ABSTRACT  War-related medical costs for U.S. veterans of Iraq and Afghanistan may be enormous because of differences between these wars and previous conflicts: (1) Many veterans survive injuries that would have killed them in past wars, and (2) improvised explosive device attacks have caused “polytraumatic” injuries (multiple amputations; brain injury; severe facial trauma or blindness) that require decades of costly rehabilitation. In 2035, today’s veterans will be middle-aged, with health issues like those seen in aging Vietnam veterans, complicated by comorbidities of post-traumatic stress disorder, traumatic brain injury, and polytrauma. This article cites emerging knowledge about best practices that have demonstrated cost-effectiveness in mitigating the medical costs of war. We propose that clinicians employ early interventions (trauma care, physical therapy, early post-traumatic stress disorder diagnosis) and preventive health programs (smoking cessation, alcohol-abuse counseling, weight control, stress reduction) to treat primary medical conditions now so that we can avoid treating costly secondary and tertiary complications in 2035. (We should help an amputee reduce his cholesterol and maintain his weight at age 30, rather than treating his heart disease or diabetes at age 50.) Appropriate early interventions for primary illness should preserve veterans’ functional status, ensure quality clinical care, and reduce the potentially enormous cost burden of their future health care.

INTRODUCTION
In 2010, the United States conflict in Afghanistan surpassed Vietnam as the longest American war in history with approximately 2 million U.S. service members deployed to Iraq or Afghanistan. Operation Enduring Freedom (OEF) in Afghanistan has resulted in 1,903 service deaths with 15,516 fighters wounded in action. Operations Iraqi Freedom (OIF) and New Dawn (OND), which ended on December 18, 2011, have resulted in 4,475 deaths and 32,224 service members wounded in action. Through September 2009, the Veterans Health Administration had treated about 510,000 unique veterans from either conflict, and that number is probably closer to 800,000 today. Following the conclusion of the war in Iraq and the reduction of operations in Afghanistan, war-related medical costs for these veterans are likely to grow exponentially over time because of several major differences in these wars compared with previous conflicts. Specifically: (1) Many warriors now survive injuries that would have killed them in past wars (Table I). (2) Current improvised explosive device (IED) attacks have caused “polytraumatic” injuries—multiple limb loss; brain injury; severe facial trauma or blindness—that may require decades of costly rehabilitation. (3) In 2009, the average OEF/OIF service member was 25 to 29 years old and might be expected to live 50 more years. Today’s focus of medical, political, and economic attention has been the primary wounds impacting our veterans, such as IED explosive injuries. The strategic theme of this article is that society is not yet considering the medical costs of caring for today’s
veterans in 2035—a time when they will be middle-aged, with health issues like those now seen in aging Vietnam veterans, exacerbated by comorbidities of post-traumatic stress disorder (PTSD), traumatic brain injury (TBI), and polytrauma. We are concerned about the reality that in 2035, these acute issues will lead to costly long-term medical consequences.

Research is underway to examine the impact of long-term illnesses in military service members following deployment.9-14 Table II shows fatalities and war injuries drawn from public reports. Unfortunately, these data do not assess the extent of polytrauma, the overlap between injury categories, the persistence of mild TBI and PTSD, or the prevalence of comorbidities or undiagnosed conditions that manifest later. This makes long-term estimates of the costs of treating war wounds highly challenging; but, an emerging consensus among clinicians, government officials, and economists indicates that such costs are likely to be large.4,6,7,11-14 In 2008, economists Joseph Stiglitz and Linda Bilmes, in “The Three Trillion Dollar War,” predicted lifetime Veterans Affairs (VA) medical costs for Iraq and Afghanistan veterans to range from $121 to $285 billion in present value.5 In their 2010 Congressional testimony, they updated their forecast for lifetime VA medical costs (alone) for this cohort to $201 to $348 billion12 and estimated that the total costs for providing medical care and disability (from VA and the U.S. Social Security Administration) for returning veterans will be $589 billion to $984 billion, depending on the length and intensity of the conflict.12 In 2011, the Congressional Budget Office estimated that VA medical-care costs for treating OEF/OIF veterans from 2011 to 2020 (excluding disability) could total $40 to $54 billion in inflation-adjusted 2010 dollars.4-update A simple extrapolation of the Congressional Budget Office estimates produces a present value of total lifetime medical costs, i.e., discounted over 40 future years, of between $300 and $600 billion if current trends were to continue. Although there is uncertainty in predicting future costs, the estimates continue to rise.

Our goal is to qualitatively list the medical costs of the war on terror and proactively target those costs that we can reduce using medical interventions. The section, Medical Costs of the Iraq and Afghanistan Wars: Sources and Mitigation, and Table III categorize many sources of medical costs of war, along with strategies for prevention and mitigation of such costs. This article cites emerging knowledge about best practices that have demonstrated cost-effectiveness in mitigating the long-term medical costs of war. We propose that clinicians and health care systems employ early interventions (trauma care, physical therapy, and early PTSD diagnosis); preventive health programs (smoking cessation, alcohol-abuse counseling, weight control, stress reduction); and innovations in technology, surgery, and care delivery15,16 to treat primary medical conditions today so we can avoid treating costly secondary and tertiary complications in 2035. Although the scope of this article covers the future medical costs for veterans’ care, translating these medical activities

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**Table I.** Numbers and Ratios of Wounded vs. Dead in U.S. Wars During the Past 100 Years

<table>
<thead>
<tr>
<th>War</th>
<th>Number Serving</th>
<th>Battle Deaths</th>
<th>Wounded in Action</th>
<th>Ratio of Wounded/Dead</th>
<th>Source</th>
</tr>
</thead>
<tbody>
<tr>
<td>OEF Afghanistan</td>
<td>2 Million OIF + OEF</td>
<td>1,903</td>
<td>15,516</td>
<td>8.2</td>
<td>SIAD5</td>
</tr>
<tr>
<td>OIF Iraq</td>
<td>4,409</td>
<td>31,923</td>
<td></td>
<td>7.2</td>
<td>SIAD4</td>
</tr>
<tr>
<td>OND Iraq</td>
<td>66</td>
<td>301</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Total Iraq</td>
<td>4,475</td>
<td>32,224</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Vietnam</td>
<td>8,744,000</td>
<td>47,434</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Korea</td>
<td>5,720,000</td>
<td>33,739</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>World War II</td>
<td>16,112,566</td>
<td>291,557</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>World War I</td>
<td>4,734,991</td>
<td>53,402</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>OIF Iraq</td>
<td>4,409</td>
<td>31,923</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>OIF Afghanistan</td>
<td>1,903</td>
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<td>World War I</td>
<td>4,734,991</td>
<td>53,402</td>
<td></td>
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<td></td>
</tr>
</tbody>
</table>


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**Table II.** Total War-Related Injuries by Type and Characteristic5

<table>
<thead>
<tr>
<th>Type of Injury</th>
<th>Incidence by Characteristic</th>
<th>Total Incidence</th>
</tr>
</thead>
<tbody>
<tr>
<td>Deaths, All</td>
<td>n/a</td>
<td>5,945</td>
</tr>
<tr>
<td>Deaths, Suicides</td>
<td>n/a</td>
<td>260</td>
</tr>
<tr>
<td>PTSD Ever Diagnosed</td>
<td>Deployed 66,935</td>
<td>88,719</td>
</tr>
<tr>
<td></td>
<td>Not Deployed 21,784</td>
<td></td>
</tr>
<tr>
<td>TBI Ever Diagnosed</td>
<td>Penetrating 3,451</td>
<td>202,281</td>
</tr>
<tr>
<td></td>
<td>Severe 2,124</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Moderate 34,001</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Mild 155,623</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Not Classifiable 7,082</td>
<td></td>
</tr>
<tr>
<td>Amputations</td>
<td>Major Limb 1,222</td>
<td>1,621</td>
</tr>
<tr>
<td></td>
<td>Partial 399</td>
<td></td>
</tr>
</tbody>
</table>
into social actions and policies, with adequate funding, is key to providing more optimal and economical veterans’ health care through 2035 and beyond.

**MEDICAL COSTS OF THE IRAQ AND AFGHANISTAN WARS: SOURCES AND MITIGATION**

Although some veterans may experience only acute psychological issues, mild PTSD that resolves, or limited physical injuries, many others will experience long-term medical costs—either from the initial illness or trauma, developing chronic medical conditions, or long-term disability. Amputation care, PTSD, and TBI are likely to cause the greatest long-term medical and disability costs. Backlogged VA benefits claims currently number over 800,000, an issue that VA continues to work to resolve. Economist Dr. Linda Bilmes, testifying before the House Veterans Affairs Committee in 2010, said that, “...veterans from recent wars are utilizing VA medical services and applying for disability benefits at much higher rates than previous wars,” and that “...the cost of caring for war veterans... peaks in 30 to 40 years or more after a conflict.” Current military service members will begin to hit this peak cost around 2035. For an amputation, the secondary and tertiary consequences in middle age might include decreased mobility, weight gain, coronary artery disease, and diabetes mellitus. For PTSD, the secondary and tertiary comorbidities include obesity, depression, substance

### TABLE III. Sources of Medical Costs of War and Preventive Strategies to Help Mitigate Costs

<table>
<thead>
<tr>
<th>Potential Sources of Higher Medical Costs of War</th>
<th>Preventive Strategies to Help Mitigate Costs</th>
</tr>
</thead>
<tbody>
<tr>
<td>Trauma and Polytrauma: Prevention</td>
<td>Several tactics can either prevent the trauma or reduce the level of injuries sustained and hence the costs:</td>
</tr>
<tr>
<td></td>
<td>—Better preventive/protective equipment, body armor, armored vehicles, etc.</td>
</tr>
<tr>
<td></td>
<td>—More ways to preventively detect or disarm IEDs</td>
</tr>
<tr>
<td>Trauma and Polytrauma: Acute Care and Treatment Surgery, transportation, medical care, rehabilitation</td>
<td>—Better technology for battlefield treatment and evacuation</td>
</tr>
<tr>
<td></td>
<td>—Better surgical techniques, closer to point of injury</td>
</tr>
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<td></td>
<td>—Streamlined processes of moving the patient through the tiers of the medical system</td>
</tr>
<tr>
<td>Amputations</td>
<td>—Improvements in prosthesis technology (may reduce time in rehabilitation or disability)</td>
</tr>
<tr>
<td></td>
<td>—Improvements in care delivery that allow more amputees to return to active duty or work</td>
</tr>
<tr>
<td></td>
<td>—Programs to help soldiers with polytrauma repair or regenerate their bodies for better self-image, function, cosmesis and return to work— Armed Forces Institute for Regenerative Medicine</td>
</tr>
<tr>
<td>Psychiatric and Neurological Care for PTSD, TBI, along with disability and care for comorbid illnesses, when one disease or injury begets or worsens another</td>
<td>—Outreach, education, early detection, and treatment in primary-care clinics</td>
</tr>
<tr>
<td></td>
<td>—Early identification and treatment of the “first” presenting illness, such as PTSD, to reduce the chance of the patient developing comorbidities</td>
</tr>
<tr>
<td></td>
<td>—Screening for PTSD along with related comorbidities</td>
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<tr>
<td></td>
<td>—PTSD decompression following deployment</td>
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<td></td>
<td>—More mental health providers in DoD/VA healthcare systems</td>
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<tr>
<td></td>
<td>—The Army’s protocol to “educate, train, treat and track” soldiers for TBI after concussions</td>
</tr>
<tr>
<td></td>
<td>—Refined screening instruments for PTSD and TBI and ability to distinguish and treat PSTD and TBI</td>
</tr>
<tr>
<td></td>
<td>—Allocating more resources for veterans’ medical and mental health treatment, including Vet Centers</td>
</tr>
<tr>
<td></td>
<td>—Improving processing of veterans’ disability claims</td>
</tr>
<tr>
<td>Additional Mental and Physical Health Impacts on the Service Member’s Family</td>
<td>—Counseling and early intervention for service members’ families can treat stress and anxiety and prevent these conditions from leading to more serious issues like domestic violence</td>
</tr>
<tr>
<td></td>
<td>—Military “resiliency programs” can help teach service members’ families skills to cope with personal and financial problems</td>
</tr>
<tr>
<td></td>
<td>—The Military Spouse Employment Partnership helps military spouses maintain portable careers</td>
</tr>
<tr>
<td></td>
<td>—The VA proposed plan to compensate family members caring for wounded service members in their homes could reduce nursing-home costs</td>
</tr>
<tr>
<td></td>
<td>—Some hospital programs serve veterans’ families whose needs cannot be met within the VA system</td>
</tr>
<tr>
<td></td>
<td>—Preventive or early-intervention programs might cure or stabilize veterans sooner and thereby mitigate the escalation of long-term extra medical or nonmedical support costs</td>
</tr>
</tbody>
</table>

Sources (citations) for Table III are provided in the narrative of the article and not repeated here.
abuse, smoking, etc. Our goal is to focus limited medical resources on treating the primary issues today, which should help our patients avoid the more costly comorbid health problems in 2035 (Fig. 1)—and help society avoid the scenario in which we lack sufficient funding to care for veterans who have bravely served our country.

Trauma and Polytrauma: Prevention and Acute Care

Trauma and polytrauma, especially from IED injuries, constitute a huge component of medical costs for Afghanistan and Iraq war veterans. Our future goal would be to prevent the trauma or reduce the severity of injuries sustained—through better protective equipment, body armor, armored vehicles, etc., and more methods to detect and disarm IEDs. The acute costs of trauma care are higher for current veterans as a cohort since more wounded service members now survive with profound injuries than in any previous U.S. war. Access to care poses challenges when providers themselves are deployed. During recent conflicts, the Army lacked enough medical providers for the active force; this was increasingly true for women soldiers. Medical costs will accrue at various points in the military health care system, from battlefield evacuation through surgery, transportation, and rehabilitation, and will include job retraining and assistive devices, such as prostheses and wheelchairs. One way to streamline costs is to make the system of evacuation and treatment optimally efficient through better technologies and improved surgical techniques.

Amputations

War-related military amputations now occur at double the rate seen in previous wars. A 2010 study found that twice as many wounded U.S. soldiers had limb amputations as in either 2009 or 2008, and three times as many had lost more than one limb. The report cited increased foot patrols in Afghanistan in 2010, during which soldiers could step on buried mines, as a likely cause. As of April 2012, there had been 1448 OIF/OEF/OND amputee patients treated in all Military facilities; 436 (30%) with multiple amputations (Dr. Michael J. Carino, Department of the Army Office of the Surgeon General, Public Affairs, personal communication).

Amputations pose the greatest challenges of war, financially, physically, and socially. In the acute setting, amputees require trauma care, with complications of infections, anemia, and heterotopic ossification. In one study of Iraq and Afghanistan amputees, 80% needed physical therapy, occupational therapy, prosthetics, and psychiatry. OIF/OEF amputees reported lower quality of life if their amputation were accompanied by either a combat-related head injury, a greater injury to the nonamputated limb, or a need for assistance with daily activities. Amputees’ anatomy will change with age, and obesity is a serious concern. Amputees may experience cardiovascular disease, osteoarthritis, back pain, and phantom limb pain. Their prostheses and wheelchairs may require replacement or upgrades based on newer technologies (such as neurally controlled robotic arms). Given Moore’s Law, which predicts ongoing exponential growth in digital devices’ capabilities, these veterans’ devices may have ongoing high costs forever.

However, improved technologies and treatments may somewhat mitigate the cost of amputations. Newer prostheses that allow amputees to run and remain active may offset weight gain. And although military amputation rates have risen, improvements in care delivery have allowed more amputees...
Many veterans develop PTSD whether or not they have been physically injured. These veterans have a lower quality of life and more medical problems than those without PTSD. \(^3\)

Suicide rates are high in current conflicts. \(^3\) Returning service members face financial challenges and high divorce rates. \(^4\) PTSD is associated with smoking, \(^5\) substance abuse, \(^6\) depression and anxiety, \(^7\) heart disease, \(^8\) obesity, \(^9\) diabetes, \(^10\) gastrointestinal, dermatologic, and musculoskeletal disorders; \(^11\) chronic fatigue; \(^12\) and increased dementia. \(^13\)

Treatment for both PTSD and its comorbidities is costly. A comprehensive study of PTSD and major depression in OEF/OIF service members estimated the prevalence of each at 14%, with a 4% overlap. \(^1\) In a 2010 study of U.S. service members in Iraq, the prevalence rates of PTSD and depression after combat ranged from 9 to 31%, depending on the level of functional impairment. \(^2\) That study also estimated that the total societal cost per person—including lost earnings and overlap suicide costs—was between $5,900 and $25,800 over 2 years, of which only about 3% represented treatment costs paid by Department of Defense (DoD), VA, or private payers. A follow-up study, with improved data on personnel and treatments, estimated the 2-year costs at about $16,000 per case. \(^3\) If rates of price inflation and prevalence were to remain unchanged, the per-person societal cost could reach nearly $50,000 over 2 years by 2035. Using this figure as a rough average, it might cost $1,250,000 to treat depression and PTSD in one current veteran for 50 years—not counting other health problems.

Society’s best hope of containing costs may be to screen and treat PTSD early, along with related physical-health consequences. \(^4\) For example, PTSD and alcohol/drug abuse require concomitant treatment since psychological disease can reduce substance-abuse treatments’ effectiveness. Smoking cessation combined with PTSD care is more effective than smoking-cessation treatment alone. \(^5\) Depending on which condition (PTSD or a physical ailment) is first diagnosed, screening and treatment can be bidirectional. When male VA diabetes patients with PTSD and depression were found to be vulnerable to weight/lipid problems, one study recommended screening of all diabetes patients for mental health comorbidities. \(^6\) Some issues complicate PTSD diagnosis and treatment. Clinicians often do not agree on how to diagnose PTSD or how to distinguish it from mild TBI, depression, or other mental health conditions. Misdiagnosis also occurs in cases in which veterans may suffer from stress or anxiety that is unrelated to combat trauma. When diagnosed, it is difficult to classify PTSD (or TBI) as minor vs. major. Finally, it is critical to have enough providers to serve veterans; in 2007, there were too few mental health providers in the DoD/VA health care systems, \(^7\) and although measures have been taken to increase staffing and reduce waiting times, more help is needed to achieve optimum treatment. However, despite such limitations, patients will benefit from a preventive approach that employs early intervention and treatment for PTSD and comorbid illnesses, and possible decompression following deployment; \(^8\) this should improve outcomes and avoid a “snowballing effect” on long-term medical-care costs.

**Traumatic Brain Injury**

TBI from bomb blasts, which cannot be prevented by body armor or rapid medical attention, \(^9\) is being called a “signature wound” of the Iraq war. \(^10\) TBI accounts for roughly 22% of casualties in Afghanistan and Iraq, and was found in 59% of patients exposed to blasts in one study. \(^11\) Mild TBI can be missed on imaging, \(^12\) and veterans may not show brain damage until years after a blast injury. \(^13\) Head injury in young adulthood may correlate with greater risk of Alzheimer’s disease in later life. \(^14\) Mild TBI, like PTSD, correlates statistically with increased rates of psychological, physical, and functional problems, \(^15\) and is associated with alcohol-abuse disorders. \(^16\) Among 2525 U.S. Army soldiers deployed to Iraq, those who had experienced mild TBI, based on self-reported prior loss of consciousness (a noted study limitation), \(^17\) were more likely to report poor health, missed workdays, medical visits, and somatic and postconcussive symptoms, compared to soldiers with other injuries. \(^18\) In a cross-sectional cohort study of 278 TBI patients and 3218 normal controls, mild TBI, even years after the injury, correlated with increased headaches, sleep problems, and memory difficulties; it could also prolong recovery from comorbid conditions, including PTSD. \(^19\)

An important but difficult objective is to separate TBI from PTSD, to diagnose when the two conditions coexist, and avoid attributing health problems to mild TBI if associated PTSD and depression may be the primary problem. \(^20\) Patients diagnosed with both disorders are likely to require collaborative, coordinated support across a broad set of providers who possess combined expertise in mental health, neurology, and internal medicine.

As the veterans of Iraq and Afghanistan age, it will be important to refine screening instruments, to evaluate and treat patients proactively for PTSD and TBI, and to employ resiliency programs. One initiative is the U.S. Army’s protocol to “educate, train, treat and track soldiers”—intervening,
assessing, evaluating, and tracking progress of a service member after a concussion.\textsuperscript{67} The U.S. Marine Corps Combat Operational Stress Control program proactively identifies five core ways in which to manage stress: “strengthen Marines; mitigate and remove unnecessary stressors; identify Marines with stress problems; treat and coordinate care, and reintegrate back to unit.”\textsuperscript{68} The U.S. Navy has 10 resilience initiatives to help both veterans and families who care for them.\textsuperscript{69} A Veterans Health Administration program trains clergy to help the estimated 30 to 40% of veterans from rural areas connect with mental health resources;\textsuperscript{70} the Restore Warriors website provides information and tools on how to manage PTSD and TBI and “aims to educate veterans, service members, families and friends on the potentially life-altering after-effects of war, from post-traumatic stress and depression to relationship problems or general anxiety.”\textsuperscript{71}

**Additional Health Impacts and Costs for Service Members' Families**

Repeated deployments in Afghanistan and Iraq, with extended separations, have caused unusual stress for service members’ families—before, during, and after deployments. First lady Michele Obama said that it was “important to recognize that the children of people in the military are also making sacrifices and must often move from school-to-school, or deal with prolonged absences of one of their parents.”\textsuperscript{72} Anxiety over impending deployment can cause unhealthy behaviors, including tobacco and alcohol abuse,\textsuperscript{73,74} overeating, children’s behavioral problems,\textsuperscript{75,76} increased domestic abuse,\textsuperscript{9} reckless driving with potential trauma, or high-risk sexual activity. Military spouses may have increased depression or worries about family functioning during deployment.\textsuperscript{77,78} Many servicemen’s wives “are obliged to give up their own careers when they accompany personnel to new postings, especially overseas” (or to care for them when wounded). The result is that “military families lose not only the wife’s salary but also the future pension entitlement that her on-going employment would have earned.”\textsuperscript{79} Stress impacts one’s mental and physical health, in the short and long terms;\textsuperscript{32} some relatives may suffer negative psychological consequences long after their loved one’s acute issue is resolved.\textsuperscript{80} Long-term costs for the family and society may include at-home nursing care, relocation expenses, and lost job productivity for family members who leave work to care for injured veterans; increased administrative overhead for disabled veterans’ claims; and costs associated with stress induced by delayed response to medical claims.\textsuperscript{14} Systems of care may or may not be burdened by these “hidden” costs, but regardless, they represent harms to an individual’s physical and emotional well-being.

Hidden costs are hard to quantify or mitigate. However, military resiliency and support programs exist to help families cope with personal and financial problems, including the Survivor Outreach Services program, serving 133,000; the Military Family Life Consultant program; the Exceptional Family Member Program; the alcohol and substance abuse program; mobilization readiness programs for both service members and their families;\textsuperscript{81} and counseling to treat service members’ families for deployment-related stress to hopefully prevent it from escalating into trauma, family abuse, or suicide. Hospital programs in Boston, Massachusetts,\textsuperscript{58} Grand Rapids, Michigan,\textsuperscript{82} and elsewhere also serve veterans and their families whose health care needs cannot be met within the VA system. In 2011, VA announced a plan to compensate families caring for wounded service members at home, which could reduce nursing-home costs.\textsuperscript{83} (The U.S. Department of Labor’s Family and Medical Leave Act allows for military caregiver leave, but only on an unpaid, temporary basis.\textsuperscript{84} In 2012, the Obama administration proposed that service members’ spouses, children, or parents be allowed to take “up to 12 weeks of leave from work to help a service member deployed on short notice” to “arrange child care...financial and legal arrangements without fear of losing their jobs.” Also, they would get “up to 26 weeks of leave to care for recent veterans who were injured or became ill in the line of duty.”\textsuperscript{85} The Military Spouse Employment Partnership is a group of companies that pledge to “recruit, hire and promote military spouses and help them maintain portable careers.”\textsuperscript{86} In Virginia, a retreat for recovering service members and their families is planned, where they can vacation, partake in therapy and recreational activities, rest and heal.\textsuperscript{87}

Employing early interventions for sick or injured veterans might also reduce some administrative costs of managing their long-term care needs. Additionally, many strategies proposed to mitigate direct medical costs may reduce or offset indirect costs; however, some intangible, nonreimbursable costs will continue to burden military families. Beyond the scope of this article, other factors can or potentially will influence the future medical costs of today’s veterans, but are harder to predict, and not all have defined mitigating actions. These may include, but are not limited to, the length of the conflict; a “young” military, with higher lifetime medical costs; the increasing American lifespan; changing political climate and policies; TRICARE and other third-party payer policies; and evolving medical technologies.

**DISCUSSION**

This article presents some unique contributions and themes that have not previously been covered in other published articles on the costs of war.\textsuperscript{4,6,11–13} Although long-term costs have been discussed in the policy realm, the speakers and authors have mainly been economists and policy experts—not medical experts, planners, or clinical providers in the medical domain who can actually put preventative strategies into place. The most recent articles did not typically discuss medical interventions or nuances, and we believe this article offers a singular perspective with suggested preventative medical strategies to reduce the costs of war.
Much of the current discussion on costs of war focuses on the primary injury costs, such as the costs of a leg amputation, prosthesis, or IED injury. Other articles have not focused, as ours does, on the secondary and tertiary consequences of the original illness or disability (Fig. 1). Many authors have not fully considered or examined the practical costs of such second and third degree comorbidities that will ultimately result from today’s acute issues.

One limitation of this work is that we list costs qualitatively rather than quantitatively. As previously mentioned, long-term estimates of the costs of war are highly challenging; hence, we chose to classify medical costs qualitatively and target cost categories for which clinical interventions exist that have been shown cost-effective. Also, since there are inherent challenges in implementing any preventive strategies to mitigate care costs—especially in an environment of fiscal budgetary constraint, decreased defense spending, and prioritizing limited medical resources—any new health technologies and interventions should be evaluated for their economic outcomes.

Several proposed interventions (Table III) have been validated and tested to reduce actual care costs. Injury-prevention technologies like improved body armor did reduce deaths in OIF and OEF; if this were not so, we would have a lower ratio of wounded:dead, more like that of Vietnam (Table I). Weight control has been shown to reduce or eliminate amputation comorbidities like diabetes, high blood pressure, heart disease, and morbid obesity. Lehnert et al.88 reviewed 41 obesity-prevention interventions for long-term (40+ years) economic effectiveness and found that the greatest cost savings came from interventions that promoted healthy eating and/or physical activity by modifying a target population’s environment through regulatory or fiscal measures (e.g., taxes or subsides on certain foods, distribution of educational information, mandatory nutrition labeling, etc.). Saha et al.89 found that lifestyle interventions for preventing diabetes and cardiovascular disease were cost-effective (notably, diabetes screening and prevention programs, childhood obesity prevention, and community-based programs). Treatments for stopping smoking and drug abuse (which commonly accompany PTSD) have been demonstrated to reduce long-term comorbidities like lung cancer, liver failure, etc. Kahende et al.90 reviewed economic evaluations of tobacco control programs and found that “in almost every case… tobacco control programs and policies are either cost-saving or highly cost-effective.” Popova et al.91 reviewed cost–benefit analyses of alcohol dependence (AD) treatments and also found that “Most of the available treatment options for AD appear to produce marked economic benefits.” Treating PTSD patients and amputees with lifestyle interventions should thus reduce the incidence of secondary and tertiary complications, and the associated long-term costs.

CONCLUSION

Improvements in technology and health care delivery have significantly increased veterans’ survival from grievous war wounds. Although media coverage of the Iraq and Afghanistan conflicts has focused on IED injuries or PTSD, little attention has been given to how such war injuries will impact the long-term health of these young veterans. Some will face life with PTSD or TBI and others will adjust to a lifetime without limbs, eyesight, or even a normal face. Many will develop comorbid conditions that exacerbate an original illness or injury. Veterans with polytraumatic injuries will need long-term rehabilitation, job retraining, and support for daily life activities.

For polytraumatic injuries, improving assistance to young amputees during the critical period in which they are developing coping skills may foster independence and reduce both patient need and societal cost in the longer term. PTSD and TBI patients will need support to return to active service, if possible, and to avoid comorbidities. We recommend addressing veterans’ mental-health and neurological needs via a new paradigm for health care delivery—one that includes outreach, education, early detection, lifestyle interventions, and more accurate postdeployment diagnosis and treatment by skilled providers in primary-care clinics—to improve mental and physical health outcomes and contain costs.

Despite resource constraints, VA and other groups are spearheading improvements that support veterans’ care. The 2010 IOM report noted that VA has opened more vet centers.2 Linda Bilmes’ 2010 testimony12 noted that VA has “expanded the Benefits Delivery at Discharge (BDD) program and Quick Start, … liberalized the PTSD stressor definition, increased … benefits and outreach, provided five years of free healthcare … and is … restoring medical care to 500,000 moderate-income “Category 8” veterans. VA has also hired more medical and claims personnel, [and] invested heavily in IT upgrades to the claims processing system.” She then noted that, “All of these factors contribute to the rising cost estimates.”

Our suggestion for mitigating costs is to work “above the line” and prioritize initiatives that would help maintain primary mobility, functionality and physical activity for amputees, and support rehabilitation for PTSD or TBI so that the wounded veteran could work productively and engage in society (Fig. 1). We should help an amputee to reduce his cholesterol and maintain his weight at age 30 to 40, rather than treating his coronary artery disease or diabetes at age 50. If we treat a veteran’s PTSD at age 21, with counseling and lifestyle interventions, we may help her to reduce suicidal thoughts and avoid the abuse of tobacco or alcohol. This will save us from having to fund her treatment for chronic obstructive pulmonary disease or alcoholic liver disease in 2035.

Looking forward, we should use outcomes research and real-time epidemiology to track our veterans’ progress through the health care system, and guide our therapies and preventative strategies. For example, a 30-year-old soldier who had a profound injury in 2001 is now over 40—we
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should ask, are lifestyle interventions working? If so, which ones? The correct answers for today may be different than the answers in 2035—when improved outcomes, techniques, and technologies will guide our planning and funding of veterans’ health care.

This article’s goal has been to highlight the medical costs of war—specifically, the long-term secondary and tertiary costs of care that may result from the primary injuries of our current young veterans—and to suggest prevention and treatment measures that may mitigate such costs for these wounded warriors, their families, and support systems such as VA and TRICARE. We hope that an open discussion might ensue in the military and medical communities regarding how to strategically care for veterans of the current wars in a sustainable manner through 2035 and beyond. Support for veterans’ long-term care will require the same diligence, perseverance, research, innovative thinking, and funding that we currently apply to the acute medical issues facing our servicemen and women. Strategizing preventive measures now may improve clinical and social outcomes for our wounded warriors and mitigate the potentially enormous cost burden of their future health care.

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