A Review of Military Health Research Using a Social–Ecological Framework

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Abstract

Objective: We aim to contextualize the growing body of research on the sequelae of military service in the wars in Afghanistan and Iraq. We employ a social–ecological (SE) framework for the taxonomy of military health research and classify risk as arising from the individual, family, community, and the institutional levels. We intend for this review to inform enhanced health promotion efforts in military communities.

Data Source: Articles reviewed were extracted from Web of Science, PubMed, and Scopus.

Inclusion and Exclusion Criteria: Research focused on somatic and psychological sequelae of combat deployment published from 2001—the year the war in Afghanistan began—through the end of 2014. We excluded studies of non-US military personnel, other systematic reviews, meta-analyses, book chapters, and theoretical papers.

Data Extraction: We examined and summarized the aims, participants, methods, study design, SE framework tier, risk factors, and health outcomes.

Data Synthesis: Studies were categorized according to SE tier, whether they focused on somatic, behavioral, or psychological outcomes, and by risk factor.

Results: Of the 352 peer-reviewed papers, 84% focused on war’s sequelae on the index military personnel, and 75% focused on mental or behavioral health outcomes—mostly on post-traumatic stress disorder. We find comparatively little research focusing on the family, community, or institutional tiers.

Conclusions: We know relatively little about how family and community respond to the return of personnel from combat deployment; how family resources affect the health of returning military personnel; and how a war’s persistence presents challenges for federal, state, and local agencies to meet military health-care needs. Such work is especially salient as US troops return home from war—particularly in communities where there are substantial military populations.

Keywords

military, health, iraq, afghanistan, social ecology, veterans

Objective

War exacts a heavy health burden. Since the onset of the wars in Afghanistan in 2001 and Iraq in 2003, researchers have focused on armed conflict’s acute and long-term health consequences. For American scholars, this work concentrates on US military personnel who have served in the wars in Afghanistan and Iraq, Operation Enduring Freedom (OEF) and Operation Iraqi Freedom (OIF), respectively. The growing body of research has resulted in a greater accounting of the psychological and somatic toll of combat service.

War, however, affects not only the health of military personnel. Shortly after the 2009 shootings at Fort Hood in Texas by an Army psychiatrist, the New York Times published a story about Killeen, a nearby military town where the gunman lived. A spate of killings occurred in Killeen by soldiers who had returned from the war zones. According to the writer, domestic violence had increased by 75% compared to previous years and violent crime rose by 22%.1 This press report underscores the possibility that the well-being of service members, veterans, their families, and their communities all could be affected by war’s toll.

Health professionals hoping to contribute to military health may be unaware of its breadth, especially given the field’s multidisciplinary contributions. To assist with contextualizing the work, we provide a taxonomy and review of research examining psychological and somatic health in US military personnel who have served in OEF or OIF. We intend for this

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Public health professionals have employed the SE framework to classify predictors of health as arising from the SE framework’s multiple tiers: the individual, family, community, and the institutional. In describing SE, Catalano\(^2\) identifies the role of a perturbation, or outside agent, in transforming or upsetting an ecosystem—defined as a complex network of dynamic components that coexist, ideally achieving equilibrium. These outside agents may impede health or well-being in military communities by upsetting the ecosystem at any or all of the 4 SE tiers. Our basic assumption is that military exposure to war perturbs the entire SE system in that it threatens an individual service member’s well-being as well as the equilibrium of his or her network of coexisting components: family, social, and community networks, and institutions designed to protect national security or provide health care. We acknowledge that military personnel “expect” the war perturbation. However, understanding the nature of the perturbations and its influence across all SE tiers—not just the individual—may inform our approaches to health promotion.

Public health scholars routinely use the SE framework—in preference over individual determinants of health—to explain health risks and outcomes.\(^5,7\) based on the theory that the social environment (e.g., both family and community) influences individual health behaviors and outcomes. The SE model also posits that the 4 tiers interact and reciprocally influence one another.\(^4\) Public health professionals have employed the SE framework to examine risk factors and to design interventions for an array of public health problems.\(^5-7\) Moreover, public health professionals have employed the SE framework as a tool for health promotion, communication, and intervention by focusing on how the dynamic interplay among the tiers influences outcomes and informs interventions. The renowned Ottawa Charter for Health Promotion, for example, identified the complex roles of the SE tiers in meeting the goals for global public health.\(^8\)

Kohrt and colleagues\(^9\) used 3 of the SE framework’s tiers to study the well-being of Nepalese child soldiers after their country’s civil war. They found that individual-level traumatic exposures (e.g., torture), gender, education, and caste predicted the severity of psychological outcomes and that socioeconomic and family functioning mediated those outcomes. Community-level factors, such as attitudes toward the returning child soldiers, also predicted psychological health and their ease of reintegrating into their communities.

Just as Kohrt and colleagues\(^9\) used the SE framework to study and restore the health of Nepalese child soldiers, we use the SE framework to review the literature on US military health. Two other reviews\(^10,11\) apply the SE perspective to their discussion of military family health. Paley and colleagues\(^11\) use the family systems and SE perspective to describe the interdependence of the health of individual service members, their family members, and the well-being of the family unit. They also note the contribution of social support and identify a lack of clinical resources available to military families. Paris and colleagues\(^10\) apply both systems and family attachment theories to discuss how the broader culture and belief systems may influence a child’s well-being. Both reviews address institutional barriers to mental health services for military families. However, these reviews focus specifically on outcomes at SE’s family tier. We, in contrast, examine studies at each of the 4 SE tiers, going beyond the family or individual tiers. We know of no other literature review that applies the SE framework to review studies at all SE tiers. We identify gaps in the literature and contextualize the body of military health research focusing on the health consequences of the US wars in Afghanistan and Iraq.

**Methods**

**Data Source**

We conducted a Web of Science search for somatic and psychological sequelae of combat deployment of US military personnel published from 2001—the year the war in Afghanistan began—through the end of 2014, using the syntax (“Mental Health” OR Health) AND Deploy* AND Military AND combat (Afghanistan OR Iraq). The query yielded 598 results. Two additional searches of PubMed and SCOPUS using the same search terms yielded 54 and 436 results, respectively. After excluding 375 duplicates, we added 5 papers that the lead author deemed salient (see Figure 1 for the Preferred Reporting Items for Systematic Reviews and Meta-Analyses [PRISMA] study flow diagram and Online Appendix A for the PRISMA checklist). We also searched the Cochrane database but found no additional sources (see Online Appendix B for additional details about our database searches).

We did not register our study with PROSPERO or a similar registration system since we do not classify our manuscript as a systematic review. We made this decision because our topic is rather general (specific clinical or other health questions), we made no attempt to provide a quantitative synthesis of results, and we did not exhaustively search all databases. We, moreover, view our contribution primarily as providing an overview and organizational taxonomy of military health research within the SE framework.

**Inclusion and Exclusion Criteria**

We excluded literature and research that did not focus exclusively on US military personnel (including their families, communities, or institutions), book chapters, other systematic reviews, and theoretical papers. Three hundred fifty-two papers comprised the final body of literature reviewed (see Online Appendix C).

**Data Extraction**

The lead author examined the abstracts of all papers to determine the eligibility for inclusion. During the second phase of
Data extraction, the lead author recorded study populations, sample sizes, study designs, data sources, predictors, measures, health outcomes, and analytic strategies. The lead author then classified the papers according to the SE framework tier and further classified the papers within the tiers according to the primary outcomes of the study (e.g., post-traumatic stress disorder [PTSD], anxiety, physical health, and specific physical health problem). Next, we noted the predictors for those outcomes that were examined.

Data Synthesis

The lead author read the full text of the articles, identifying whether studies focused on somatic, behavioral, psychological outcomes, or comorbidities. Articles within each of the SE tiers were then classified according to health outcomes and predictors.

Quality Assessment

To assess the quality of the papers for the studies that were not qualitative, we devised a checklist that included (1) use of a control or comparison group; (2) use of measurements at more than 1 time point; (3) attempt to control for confounding, such as covariate control, or other statistical adjustment; and (4) exposure assessment using a reliable or validated measure other than self-report. We gave each paper 1 point for each of the checklist items, with a maximum score of 4, and subsequently calculated a mean score for the papers at each SE tier (see Table 1).

For the 20 qualitative studies we reviewed, our measures of quality included use of multiple coders to reach consensus on the final themes, a sample size based on the qualitative research standard of data saturation, use of a systematic sampling strategy rather than convenience sampling, and use of predominantly open-ended questions (intended to elicit more detailed, narrative responses) rather than closed-ended questions (can be answered in a few words or with “yes” or “no”). One hundred percent of the qualitative studies used multiple coders, 80% had justified sample sizes, 85% used systematic sampling strategies, and 25% asked predominantly open-ended questions.

Results

Defining Terms

Table 2 demonstrates our definition of terms used in discussing our results.

Overview of Results

In order to promote data transparency and openness in accordance with Transparency and Openness Promotion...
Table 1. Quality Measures of Papers Reviewed at Each Tier.\textsuperscript{a}

<table>
<thead>
<tr>
<th>Tier</th>
<th>Use of Multiple Time Points</th>
<th>Control or Comparison Group</th>
<th>Control for Confounders or Other Statistical Adjustment</th>
<th>Use of Validated Measures or Exposure Assessment</th>
<th>Mean Score (Out of 4)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Individual (n = 281)</td>
<td>42.70%</td>
<td>48.30%</td>
<td>81.40%</td>
<td>95.40%</td>
<td>2.64</td>
</tr>
<tr>
<td>Family (n = 26)</td>
<td>42.30%</td>
<td>38.50%</td>
<td>84.60%</td>
<td>96.20%</td>
<td>2.65</td>
</tr>
<tr>
<td>Community (n = 5)</td>
<td>20%</td>
<td>20%</td>
<td>40%</td>
<td>60%</td>
<td>1.4</td>
</tr>
<tr>
<td>Institution (n = 20)</td>
<td>40%</td>
<td>45%</td>
<td>30%</td>
<td>85%</td>
<td>2.05</td>
</tr>
</tbody>
</table>

\textsuperscript{a}Figures do not include qualitative studies.

Table 2. Explanation of Terms Used in Discussion of Results.

<table>
<thead>
<tr>
<th>Term</th>
<th>Explanation</th>
</tr>
</thead>
<tbody>
<tr>
<td>Combat deployed</td>
<td>Military personnel who have been deployed to either Iraq or Afghanistan. In military parlance, “deployed” refers to working somewhere other than a home base, and personnel can be deployed to any country, or within the United States. For the purposes of our discussion, an individual is not “combat deployed” if the deployment did not involve working in a combat zone, engaging in actual combat, or supporting combat operations.</td>
</tr>
<tr>
<td>Combat exposure or combat stressors</td>
<td>Exposures or stressors experienced as part of a group being fired upon, having fired upon opposing forces, or on missions in combat zones.</td>
</tr>
<tr>
<td>Deployment stressors</td>
<td>Extracurricular (non-combat) stressors experienced during combat deployment including family concerns, lack of respite, concern over unit cohesion, and other matters that can exacerbate the pressures of combat.</td>
</tr>
</tbody>
</table>

guidelines, in addition to providing the syntax for our searches as stated previously, the results of our data search, and our summary table of the articles, are available upon request to other researchers who are interested in replicating our findings.

Figure 2 provides the SE taxonomy for the body of research from 2001 to 2014. Of the 352 peer-reviewed papers, 75\% (n = 303) included research on mental health, behavioral health, or both. Eighty-four percent (n = 294) focused on health at the individual tier (see Figure 3). Much of the literature describes the association between increased combat exposure or deployment stressors and elevated levels of PTSD in combat-deployed US military personnel, or their families. Researchers have also explored the etiology and comorbidities of traumatic brain injury (TBI), an injury that has been labeled the signature wound of the war, and morbidities associated with war-zone exposures to pathogens or environmental toxins.

Increasingly, research identifies the ripple effect of war on US military families. More than 1.8 million US military personnel have deployed to combat since 2001, and about one-third of them have deployed multiple times. Over 50\% of those who have served in Iraq and Afghanistan are married and more than 700 000 of the 1.2 million military children have seen one or both of their parents head to a war zone. Research finds a positive correlation between the number of combat deployments and adverse mental health not only in those who have been combat deployed but also in their families.

Social–Ecological Tier 1: Individual

At the individual tier, a majority (63\%) of papers focus on mental health (largely on PTSD), 20\% on physical health, and 17\% on behavioral health (i.e., smoking or alcohol use; see Online Appendix C). Although most studies seek to understand war’s health risks, researchers have also assessed the effectiveness of interventions and trends in health-care access or symptom reporting.

Hoge and colleagues wrote the earliest paper found in this search. The authors administered anonymous surveys to 2530 US soldiers and marines prior to deployment and 3671 after they returned. Their results—that 17\% of the participants had elevated prevalence of major depression, PTSD, and generalized anxiety disorder after returning from combat deployment to Iraq—have been replicated in other studies. Hoge and colleagues also found that fewer than half of the troops with psychological disorders actually sought care.

Individual-level risk factors. At the individual level, the primary predictors of adverse health studied include combat exposure, the number of combat deployments, gender, non-combat deployment stressors, and war-zone environmental exposures. In addition, stigma has been the primary predictor in studies of troops’ help-seeking and reporting of symptoms.

Combat exposure, the most studied individual-level predictor during OIF and OEF, has been assessed using a variety of measures. Hoge et al inquired about experiences such as “handling or uncovering human remains,” “had a buddy shot or hit who was near you,” or “receiving incoming artillery, rocket, or mortar fire.” Kolkow and colleagues also asked whether troops had experienced “fear of death” or “fear of exposure to biological or chemical weapons.”

This research found that combat exposure predicts PTSD, alcohol abuse, depression, anxiety, physical aggression, antisocial behavior, worse general physical health, hypertension, TBI, and suicidal ideation. The association with suicidal ideation can be indirect through PTSD symptoms and unit cohesion can reduce suicidal ideation.
Moreover, Bagnell and colleagues found that combat specialists were less likely to experience adverse outcomes, possibly because they are better prepared mentally and physically for combat. Several studies specifically examined the effects of the act of killing someone and found that killing in combat increased the risk of alcohol misuse, although, Russell et al found an inverse relationship when comparing pre-deployment and post-deployment drinking patterns.

Researchers found that the number of deployments predicts adverse mental health, trauma symptoms, weight loss in women. The association with post-traumatic stress may be mediated by homefront stressors, and the length of time between deployments has a negative association with PTSD. On the other hand, van Zuiden and colleagues found no association between the number of previous deployments and PTSD symptoms in National Guard soldiers who had deployed to Afghanistan. Researchers found that stigma associated with mental health diagnoses in combat-exposed troops prevented them from seeking necessary care.

In addition to finding that exposure to war predicts adverse mental health, studies have found that mental or behavioral health disorders themselves may predict poor psychosocial or physical health. Post-traumatic stress disorder and depression were associated with increased alcohol misuse and suicidal ideation. Guerra and Calhoun found specifically that PTSD’s numbing symptom cluster predicted suicidal ideation. Poor mental health may also predict initiation of smokeless tobacco use. Moreover, PTSD predicts physical health ailments such as musculoskeletal disease, hypertension, digestive disorders, diabetes, and coronary heart disease. The role of gender appears complex. Female gender predicted higher levels of pre-deployment stressors and sexual stressors during combat deployment, pre- and post-deployment post-traumatic stress symptoms, greater severity of postcombat deployment PTSD and depression, lack of improvement in PTSD symptoms following...
treatment, and reintegration stress. Other research found that female gender strengthened the association between physical injury and PTSD, that female gender predicted lower levels of alcohol abuse, but that gender did not mediate the association between PTSD and alcohol use. Although ample research has explored combat deployment’s deleterious effects, some research found that non-combat deployment stressors and other war-zone exposures were stronger risks for adverse mental health. Moreover, deployment stressors may correlate positively with adverse mental health and suicidal ideation, and were stronger risks for those outcomes than the number or duration of combat deployments. In addition, war-zone environmental exposures, particularly to burn pits used for waste disposal, can be risks for adverse respiratory health, and rheumatoid arthritis.

**Intervention and prevention studies.** Thirty-four studies at the individual level focused on treatments, intervention, or prevention measures. Studies examined a wide range of treatments, including a comparison of the use of medication to the use of virtual reality exposure for the treatment of PTSD, techniques for minimizing anxiety, and use of acupuncture in the combat zone to alleviate pain. In addition, Warner and colleagues found that using a suicide prevention program throughout a US Army division’s 15-month deployment to Iraq may have reduced its suicide rate.

**Study designs.** Many of the studies had sample sizes of more than 1000. In some cases, they involved secondary data analyses of ongoing longitudinal studies or electronic records. Other researchers surveyed large numbers of military personnel; 46.2% (n = 136) of the studies at the individual level included controls or comparison groups. Many of the papers that did not have control or comparison groups were longitudinal in design and thus were able to establish temporal order. The lack of a comparison or control group, however, remains a weakness of these studies. Moreover, the abundance of cross-sectional studies is also a limitation of this research.

Early studies estimated the prevalence and incidence of health outcomes in troops after deployment. More recently, researchers have included analyses of exposures in addition to combat exposure, including other deployment stressors, pre-deployment stressors, and pre-enlistment risks. Some research has explored comorbidities such as that of PTSD and TBI, or the use of alcohol by military personnel who have sustained a TBI.

**Social–Ecological Tier 2: Family**

All studies of military families found in this search focused on psychological or behavioral health. Earlier in this article, we discussed the concept of war and its associated health outcomes in military personnel as a perturbation, with the potential to alter the family ecosystem’s balance. The small body of research on military families illuminates this concept.

Specific outcomes studied include the mental health of non-deployed spouses during combat deployment, children’s behavioral outcomes, parenting challenges for returning deployers, and spousal or partner relationships. The most common predictors studied are combat deployment of a parent or spouse, the psychological health of the non-deployed parent, the psychological health of the returned deployer, and relationship functioning (spousal or unmarried partner).

Spousal deployment correlates positively with the prevalence of anxiety, global distress, and depression, and the length of deployment increases the incidence of depression and sleep disorders in non-deployed spouses. Mansfield and colleagues found that multiple deployments strengthened those associations when they explored the medical records of 250 626 deployed persons and their spouses. Nondeployed wives also sought mental health services at an increased rate when their husbands were gone. Moreover, Lester and colleagues found that a nondeployed parents’ depression predicted children’s depression, that depression, anxiety, and PTSD were associated with externalizing and internalizing behaviors, and that length of deployments moderated the associations.

Combat deployment not only predicts adverse outcomes in spouses but also poor mental and behavioral health in children of the military. Lester and colleagues compared mental health outcomes and levels of externalizing and internalizing behavior in children whose parents were combat deployed to those outcomes and behaviors in military children whose parents did not deploy, and also to civilians in the surrounding community. Their results suggest that anxiety in military children who had a deployed parent was significantly elevated relative to the other 2 groups. Moreover, girls with currently deployed fathers showed elevated externalizing behaviors compared to those whose fathers returned. The authors suggested that anxiety in military children may be due to a child’s knowledge that deployment may occur again. Moreover, these multiple separations occur during some children’s key developmental stages.

Poor health in returning troops may adversely impact the well-being of their families. Cozza et al found that children’s distress levels increased if their deployed parent returned home with an injury sustained during deployment, but that the level of distress was moderated by how much the injury created family disruption. Research has also found that PTSD can negatively impact parenting and relationships with children. Fathers returning from combat deployment have identified parenting challenges, including reestablishing relationships with their children, adjusting to the difference between the structured military environment and a less structured home life, and controlling their tempers in stressful situations. Other researchers have found PTSD status in the returning service member can be a risk for intimate partner violence and reduced couple satisfaction. Moreover, the perception of a deployed person’s PTSD symptoms (regardless of actual symptoms) influences spousal mental health and couple satisfaction, but spousal perceptions of combat intensity may moderate the association.
Studies that examine both the individual and family tiers. Some research has explored the reciprocal relationship between individual and family functioning. Milliken et al. focused on individual outcomes in military personnel, but measured the degree to which family problems influenced those outcomes. Likewise, Gewirtz and colleagues compared mental health and family functioning outcomes in women who had deployed to the same outcomes in women whose spouses or partners were the deployers. Deployed women reported more conflicts with their partners about parenting and had greater PTSD and depression severity compared to those who were spouses of deployers. Skopp and colleagues found that if female troops had experienced higher levels of combat, the quality of their intimate relationships may predict their PTSD symptom severity—an association that is stronger for females than for their male counterparts.

Social–Ecological Tier 3: Community
The literature suggests that when troops bring home the burden of war to their families, this event perturbs the family ecosystem. It remains unknown, however, how health of the community ecosystem may respond. As shown in Figure 2, only 1.4% of papers in our search focus on the role of the community in the aftermath of war. This research examines the challenges facing civilian healthcare providers treating patients who served in the wars and community reintegration strategies for service members.

Scant empirical research examines the role of war’s impact on community health or the community’s role in the health of military personnel when they return home. Other than reports from advocacy groups quantifying the number of homeless who are veterans of the current wars or reports about backlogs at Department of Veterans Affairs, we know of little data about what kind of burden communities bear. We do not know whether the level of community violence rises with the incidence of PTSD in returning troops, other than anecdotal reports we read in the media such as the 2009 shootings at an Army psychiatrist at Fort Hood, Texas, or a recent shooting in Colorado by a former army sniper. We know little about whether adolescents whose parents have deployed or come home troubled perpetrate community crime or disruptions in schools. We know little about whether the wars in Iraq and Afghanistan war will play a role in the future prevalence of chronic disease. Just as Kohrt et al. identified the role of communities in predicting health outcomes in child soldiers in Nepal, future research should seek to quantify the role of communities in health outcomes in US troops who have served in OEF or OIF.

Social–Ecological Tier 4: The Institutional Level
The 20 papers found at the institutional tier focused on how combat deployments affect military institutional capacity, warzone health care, and the efficiency or capacity of military medical facilities.

The decisions by military personnel of whether or not to re-enlist are an important factor in predicting military capacity. Unit support (cohesion), pre-deployment depression, and perception of danger during deployment predicted the intention of National Guard members to re-enlist. Level of pre-deployment introversion and post-deployment stressors also predicted female National Guard members’ re-enlistment.

Innovations in war-zone medical care have reduced casualty rates and complications. Kotwal and colleagues found using new guidelines lowered battlefield casualty rates compared to general Department of Defense rates. Training medical personnel to act more as a team was found to decrease communication-related errors, and use of vigorous infection control procedures has been found to minimize rates of ventilator-associated pneumonia in an Air Force hospital in Iraq.

In contrast to the trends in research at the individual or family tiers, the majority (75%) of institutional research focused on physical health. Research has included surveillance studies of rates of infection, orthopedic injuries, environmental contamination and bacteria, screening, and medical personnel training procedures. In light of the preponderance of research quantifying the high rates of PTSD and other psychological disorders among the current generation of military personnel and veterans, research assessing the increased use of Veterans Affairs (VA) mental health services is particularly salient. Moreover, as deployments to Iraq and Afghanistan have wound down, we have seen an abundance of media coverage about weaknesses in the Department of Veterans Affairs capacity to manage the mental health-care workload resulting from OIF and OEF. However, little empirical research has focused on these challenges or quantified the burden of mental health care on the institutions charged with caring for the military community after combat deployment.

Conclusions
Our narrative review of health outcomes associated with the wars in Iraq and Afghanistan summarizes key areas of convergence at the level of combat personnel, while also highlighting relatively unexplored areas of research. The burden of the fighting is borne most heavily by those who are deployed into combat. For this reason, the research emphasizes war’s toll at the individual tier. However, even at the individual tier, we see a paucity of research about the physical health consequences of war compared to the abundance of research focusing on mental or behavioral health, and a lack of research exploring how military rank or demographic factors such as age and socioeconomic status may influence health. If we are to fully understand how we can promote the long-term health of veterans who have served in combat, future research should examine chronic diseases as well as mitigating sociodemographic factors.

The influence of gender on health outcomes in deployed military personnel is another underexplored research domain. A substantial majority of research focused on male veterans or, at minimum, has not been gender-specific, thus leaving gaps in the research exploring the association of gender with health outcomes or if combat deployment uniquely impacts women. Men comprise the vast majority of service members and it is
reasonable that their health outcomes have been the primary focus. However, within the SE framework, women’s health takes on greater significance, because women still play the primary childrearing role, and thus their health—more than that of men—is crucial to maintaining the equilibrium of the family ecosystem. Fortunately, the pace of research focusing on the health of women deployed to war zones has increased considerably in the past 5 years.

As our SE taxonomy elucidates, there is a paucity of research at the family, community, and institutional levels. Future studies may better inform health promotion efforts by focusing more on these levels, as well as on the interplay of the individual and family levels. Such work would inform specific approaches to maximize the health of our military communities and minimize future health risks. At the family level, one key area of inquiry involves understanding how a family’s mental and behavioral health can influence the reintegration and mental health of the returning service member. Research at the family, community, and institutional tiers is especially salient as US troops return home from war to their families and communities.

Whereas we applied a SE framework that addresses 4 distinct tiers, this taxonomy necessarily oversimplifies Bronfenbrenner’s classic ecological model of human development. For instance, Bronfenbrenner describes an exosystem that is comprised of local resources such as economic opportunities, social services, and neighborhood organizations. In addition, Bronfenbrenner’s macrosystem includes the influence of public policies, culture, and political institutions on individual health. All the ecological model’s tiers operate within the context of the physical environment, the individual’s life stage, and the epoch in which the individual is embedded. Furthermore, the ecological model’s levels can interact in various ways (e.g., reciprocity, mutual reinforcement, antagonism).

As Bronfenbrenner’s ecological model relates to the SE of war, many research areas remain open for inquiry. For instance, increased generosity of political institutions in researching specific wartime exposures that cause morbidity, or increased willingness to fund the US Department of Veteran’s Affairs, could destigmatize the morbidity of veterans and yield more effective health interventions. Furthermore, the political and cultural climate toward returning veterans, both at the federal and neighborhood level, may improve the ability of veterans to socially reintegrate into civilian life. We encourage further inquiry on these and other exosystem and macrosystem factors that, while not classified explicitly in our SE taxonomy, may exert an important influence on the health of combat veterans.

We do not categorize research that examines indirect influences of war on health. For example, federal spending on wars may reduce funding on system-level factors (e.g., supporting national economy), which in turn could adversely affect population health. The true costs of war cannot be measured until decades after the battles end, because the long-term health effects pose long-term budget challenges. This may be true especially for the current generation of veterans whose VA healthcare utilization and disability benefits are greater than those of previous generations. Our taxonomy, therefore, is limited in its focus on the “direct effects” of war on health, and not indirect health pathways. Finally, although our conclusions pertain to the 352 papers pulled from 3 different databases, we recognize that our search may have overlooked published papers that may have resulted from a search of additional databases.

Future research should explore how community response influences the health of troops returning home. Because the United States has an all-volunteer military, only 1% of the public has served in the military since the wars began. Thus, after the crowds greeting returning troops dissipate, future work could evaluate troop reintegration into a community largely disengaged from their war experiences. Moreover, qualitative research can explore how combat personnel perceive the reintegration process and whether their perspective impacts any sense of isolation or alienation. We also noted a gap in research exploring whether greater community engagement and other community factors may contribute to healing and minimize adverse outcomes such as aggression or gun violence.

New research in this field may identify war’s effect on community health and institutional capacity. As the 2009 shooting at Fort Hood in Texas makes clear, community health promotion efforts—especially in military communities such as Killeen—may serve as an important area for future health promotion. The military town of Killeen, moreover, may serve as a case study for the SE framework of war’s health consequences and how the interplay of the framework’s tiers influences community violence—a critical public health issue. Absent empirical research, however, we are left only with anecdotes such as those about Killeen. A remaining issue the SE

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**SO WHAT?**

**What is already known on this topic?**

The wars in Iraq and Afghanistan exact a heavy toll on service members and veterans who have served in war zones—particularly psychologically. High rates of PTSD, TBI, and suicide have been reported.

**What this review adds to the body of knowledge?**

This review is the first to use a social–ecological framework to examine the health effects of war, to clarify the need to focus future inquiry not only on adverse outcomes in the individuals who serve in combat zones but also on how war affects families, communities, and institutions.

**Implications for health promotion practice or research?**

If we are to heal the wounds of war and mitigate the toll of future conflicts, health promotion practitioners, clinicians, and researchers must appreciate how the cascading effects of war ripple through US military families, communities, and institutions.
framework identifies how we can understand OIF and OEF’s impact on the ability to enhance military health care at the institutional level and how characteristics of institutions or public policy can influence the health of military personnel. When war ends, the battle begins for many of those who have been combat deployed. As the wars in Iraq and Afghanistan have wound down, public commentary has predicted trillions of dollars in savings. However, rigorous accounting dictates that researchers assess the social and health costs, across all 4 SE tiers of these wars to inform proper allocation of public health resources to heal the wounds of war.

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