam War. Bellamy noted that of the hundreds of "casualties who were killed in action by hemorrhage from arterial wounds, no less than 38 percent had a site at which hemorrhage could have been controlled at least temporarily by simple first aid measures."⁴⁸ Following Bellamy's plea, use of the tourniquet, which had previously been abandoned by both military medics⁴⁹ and civilian purveyors of first-aid kits, was revived.⁵⁰ Historically, tourniquets had frequently been mis-

42. Richard D. Forrest, "Early History of Wound Treatment," *Journal of the Royal Society of Medicine*, Vol. 75, No. 3 (March 1982), p. 198.

43. Homer, *The Iliad*, trans. Robert Fagles (New York: Viking, 1990), bk. 4, pp. 151–152.

44. *Ibid.*, bk. 11, p. 313.

45. Ronald F. Bellamy, "The Causes of Death in Conventional Land Warfare: Implications for Combat Casualty Care Research," *Military Medicine*, Vol. 149, No. 2 (February 1984), table 4, p. 57.

46. *Ibid.*

47. Joseph F. Kelly et al., "Injury Severity and Causes of Death from Operation Iraqi Freedom and Operation Enduring Freedom: 2003–2004 versus 2006," *Journal of Trauma Injury, Infection, and Critical Care*, Vol. 64, No. 2 (February 2008), p. S25.

48. Bellamy, "The Causes of Death in Conventional Land Warfare."

49. Frank K. Butler and Lorne H. Blackbourne, "Battlefield Trauma Care Then and Now: A Decade of Tactical Combat Casualty Care," *Journal of Trauma and Acute Care Surgery*, Vol. 73, No. 6 (December 2012), table 1, p. S396. For a historical review of the use of the tourniquet, see Col. John F. Kragh et al., "Historical Review of Emergency Tourniquet Use to Stop Bleeding," *American Journal of Surgery*, Vol. 203, No. 2 (February 2012), pp. 242–252.

50. The reintroduction of tourniquets has been credited with saving many lives following the 2013

used in several ways, including misapplication and overtightening. In addition, patients and doctors were often reluctant to remove the tourniquet for fear of more bleeding. Also, tourniquets were blamed for the onset of gangrene and, even more dramatic, the necessity for amputation.⁵¹ But with new research on the perils of exsanguination, advances in prosthesis, and the invention of the one-handed tourniquet,⁵² tourniquets have returned to the battlefield. Similarly, the development and improvement of equipment such as hemostatic dressings and the Heimlich chest drainage valve have also decreased the likelihood of battlefield death from exsanguination.⁵³

A second advancement in battlefield medicine concerns the deployment of forward medics. Assigning combat medics at the platoon level is a relatively novel innovation, but a particularly important one given that these medics have been trained to, among other things, apply tourniquets and hemostatic dressings correctly.⁵⁴ The training and deployment of forward medics was pioneered by the U.S. Trauma Combat Casualty Care program, which militaries around the world have subsequently adopted.⁵⁵

Third, assuming a soldier survives injuries sustained on the front lines, s/he is likely to be sent to a rear medical facility. There, the soldier will likely benefit from two additional advancements in (military) medicine: the invention and use of antibiotics and anesthesia. The use of penicillin and other antibiotics to treat and prevent infection has been an enormous boon to military medicine. Anesthetics have also revolutionized military medicine by allowing patients to be sedated so that surgical tasks can be conducted effectively.⁵⁶

Boston Marathon bombings. See Lydia Depillis, "The Return of the Tourniquet: What We Learned from War Led to Lives Saved in Boston," *New Republic*, April 17, 2013, <http://www.newrepublic.com/article/112939/boston-marathon-bombing-return-tourniquet>.

51. For a helpful survey of tourniquet use in wartime, see Stephen L. Richey, "Tourniquets for the Control of Traumatic Hemorrhage: A Review of the Literature," *World Journal of Emergency Surgery*, Vol. 2, No. 28 (October 2007), pp. 1–10.

52. Thomas J. Walters et al., "Battlefield Tourniquets: Modern Combat Lifesavers," *Army Medical Department Journal*, April/June 2005, pp. 42–43.

53. Bijan S. Kheirabadi et al., "Development of Hemostatic Dressings for Use in Military Operations," in *Combat Casualty Care in Ground Based Tactical Situations: Trauma Technology and Emergency Medical Procedures* (Brussels: North Atlantic Treaty Organization, 2004). Another concern for military medics has been the application of pressure to wounds, but innovations in this field, such as military antishock trousers, have been more controversial. See, for example, Ian Roberts, Karen Blackhall, and Karen Joanna Dickinson, "Medical Anti-Shock Trousers (Pneumatic Anti-Shock Garments) for Circulatory Support in Patients with Trauma," *Cochrane Database of Systematic Reviews*, Issue 4, Art No: CD001856.

54. Chad E. Cooper, "Combat Medics Are Always in the Fight," March 14, 2013, <http://www.army.mil/article/98620/>.

55. Butler and Blackbourne, "Battlefield Trauma Care Then and Now," p. S399.

56. Richard A. Gabriel, *Between Flesh and Steel: A History of Military Medicine from the Middle Ages to the War in Afghanistan* (Washington, D.C.: Potomac, 2013), pp. 133–135.

IMPROVEMENTS IN EVACUATION TIME

Many advances in military medicine would be irrelevant to the survival prospects of a wounded soldier if that soldier could not be transported to a place where s/he can receive effective medical care. To some extent, advances in evacuation technology mirror advances in transportation technology more generally. A soldier could not be evacuated by helicopter if helicopters had not yet been invented. But even prior to the widespread use of mechanized transport, there were two main advances in the evacuation of the military wounded.

For centuries, the wounded were transported from the battlefield by litter, a labor-intensive process that often took days and surely meant a higher fatality rate than would have been the case with modern transport options. Although field hospitals existed as early as the eighteenth century,⁵⁷ no organized means of transporting the wounded from the battlefield or treating them on the battlefield were available. Dominique-Jean Larrey, Napoleon's chief surgeon, is lauded for his invention of "flying ambulances." Created long before the era of mechanized flight, these horse-drawn carriages were tasked with "drawing as close as forty feet to the battle line [after which they would] deploy litter bearers to reach the wounded still under fire and transport them to the ambulance."⁵⁸ From there, the injured would be taken to a field hospital.

The next major shift in the evacuation of the wounded did not occur until after the Austro-Sardinian War of 1859. Henri Dunant, a businessman seeking Napoleon III's support for a business venture in Algeria,⁵⁹ was so struck by the despair he observed on the battlefield at Solferino that he wrote a book about the experience.⁶⁰ The book in turn inspired the creation in 1863 of the International Committee of the Red Cross (ICRC).⁶¹ The ICRC's mission—"to protect the lives and dignity of victims of armed conflict and other situations of violence and to provide them with assistance"⁶²—led to the development of a corps of doctors and nurses committed to treating the wounded with impartiality. Dunant's efforts also resulted in one of the first codified laws of war, the

57. *Ibid.*, pp. 69–70.

58. *Ibid.*, p. 144.

59. John F. Hutchinson, *Champions of Charity: War and the Rise of the Red Cross* (Boulder, Colo.: Westview, 1996), pp. 13–14. See also Michael Barnett, *Empire of Humanity: A History of Humanitarianism* (Ithaca, N.Y.: Cornell University Press, 2011), p. 77.

60. Henri Dunant, *Souvenir de Solferino* [A memory of Solferino] (Geneva: Imprimerie Jules-Guillaume Fick, 1862).

61. For a history of the ICRC, see Hutchinson, *Champions of Charity*. Florence Nightingale was a contemporary of Dunant who also trained the world's attention on the state of the battle wounded.

62. ICRC, "Mission Statement," <http://www.icrc.org/eng/who-we-are/mandate/index.jsp>.

1864 Geneva Convention on the Protection of the Wounded, which solved a coordination problem for belligerents by creating space and time to safely evacuate the wounded from the battlefield. His legacy endures today, as ICRC staff are deployed to conflicts around the world.

Five decades after the 1864 convention, primitive mechanized transport during World War I transformed battlefield medicine,⁶³ just as it had the battlefield. Motorized ambulances were equipped and driven much more safely onto the battlefield. Mechanization also meant that field hospitals could be farther from the front line, and thus safer. Additionally, U.S. military ambulance staff were trained to resuscitate and treat patients under their care. These changes made for quicker transport and the possibility of saving lives en route to a field hospital. Nonetheless, the time to reach a field hospital could still be quite long. A U.S. soldier wounded during World War I could expect to be in an ambulance for an average of six hours prior to arriving at a field hospital (which was typically located six to eight miles from the front).⁶⁴

As mentioned above, another innovation in military evacuation is the use of helicopters. Helicopters were first used for evacuation in the Korean War.⁶⁵ The employment of helicopters not only shrank evacuation times but, as with ambulances, allowed field hospitals to be set up farther from the front. Although evacuation times always depend on the theater of war, a U.S. soldier injured in Iraq in 2003 could be in a hospital and receiving treatment in less than an hour; by 2009 the same was true of medevac times in Afghanistan, despite much harsher terrain.⁶⁶ U.S. medical helicopters are now staffed with paramedics, nurses, and sometimes doctors. Virtually all of the world's major militaries now use helicopters for evacuation, though U.S. equipment and deployment strategies are likely the most advanced. NATO, in fact, has adopted a policy whereby troops are typically limited in their deployment, so that any injured soldiers can be provided surgical care within the "golden hour" of sustaining wounds.⁶⁷ According to one senior NATO official, "All NATO-led op-

63. Richard V.N. Ginn, *The History of the U.S. Army Medical Service Corps* (Washington, D.C.: Government Printing Office, 1997), chap. 2, <http://history.amedd.army.mil/booksdocs/HistoryofUSArmyMSC/chapter2.html>.

64. *Ibid.*

65. Bellamy, "The Causes of Death in Conventional Land Warfare," p. 57. Air evacuation was in limited use during World War II. See Harrison, *Medicine and Victory*, pp. 112–113, 130.

66. Gregg Zoroya, "Medevac for Troops Gets Faster in Afghanistan," *USA Today*, December 9, 2009.

67. North Atlantic Treaty Organization, "Allied Joint Medical Support Doctrine," March 2006, p. 1-6, <http://www.aco.nato.int/resources/site6362/medica-secure/Publications/AJP-4.10%28a%29.pdf>.

erations are planned and resourced on the basis that primary surgery for critically injured patients should be available within one hour.”⁶⁸

IMPROVEMENTS IN PROTECTIVE EQUIPMENT

Personal protective equipment has evolved remarkably over time. A traditional suit of arms covered its wearer from head to toe. Unlike their medieval predecessors, Napoleon’s infantry wore no protective equipment, instead going into battle wearing colorful dress uniforms. One of the most distinctive elements of an infantryman’s uniform was the *bonnet*, or felt cap, which had no protective application. Fast forward to today, when the modular tactical vest used by the U.S. military in Iraq covers the torso and groin. U.S. military personnel also wear protective helmets when in combat. Thus the soldier’s head and trunk are afforded some protection, while her/his extremities are more vulnerable. This configuration makes a limb injury more likely in some respects, but it allows much greater mobility than a suit of armor.

Why did militaries give up suits of armor for dress uniforms? One answer lies in changes in weaponry. The gunpowder revolution made traditional armor obsolete, as suits of armor that protected their wearers against swords and knives were easily penetrated by bullets and cannon fire.⁶⁹ The decline of armor also coincided with the rise of the sovereign state. One of the most important symbols of statehood remains a military, and one of the symbols of being in the military continues to be a uniform. Thus the focus on clothing soldiers shifted from protection to identification; militaries needed to be able to distinguish their forces from those of their enemies, and did so by using color and design. Indeed, uniforms became so elaborate that they sometimes impeded the effective conduct of war. During Frederick of Prussia’s reign, for example, uniforms were so tight that the soldiers wearing them had difficulty breathing.⁷⁰

World War I witnessed a shift back toward protective gear. For the first time in centuries, soldiers wore helmets in battle. Previously, “for the soldier, the disappearance of the protective helmet proved to be a medical disaster, and the rate of head injuries rose considerably.”⁷¹ The re-adoption of the helmet is ascribed to France’s Gen. August Louis Adrian, who is said to have been speaking with

68. Correspondence with author, April 2, 2014.

69. Bashford Dean, *Helmets and Body Armor in Modern Warfare* (New Haven, Conn.: Yale University Press, 1920), pp. 30–34.

70. Toni Pfanner, “Military Uniforms and the Law of War,” *International Review of the Red Cross*, March 2004, p. 98; and Gabriel, *Between Flesh and Steel*, p. 92.

71. Gabriel, *Between Flesh and Steel*, p. 75.

an injured soldier whose injuries would have been much more severe if he had not been wearing a “metal mess-bowl” in his hat. Adrian went on to design a metal helmet for the French military based on this example. Subsequently, although the rate of head injuries rose, the fatality rate went down as more soldiers survived head wounds that would have previously been fatal. The other major militaries in the war soon followed the French example.⁷²

During the Vietnam War, the U.S. military introduced flak jackets. Although heavy, hot, and generally uncomfortable to wear, they are credited with “reducing the number of chest, back, and abdomen wounds by up to 70 percent.”⁷³ Since the Vietnam War, flak jackets have become significantly lighter and more comfortable. In addition, the U.S. military now issues equipment to protect soldiers’ ears and eyes. In a 2006 study, the U.S. Defense Department estimated that more than half of the Marine fatalities in Iraq could have survived their wounds had they been wearing body armor.⁷⁴ Today all U.S. troops are deployed with body armor.⁷⁵ This armor is considered so important that hundreds of families and charities in the United States have raised money to purchase it for U.S. soldiers.⁷⁶

IMPROVEMENTS IN MILITARY MEDICINE: A BRIEF SUMMARY

Military medicine has witnessed tremendous advances in the past 200 years. If a British soldier fighting at the close of the Napoleonic Wars had been lucky enough to avoid contracting typhus, he would have nevertheless faced good odds of experiencing a gunshot wound given the limited protection of his dress uniform. This same soldier might have lain on the battlefield for days, his wound festering. If he were lucky enough to be evacuated to a field hospital, his surgeon would not have had access to modern antiseptics or anesthesia, thus decreasing the prospects for a successful surgery and increasing the likelihood of a (frequently fatal) postoperative infection.

72. Dean, *Helmets and Body Armor in Modern Warfare*, pp. 65–67.

73. Brendan Koerner, “Flak Jackets vs. Bulletproof Vests: What’s the Difference?” *Slate*, November 12, 2004, http://www.slate.com/articles/news_and_politics/explainer/2004/11/flak_jackets_vs_bulletproof_vests.html.

74. Michael Moss, “Extra Armor Could Have Saved Many Lives, Study Shows,” *New York Times*, January 6, 2006. See also Darryl Tong and Ross Bierne, “Combat Body Armor and Injuries to the Head, Face, and Neck Region: A Systematic Review,” *Military Medicine*, Vol. 178, No. 4 (April 2013), pp. 421–426.

75. This is also true of troops in other countries, such as Canada, as well as many police officers. It should be noted, however, that the efficacy of body armor is the subject of debate, with opponents arguing that it is too cumbersome to allow effective movement. See Andrew Exum, “All Dressed Up with No Way to Fight,” *New York Times*, January 14, 2006; and Timothy C. Sell et al., “The Addition of Body Armor Diminishes Dynamic Postural Stability in Military Soldiers,” *Military Medicine*, Vol. 178, No. 1 (January 2013), pp. 76–81.

76. Indeed, this practice became so prevalent that the U.S. Army raised concerns about the quality of privately purchased body armor and eventually banned its use. See “Army Bans Privately Bought Body Armor,” *New York Times*, April 1, 2006.

By contrast, a British soldier fighting in Afghanistan today goes into battle much better prepared.⁷⁷ He will have passed a physical examination and will have been better nourished as a child. Also, he will have received vaccinations against a series of diseases contracted historically in military campaigns. He will be equipped with protective armor that covers his trunk and a helmet to protect his head. If he sustains an injury, he is likely to be evacuated quickly—by mechanized transport, or by helicopter—to a field hospital with highly trained and well-equipped doctors who are likely to save his life.

War, in other words, has become less lethal. The same soldier fighting in the same country's military today as compared with 200 years ago is much more likely to survive any given military campaign because of improvements in military medicine. To use a constant number for battle fatalities as a measure of the war proneness of society over a 200-year period, therefore, obscures improvements in military medicine and distorts the view of the incidence of war.

Counting Casualties

The main battle deaths dataset, coauthored by Bethany Lacina and Nils Petter Gleditsch, covers the period from 1946 to 2008.⁷⁸ Lacina and Gleditsch, who have done a great service in assembling these data, also argue that war is on the decline.⁷⁹ They describe their data in the following terms:

We have collected annual battle deaths data which includes both deaths during combat and deaths from wounds received in combat. Some of those considered dead of wounds may have died in a year following that in which combat actually took place, especially in the case of battles taking place late in the calendar year. These deaths were included, however, if they were the direct and immediate result of injuries sustained during combat violence. Long-term reduction in life expectancy because of wounds or disability was not included.⁸⁰

77. Women do not serve in primary combat units in the British army. See Paul Cawkill et al., "Women in Ground Close Combat Roles: The Experiences of Other Nations and a Review of the Academic Literature" (Porton Down, U.K.: Defense Science and Technology Laboratory U.K., Ministry of Defence, 2009); and Joshua E. Keating, "Where a Woman's Place Is on the Front Lines," *Foreign Policy*, February 10, 2012, http://www.foreignpolicy.com/articles/2012/02/10/where_a_womans_place_is_on_the_front_lines.

78. Lacina and Gleditsch, "Monitoring Trends in Global Combat." Although this dataset has received some criticism, it is the best available on battle fatalities. See Gohdes and Price, "First Things First." For a rejoinder, see Bethany Lacina and Nils Petter Gleditsch, "The Waning of War Is Real: A Response to Gohdes and Price," *Journal of Conflict Resolution*, Vol. 57, No. 6 (December 2013), pp. 1109–1127. See also Ralph Sundberg, "Collective Violence 2002–2007: Global and Regional Trends," in Lotta Harbom and Ralph Sundberg, eds., *States in Armed Conflict 2007* (Uppsala, Sweden: Universitetsstryckeriet, 2008), pp. 165–190.

79. Lacina and Gleditsch, "The Waning of War Is Real."

80. Lacina and Gleditsch, "Monitoring Trends in Global Combat," p. 163.

Thus, as is common practice, Lacina and Gleditsch include DOW cases, but they do not distinguish the dead from the wounded. To my knowledge, there is no existing dataset that includes data on both the battle wounded and the battle dead.

Below, I present original data on wounded-to-killed ratios over the past two centuries—that is, the number of military personnel who sustained wounds but survived them divided by the sum of military personnel KIA and DOW. The wounded-to-killed data are based on many of the same sources as the battle death data.⁸¹ The data are not, however, comprehensive; I do not have data for every country in every conflict. Although it is likely that many countries collect these data, they often do not make them publicly available (or readily accessible); such records may be considered highly sensitive for reasons of national security or individual privacy. Moreover, countries that enjoy better prevention, treatment, and evacuation might compile more data than other countries. Given these limitations, the data are useful primarily as a proxy for the quality of military medicine over time.

The PRIO battle deaths data and the wounded-to-killed data are not perfectly compatible for several reasons. First, Lacina and Gleditsch include the number of civilians killed in the crossfire of war as well as combatant deaths, whereas the wounded-to-killed ratios I use are based solely on combatant deaths and injuries. Because the PRIO battle deaths data do not distinguish between combatant and noncombatant deaths, I cannot compare my data on combatant fatalities and injuries to PRIO's data on combatant deaths only. Based on interviews, published studies, and the seriousness with which most physicians take the Hippocratic oath, I assume that military medical personnel treat civilians wounded in the crossfire, although they may prioritize their national military personnel over civilians from a belligerent state. Indeed, military medics are increasingly being employed by, for example, the U.S. military, as part of a "hearts and minds" counterinsurgency strategy to offer care to all civilians, not just those injured in battle.⁸²

Second, unlike the PRIO data, my data do not include all armed conflicts, and may represent a somewhat biased sample based on availability of data.⁸³ The PRIO dataset includes interstate and intrastate wars. Although

81. Lacina and Gleditsch rely on references such as Micheal Clodfelter's *Warfare and Armed Conflicts: A Statistical Encyclopedia of Casualty and Other Figures, 1494–2007*, 3rd ed. (Jefferson, N.C.: McFarland, 2008), and on secondary sources, including reports from nongovernmental organizations such as Human Rights Watch. I used similar sources, including government documents when available, to collect data on wounded-to-killed ratios.

82. Col. Michael Woll and Col. Paul Brisson, "Humanitarian Care by a Forward Surgical Team in Afghanistan," *Military Medicine*, Vol. 178, No. 4 (April 2013), p. 385.

83. For a presentation of related logic in the context of reporting of human rights abuses, see Christopher J. Fariss, "Respect for Human Rights Has Improved Over Time: Modeling the

the wounded-to-killed ratios below include data for some civil wars, such as the American Civil War and Russia's conflict in Chechnya, given resource constraints I focused on collecting wounded-to-killed data for the most frequent belligerents in interstate war. Collecting comparable data for civil wars is virtually impossible for at least two reasons. First, the states that tend to be involved in the most civil wars do not make these data readily available. Second, even if these states were to provide these data, it is highly unlikely that their nonstate adversaries would be able to do the same. These differences could produce an overstated impression of the effects of improvements in medical care in conflict zones on battle casualties properly measured. I address these possible biases later in the article.

As a first cut in bringing a broader set of casualty data into the discussion of the changing incidence of war, I provide wounded-to-killed ratios for four of the most frequent belligerents from 1775 to 2008 (see figure 3). Where possible, data on civil wars in which these countries were involved are included as well. All four graphs in this figure demonstrate a significant upward trajectory in wounded-to-killed ratios. France sees a dramatic rise after World War II, while Israel and Russia demonstrate steadier inclines; the U.S. ratio jumps during Operations Enduring Freedom and Iraqi Freedom, in particular. In figure 4, I assemble these and other data to graph wounded-to-killed ratios over the past two centuries using a smoothed spline function to plot a curve through the data.⁸⁴ The figure demonstrates an upward trend in wounded-to-killed ratios, especially beginning in the latter half of the twentieth century. Note that these data include interstate wars (such as the world wars), extrasystemic wars (such as the American War of Independence), and civil wars (such as Russia's wars with Chechnya in the 1990s and Indonesia's civil wars with leftists).

Although an ideal next step would be to regress some function of time as well as the wounded-to-killed ratio on battle deaths, missing data limit my confidence in taking this path. The PRIO battle death data aggregate all battle deaths for all conflicts in a given year; the wounded-to-killed dataset contains a much sparser grouping of data. Running regressions on battle deaths would therefore require imputing values for a significant amount of missing data. In the online appendix, I take this approach and find that, although the year

Changing Standard of Accountability," *American Political Science Review*, Vol. 108, No. 2 (May 2014), pp. 297–318.

84. This graph presents data from twelve countries and thirty-eight wars, and thus goes significantly beyond the four countries represented in figure 3. Because the data do not appear to be linear, I ran a nonparametric regression and generated fitted values to fill in missing values for wounded-to-killed ratios. I am extremely grateful to Ying Wei for guiding me through this estimation process.

in which a conflict occurs tends to be a significant predictor (and depressor) of battle deaths in bivariate regressions, the coefficient on “year” tends to be both positive and statistically insignificant when interpolated wounded-to-killed ratios are included in the analysis. By contrast, the coefficient on the wounded-to-killed ratio is almost always negative, although significant in only some models.⁸⁵ As wounded-to-killed ratios improve, battle deaths decline.

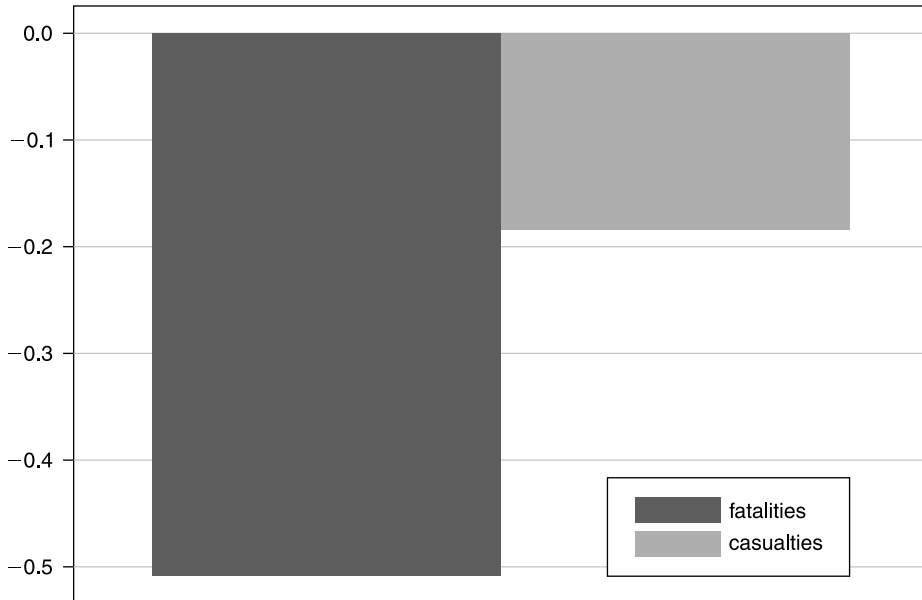
The data suggest that both battle deaths and battle casualties are on the decline. Producing a revised version of figure 1’s count of battle deaths based on available data would be problematic, however, for two reasons. First, doing so would require using predicted values of wounded-to-killed ratios from figure 4 and then plugging these already imputed values into the wounded-to-killed ratio formula ($W/K = R$, where W = wounded, K = killed, and R = ratio) to generate an estimated number of wounded that could then be added to the known number of killed. Not only would such a line be empirically questionable, but it would look almost exactly like figure 1, because it would be a function of those data. Second, it would also look as though the number of battle deaths had not declined at all while casualties were on the decline, because it would dramatically increase the scale of the graph to account for the much greater number of casualties than fatalities.

In the absence of more comprehensive data on the wounded, I take a simpler approach. Rather than trying to impute values for all of the years under consideration, I look only at the endpoints in figure 1 to compare the percentage change in battle deaths with (imputed) battle casualties. As figure 5 shows, from 1946 to 2008, the number of battle deaths declined by 50 percent. By contrast, estimated battle casualties during the same period declined by less than 20 percent. Thus, the data suggest that battle deaths declined more than twice as quickly than battle casualties during this time frame. If this is true, then it may be premature to declare victory on war.

The findings represented in figure 5 and the preceding analysis raise two additional points. First, more data on the battle wounded are needed before making a true comparison between the decline in battle deaths and the incidence of battle casualties. Second, the available data suggest that, even accounting for the battle wounded and notwithstanding improvements in medical care in conflict zones, the number of casualties of war still fell. This finding tempers, but does not negate, the empirical claim made by Goldstein and Pinker about the decline of war more generally. Indeed, in many ways it is consistent with their arguments. Improvements in medical care in conflict zones are partially

85. See http://www.mitpressjournals.org/doi/suppl/10.1162/ISEC_a_00166. It approaches statistical significance in additional models, however.

Figure 5. Percentage Decline in Fatalities and (Estimated) Casualties, 1946–2008



a result of the humanitarian revolution celebrated by the declinist theory of war. Nongovernmental organizations (NGOs) such as the ICRC and Médecins sans Frontières (MSF) are now able to access conflict zones, and state militaries make tremendous investments in the well-being of their troops, both on and off the battlefield.

The Reach of Military Medicine

Developments in military medical technology have had the strongest, and clearest, effects on militaries of advanced, industrialized states. Military medicine in the U.S. Army is much more sophisticated than in the Somali army. One should therefore expect that these developments would affect interstate wars, which tend to be fought by more industrialized states more than they do than civil wars, which tend to occur in poorer countries and where rebel groups in particular are unlikely to have significant access to modern military medicine. In addition, even among interstate wars, one should expect wounded-to-killed ratios to be larger, and perhaps also to increase more rapidly, for richer compared with poorer states.

MILITARY MEDICINE IN CIVIL WARS

The current conflict in Syria has produced major disruptions in what had previously been a highly functioning medical system. Doctors have fled the country;⁸⁶ half of Syria's ambulances are no longer operational;⁸⁷ vaccination programs have been interrupted;⁸⁸ and military checkpoints and sanctions have hindered access to medicine.⁸⁹ A U.S.-based surgeon volunteering in Aleppo reported a lack of neurosurgery, thoracic surgery, and intensive care capabilities at the hospital where he worked.⁹⁰ Civil war wracks a country's infrastructure in multiple ways, and medical care is no exception.

Preventive medicine is not well developed in most civil war zones, and with war comes infection. Civilian populations have been affected most acutely by the spread of disease in war.⁹¹ The difference between preventive care in civil wars in the developing world and interstate wars among developed states, however, is not binary. Global vaccination campaigns for major war-borne diseases such as typhoid may begin in the near future, and major immunization campaigns in the developing world have seen increased resistance to communicable diseases such as measles, the death rate from which has more than halved since 2000.⁹²

Moreover, major NGOs such as the ICRC and the MSF have played an important role in delivering improved medical care to those affected by these conflicts. The ICRC, for example, trains local medical personnel, stands up and staffs field hospitals (with their own personnel) in conflict zones,⁹³ and orga-

86. Ahmed Maher, "Civil War Challenges Health Care System in Syria," *Here & Now*, National Public Radio, September 30, 2013; "Health Care Targeted in Syrian Civil War" (Brussels: United Nations Regional Information Centre for Western Europe, October 8, 2013), <http://www.unric.org/en/latest-un-buzz/28743-both-sides-in-syrian-civil-war-accused-of-targeting-health-care>; and Deborah Amos, "As Doctors Leave Syria, Public Health Crisis Looms," *Weekend Edition Saturday*, National Public Radio, June 29, 2013.

87. "Health Impact of the Crisis in the Syrian Arab Republic" (Geneva: World Health Organization [WHO], 2013), <http://www.emro.who.int/emergency/eha-news/syria-sitre.html>.

88. Ruth Sherlock, "Polio Cases in Syria Spark Alarm over Rise in Diseases Including Flesh-Eating Parasites Due to Civil War," *Telegraph*, October 20, 2013.

89. "Insight: Starvation in Syria: A War Tactic," Reuters, October 30, 2013; and "Syria: Healthcare System Crumbling" (Geneva: IRIN News, UN Office for the Coordination of Humanitarian Affairs, 2013).

90. Matthew Hay Brown, "Local Surgeon Helps in Syria, Where Health Care System Is Overwhelmed," *Baltimore Sun*, September 7, 2013.

91. Smallman-Raynor and Cliff, "Impact of Infectious Diseases on War," table 1, pp. 343–345; and Christos Giannou and Marco Baldan, *War Surgery: Working with Limited Resources in Armed Conflict and Other Situations of Violence*, Vol. 1 (Geneva: ICRC, 2009), p. 96.

92. "State of the World's Vaccines and Immunization," 3rd ed. (Geneva: WHO, UNICEF, and World Bank, 2009), pp. 150–152, 125, fig. 111.

93. Among other locations, the ICRC has staffed field hospitals on the Thai-Cambodian and Kenyan-Sudanese borders (1979–92 and 1987–2006, respectively); in Peshawar and Quetta, Pakistan (1981–93 and 1983–96, respectively); in Kabul and Kandahar, Afghanistan (1988–92 and 1996–2001, respectively); in Rwanda (1995); and in Chechnya (1996). See Giannou and Baldan, *War Surgery*, p. 123.

nizes seminars on war surgery (held in Geneva and also in conflict zones such as Mogadishu).⁹⁴ NGOs such as the ICRC and MSF offer medical care to civilians and combatants alike; this fact suggests that any impact that these organizations have on battlefield medicine can be felt by both populations.⁹⁵ That said, systematic data are unavailable on the percentage of civil wars in which NGOs have provided medical assistance; the effectiveness of this assistance; and the medical capacity, if any, of rebel groups. Comparing these improvements against those that have been made in the context of interstate war remains difficult.

Assistance programs, coupled with changes in transportation technology, have also led to improvements in evacuation. In April 2013, for example, the ICRC airlifted fourteen patients fleeing violence in Darfur to its facility in eastern Chad.⁹⁶ Patients were also frequently flown from southern Sudan during its civil war with the north to an ICRC hospital in Kenya. Given Sudan's size, this method was typically the only way to get patients to a medical facility, and airlifting also could be efficient when humanitarian aid was flown in and patients were flown out.⁹⁷ Even in very poor countries, such as the Democratic Republic of Congo, mechanized transport is typically used to move the injured from the field to a medical facility, with critical variables being the quality of the roads and the medical facilities. In some cases, however, health care workers are able to compensate at least partially for these limitations. The ICRC, for example, reports the following during an unnamed recent conflict in Africa: "Large numbers of patients with salvageable head injuries were dying during a three-day evacuation in the back of lorries travelling over dirt roads in the bush. There was no possibility of monitoring endotracheal intubation. An ICRC surgeon advised performing a tracheotomy in a front-line field hospital before evacuation, the only way to ensure an adequate airway under the circumstances in these comatose patients. The mortality rate for these cases was halved by this simple procedure."⁹⁸ Evacuation, however, is a particular chal-

94. ICRC, "First Aid and Hospital Care," October 29, 2010, <http://www.icrc.org/eng/what-we-do/health/first-aid-hospital-care/overview-first-aid-hospital-care.htm>. For a description of the ICRC's procedures in setting up hospitals in conflict zones, see Jenny Hayward-Karlsson et al., *Hospitals for War-Wounded: A Practical Guide for Setting Up and Running a Surgical Hospital in an Area of Armed Conflict* (Geneva: ICRC, 2005).

95. Unni Karunakara and Peter Maurer, "Medical Care in the Line of Fire," *Al Jazeera*, May 14, 2013.

96. ICRC, "Chad: Seriously Injured People from Darfur Transferred to Hospital," April 24, 2013, <http://www.icrc.org/eng/resources/documents/news-release/2013/04-24-chad-wounded-evacuation.htm>. NGOs such as ICRC and MSF typically charter local aircraft and vehicles; they do not have their own fleets.

97. Telephone interview with Robin Coupland, September 17, 2013.

98. Giannou and Baldan, *War Surgery*, p. 112.

lenge in civil wars characterized by guerrilla warfare, where there is frequently much more force dispersion than in conventional conflicts.⁹⁹

Finally, the use of personal protective equipment for nonstate actors is limited in civil wars, although state militaries may provide some protective equipment to soldiers and police. Even rebels, however, may use some body armor, especially if they have a patron from the developed world (e.g., the Free Syrian Army).¹⁰⁰

Another difficult-to-assess contrast with conventional interstate wars is that the wounds sustained in civil wars today tend to come from land mines, small arms, and fragments, rather than more conventional matériel. At the same time, it is important to remember that there are at least two sides to every civil war. While rebels may not benefit much from improvements in preventive care, battlefield medicine, evacuation, and protective equipment, government forces will likely have enjoyed the benefit of some of these improvements.

MILITARY MEDICINE IN DEVELOPING STATES

Have advances in military medicine increased wounded-to-killed ratios for the most frequent belligerents in post-World War II interstate wars? This question is relevant because, as Mueller shows, major powers—which also tend to be wealthy—have not fought each other for nearly seventy years. Most interstate wars today are fought within the developing world. If the military medical advances described in this article have not diffused to the developing world militaries that fight most interstate wars today, then reliance on battle death data could be sufficient in evaluating the war proneness of these states. A look at the data for the most frequent non-great power belligerents, however, suggests that these states have benefited from improvements in military medicine. Israel's wounded-to-killed ratio has improved nearly fourfold, and the Israeli army has one of the most advanced military medical systems in the world. The Indian military has invested heavily in training and modern equipment, such as hypobaric chambers, to treat patients with high-altitude pulmonary edema (as well as other high-altitude illnesses), presumably because India's two main theaters of war are mountainous. India has a fleet of helicopters available to its medical corps, as well as within-country capacity to design and produce trauma ambulances and other evacuation vehicles.¹⁰¹ Its medical corps appears fully professionalized, with a dedicated university—the Armed Forces

99. Gabriel, *Between Flesh and Steel*, p. 266.

100. Lee Moran and Tim Shipman, "Britain Will Send Body Armour to Syrian Rebels as 'Terrorist' Blast in Aleppo Kills 25 and Violence Continues across Country," *Daily Mail*, February 11, 2012.

101. Mobile Hospital Designers & Developers India Pvt. Ltd., <http://www.mhddipl.com/disaster-responders.html>.

Medical College—and affiliated journal.¹⁰² The Indian military has also devoted significant resources to the development of personal protective equipment, including the (again, within-country) production and distribution of lightweight bulletproof jackets and bulletproof patka helmets, which can accommodate Sikh head dressings.¹⁰³ Likewise, India has rolled out a free national vaccination program,¹⁰⁴ although its sanitation in both the general population and the military remains relatively poor.

Although information on Egypt's military is sparse, organizational charts indicate a dedicated medical corps with a significant number of field hospitals and hospital ships.¹⁰⁵ The state of Chinese military medicine is sufficiently strong that China has begun a campaign of international "health diplomacy," whereby People's Liberation Army physicians and resources are deployed to regions such as sub-Saharan Africa to vaccinate and treat civilians in underserved rural areas.¹⁰⁶ Like India, China has a national vaccine program that has been supported by international organizations such as the World Health Organization.¹⁰⁷ Also like India, however, Chinese sanitation has been historically poor. China has a number of military medical universities. It also has a fleet of medical helicopters that are intended for battlefield use, but are deployed more frequently for disaster relief.¹⁰⁸ Protective equipment is in wide use within the PLA. This equipment includes the QGF03 helmet, which serves not only to protect but also to provide audiovisual communications for troops, as well as Dacheng Body Armor, which is composed of ultra-high molecular weight polyethylene (it is reported to be fifteen times stronger than steel and 40 percent stronger than Kevlar).¹⁰⁹

102. "Indian Army Medical Corps" (YouTube, 2011), <https://www.youtube.com/watch?v=z90skjJJui0>; Armed Forces Medical College, <http://afmc.nic.in>; *Medical Journal Armed Forces India*, <http://www.elsevier.com/journals/medical-journal-armed-forces-india/0377-1237>.

103. TATA Advanced Materials Limited, "Personal Armor," <http://www.tamindia.com/personal-armor.htm>; and Pakistan Defence, "Bullet-Proof Patka Helmets," <http://defence.pk/threads/bullet-proof-patka-helmets.17445/>.

104. Ministry of Health and Family Welfare, Government of India, ed., "National Vaccine Policy" (New Delhi: Government of India, 2011).

105. International Institute for Strategic Studies (IISS), *The Military Balance 2014* (London: IISS, 2014), pp. 315–318.

106. Lt. Col. James A. Chambers, "The Rise of Chinese Military Medicine: Opportunity for Mercy Ship, Not Gunboat, Diplomacy," *Military Medicine*, Vol. 176, No. 9 (September 2011), p. 1045.

107. WHO Representative Office, China, "Expanded Programme on Immunization," 2013, <http://www.wpro.who.int/china/areas/immunization/en/>.

108. "New Model of Rescue Medical Helicopter Makes Debut on PLA Hospital Ship in Indian Ocean," *People's Daily Online*, September 15, 2010; and Yadan Ouyang, "Earthquake Tests China's Emergency System," *Lancet*, May 2013, pp. 1801–1802.

109. Zhang Xiaoqui, Qin Wei, and Zhang Dun, "PLA Develops New Non-Metal Bulletproof Helmet," *China Military Online*, May 18, 2005, http://english.chinamil.com.cn/site2/news-channels/2005-05/18/content_207557.htm.

MILITARY MEDICINE AND CHANGING TECHNOLOGIES OF WAR

Even if advances in military medicine have reduced the number of fatalities in civil wars and developing countries, they may be limited to land warfare. Major powers, in particular, deploy multiple military services in their armed conflicts. Naval warfare may be making a comeback,¹¹⁰ and air warfare has played a prominent role in many recent major conflicts, including the 1999 Kosovo War. In some respects, military medicine is more limited in the realm of naval or air operations, because the catastrophic loss of a ship or plane frequently leads to a 100 percent fatality rate. That said, there have been significant advancements in naval medicine over time, particularly in the prevention of scurvy and the treatment of the shipwrecked. The use of citrus to prevent scurvy won Britain the edge against Napoleon, who did not expect that the British would be able to maintain a long-term blockade.¹¹¹ The state of naval medicine, though, has been relatively stable for some time. By contrast, the treatment of burns, which are among the most common injuries sustained by survivors of plane crashes (of particular relevance to air forces), has recently seen significant advances.¹¹²

An increase in the lethality of weaponry used in war over time also could undermine the argument that improvements in military medicine have reduced the fatality rate in war. Certainly, at both near and far quarters, a machine gun is more lethal than a bayonet. Along with changes in weaponry, however, come changes in tactics. Specifically, in response to increased lethality of weapons has come increased force dispersion, making it more difficult for weapons to hit their marks. Thus, the effect of changes in weaponry on battle casualties is to some extent checked by the subsequent changes in tactics.

Conclusion

Counting war fatalities as a means to measure the frequency of war is an apparently sensible but, ultimately, flawed strategy given recent developments in technology and warfare. Death is final and corpses are easier to count than the wounded. That fewer people are dying in war, however, does not mean that war is at an end. Indeed, it does not even necessarily mean that war has become more humane.

110. M. Taylor Fravel and Alex Liebman, "Beyond the Moat: The PLAN's Evolving Interests and Potential Influence," in Phillip C. Saunders et al., eds., *The Chinese Navy: Expanding Capabilities, Evolving Roles* (Washington, D.C.: National Defense University Press, 2011), pp. 41–80.

111. Stephen J. Bown, *Scurvy: How a Surgeon, a Mariner, and a Gentleman Solved the Greatest Medical Mystery of the Age of Sail* (New York: St. Martin's, 2003), pp. 185–210.

112. Kevin K. Chung et al., "Evolution of Burn Resuscitation in Operation Iraqi Freedom," *Journal of Burn Care & Research*, Vol. 27, No. 5 (September/October 2006), pp. 606–611.

Rethinking the approach to how scholars of international relations count wars may require significant revisions to major datasets such as the Correlates of War and the UCDP lists of armed conflicts. Both datasets have a fatality threshold for inclusion, and that threshold is constant for the entire period they cover.¹¹³ But if, because of improvements in military medicine, the same conflict that produced 1,200 fatalities in 1860 is likely to have produced 800 fatalities in 1980 (or 35 versus 20, in the case of UCDP), the ahistorical nature of the battle death threshold means that the latter conflict(s) will have been left out of the data set. Including these conflicts in Goldstein's and Pinker's analyses could force a closer look at whether war has really declined. A brief survey of UCDP's list of armed conflicts yields more than a dozen conflicts that produced more than 500 battle deaths in the post-1946 period. Among them is the 1963 "Sand War" between Morocco and Algeria, where Micheal Clodfelter reports 300 Algerian and 200 Moroccan fatalities. Based on Algeria's wounded-to-killed ratio from the independence war just prior to the interstate conflict with Morocco, it is possible that Algerian casualties alone exceeded the 1,000-combatant-death threshold used by the Correlates of War.¹¹⁴ More recently, Clodfelter reports 700 fatalities in Thailand's civil war with the Patani in the south, which began in 2003. This conflict is another candidate for inclusion in a list of wars that takes all casualties into account. Depending on a number of factors—including the percentage of fatalities that have been sustained by the government—using past wounded-to-killed ratios for Thailand suggests that this conflict may have produced more than 1,000 battle casualties in a single year.¹¹⁵ One cannot be confident in any of these adjustments, however, until additional data on the battle wounded are available.

The possibility that wars and armed conflicts have been undercounted because existing datasets use a battle death threshold that does not change over time raises questions about the comparability of cases over time and the soundness of quantitative analyses that cover the nineteenth and twentieth centuries, in particular. For example, several scholars have debated whether democracies are more likely to win the wars they fight and, if they are, why that would be so.¹¹⁶ What if democracies, especially twentieth-century democracies, are likely to have especially good military medical care? Posing this

113. Indeed, COW sometimes uses a wounded-to-kill ratio to infer battle deaths; this wounded-to-kill ratio is also time invariant. See Sarkees and Wayman, *Resort to War*, p. 52.

114. Clodfelter, *Warfare and Armed Conflicts*, pp. 585–588, 591.

115. *Ibid.*, p. 663.

116. David A. Lake, "Powerful Pacifists: Democratic States and War," *American Political Science Review*, Vol. 86, No. 1 (March 1992), pp. 24–37; and Dan Reiter and Allan C. Stam, *Democracies at War* (Princeton, N.J.: Princeton University Press, 2002).

question raises at least two possible implications for the debate. First, it may be that certain wars are not included in the observations under analysis, especially for the twentieth century. Second, if democracies are more likely to have stronger military medical systems, then, all else being equal, this could tip the balance in their favor in prosecuting wars. In other words, relative capability in military medicine could constitute an alternative explanation for the finding that democracies are winners. To the extent that the general result that democracies are more likely than nondemocracies to win the wars they fight is sensitive to recodings of data,¹¹⁷ incorporating the rise of military medicine could alter this finding.

Bringing military medicine into the discussion of what counts as war also has implications for society and policy. The massive investment that modern militaries have made in military medicine reflects their view of its importance, but the story of the battle wounded has typically remained untold.¹¹⁸ For example, in the first year of Operation Enduring Freedom, the *New York Times* published just one story on the military wounded; its “Casualties” column effectively redefined “casualty” to mean only fatalities.¹¹⁹ Moreover, these reports include only the visibly wounded, ignoring the thousands of veterans suffering from posttraumatic stress disorder and other war-induced psychiatric conditions.¹²⁰ Similarly, an influential book on casualty aversion and public support for war in the United States explicitly takes “casualty” to mean “fatality,” and finds (in a robustness test) that including the wounded in survey ex-

117. Marko Djuranovic, “Democracy or Demography? Regime Type and Determinants of War Outcomes,” Ph.D. dissertation, Columbia University, 2008; and Alexander B. Downes, “How Smart and Tough Are Democracies? Reassessing Theories of Democratic Victory in War,” *International Security*, Vol. 33, No. 4 (Spring 2009), pp. 9–51.

118. Robin M. Coupland and David M. Meddings, “Mortality Associated with Use of Weapons in Armed Conflicts, Wartime Atrocities, and Civilian Mass Shootings: Literature Review,” *British Medical Journal*, Vol. 319 (August 1999), pp. 407–410.

119. Data from a LexisNexis search on “Afghanistan” + “casualty” or “fatality.” A more recent *New York Times* series focused on the returned wounded, but in a distinctly postwar context. See “The Hard Road Back,” *New York Times*, January 2, 2012 to May 15, 2013, <http://www.nytimes.com/interactive/us/the-hard-road-back.html>.

120. On this disorder, see Charles W. Hoge et al., “Association of Posttraumatic Stress Disorder with Somatic Symptoms, Health Care Visits, and Absenteeism among Iraq War Veterans,” *American Journal of Psychiatry*, Vol. 164, No. 1 (January 2007), pp. 150–153; Karen H. Seal et al., “Bringing the War Back Home: Mental Health Disorders among 103,788 U.S. Veterans Returning from Iraq and Afghanistan Seen at Department of Veterans Affairs Facilities,” *Archives of Internal Medicine*, Vol. 167, No. 5 (March 2007), pp. 476–482; Han K. Kang et al., “Post-Traumatic Stress Disorder and Chronic Fatigue Syndrome-Like Illness among Gulf War Veterans: A Population-Based Survey of 30,000 Veterans,” *American Journal of Epidemiology*, Vol. 157, No. 2 (January 2003), pp. 141–148; Jonathan Shay, *Odysseus in America: Combat Trauma and the Trials of Homecoming* (New York: Scribner, 2002); Jonathan Shay, *Achilles in Vietnam: Combat Trauma and the Undoing of Character* (New York: Scribner, 1994); and American Psychiatric Association, *Diagnostic and Statistical Manual of Mental Disorders: DSM-5* (Arlington, Va.: American Psychiatric Association, 2013), sec. 2, 309.381 (F343.310).

periments on casualty aversion did not alter respondents' level of support for conflict.¹²¹ The wounded, in other words, seem not to figure into "the human costs of war" in any significant way.

More broadly, using fatality counts as a measure of war is increasingly questionable given new technologies of warfare. U.S. drone strikes in Afghanistan and Pakistan have probably killed fewer than 1,000 combatants each annually.¹²² Yet, in Pakistan's Federally Administrated Tribal Areas, civilians and soldiers alike must surely feel like they are living in a war zone.¹²³ In addition, the development of nonlethal weapons—used today primarily for police actions—could result in conflicts with many fewer direct casualties.¹²⁴ Similarly, a barrage of cyberattacks, which could cause a great deal of damage with or without generating casualties directly, could make a population feel it was under siege.¹²⁵

If, as Carl von Clausewitz observed, "war is the continuation of politics by other means," must those other means cause fatalities to qualify as war? More to the point, must they cause a specific, constant number of fatalities? The rapid advances in military medicine in the last half century alone suggest that an ahistorical measure of war may deny the severity (and possibly incidence) of many recent conflicts. Although war may be wounded, it is, sadly for all its victims, not dead.

121. Christopher Gelpi, Peter D. Feaver, and Jason Reifler, *Paying the Human Costs of War: American Public Opinion and Casualties in Military Conflicts* (Princeton, N.J.: Princeton University Press, 2009), pp. 1 n. 1, 144–145.

122. See New America Foundation, "The Drone War in Pakistan," <http://natsec.newamerica.net/drones/pakistan/analysis>.

123. Amnesty International, "'Will I Be Next?' U.S. Drone Strikes in Pakistan" (London: Amnesty International, 2013); and Human Rights Watch "'Between a Drone and Al Qaeda': The Civilian Cost of U.S. Targeted Killings in Yemen" (New York: Human Rights Watch, 2013). Because targets of drone strikes tend to live in remote areas, they will likely not benefit from many of the medical advances outlined above. This suggests an emerging divergence in medical care for combatants versus civilians in certain theaters.

124. Alternatively, the use of non-lethal weapons could increase the fatality rate if targets immobilized by non-lethal weapons were subsequently attacked using lethal force.

125. There is significant debate about whether cyberattacks alone could qualify as war. See Thomas Rid, *Cyberwar Will Not Take Place* (Oxford: Oxford University Press, 2013); and Erik Gartzke, "The Myth of Cyberwar: Bringing War in Cyberspace Back Down to Earth," *International Security*, Vol. 38, No. 2 (Fall 2013), pp. 41–73.