



Evidence Review: Social Determinants of Health for Veterans

September 2017

Prepared for:

Department of Veterans Affairs
Veterans Health Administration
Quality Enhancement Research Initiative
Health Services Research & Development Service
Washington, DC 20420

Prepared by:

Evidence-based Synthesis Program (ESP) Center
Minneapolis VA Health Care System
Minneapolis, MN
Timothy J. Wilt, MD, MPH, Director

Investigators:

Principal Investigator:

Wei (Denise) Duan-Porter, MD, PhD

Co-Investigators:

Brian C. Martinson, PhD
Brent Taylor, PhD

Research Associates:

Samuel Falde, BS
Kristen Gnan, MPH
Nancy Greer, PhD
Roderick MacDonald, MS
Lauren McKenzie, MPH
Christina Rosebush, MPH



PREFACE

The VA Evidence-based Synthesis Program (ESP) was established in 2007 to provide timely and accurate syntheses of targeted healthcare topics of particular importance to clinicians, managers, and policymakers as they work to improve the health and healthcare of Veterans. QUERI provides funding for four ESP Centers, and each Center has an active University affiliation. Center Directors are recognized leaders in the field of evidence synthesis with close ties to the AHRQ Evidence-based Practice Centers. The ESP is governed by a Steering Committee comprised of participants from VHA Policy, Program, and Operations Offices, VISN leadership, field-based investigators, and others as designated appropriate by QUERI/HSR&D.

The ESP Centers generate evidence syntheses on important clinical practice topics. These reports help:

- Develop clinical policies informed by evidence;
- Implement effective services to improve patient outcomes and to support VA clinical practice guidelines and performance measures; and
- Set the direction for future research to address gaps in clinical knowledge.

The ESP disseminates these reports throughout VA and in the published literature; some evidence syntheses have informed the clinical guidelines of large professional organizations.

The ESP Coordinating Center (ESP CC), located in Portland, Oregon, was created in 2009 to expand the capacity of QUERI/HSR&D and is charged with oversight of national ESP program operations, program development and evaluation, and dissemination efforts. The ESP CC establishes standard operating procedures for the production of evidence synthesis reports; facilitates a national topic nomination, prioritization, and selection process; manages the research portfolio of each Center; facilitates editorial review processes; ensures methodological consistency and quality of products; produces “rapid response evidence briefs” at the request of VHA senior leadership; collaborates with HSR&D Center for Information Dissemination and Education Resources (CIDER) to develop a national dissemination strategy for all ESP products; and interfaces with stakeholders to effectively engage the program.

Comments on this evidence report are welcome and can be sent to Nicole Floyd, ESP CC Program Manager, at Nicole.Floyd@va.gov.

Recommended citation: Duan-Porter W, Martinson BC, Taylor B, Falde S, Gnan K, Greer N, MacDonald R, McKenzie L, Rosebush C, Wilt TJ. Evidence Review: Social Determinants of Health for Veterans. VA ESP Project #09-009; 2017.

This report is based on research conducted by the Evidence-based Synthesis Program (ESP) Center located at the **Minneapolis VA Health Care System, Minneapolis, MN**, funded by the Department of Veterans Affairs, Veterans Health Administration, Office of Research and Development, Quality Enhancement Research Initiative. The findings and conclusions in this document are those of the author(s) who are responsible for its contents; the findings and conclusions do not necessarily represent the views of the Department of Veterans Affairs or the United States government. Therefore, no statement in this article should be construed as an official position of the Department of Veterans Affairs. No investigators have any affiliations or financial involvement (eg, employment, consultancies, honoraria, stock ownership or options, expert testimony, grants or patents received or pending, or royalties) that conflict with material presented in the report.

TABLE OF CONTENTS

Executive Summary	1
Introduction.....	1
Methods.....	2
Development of Conceptual and Analytic Frameworks	2
Data Sources and Searches	2
Study Selection	2
Data Abstraction and Quality Assessment.....	3
Data Synthesis and Analysis.....	3
Results.....	4
Results of Literature Search.....	4
Summary of Results for Key Questions.....	4
Discussion	6
Key Findings.....	6
Applicability and Implications for Policy and Practice	6
Research Gaps/Future Research	7
Conclusions.....	8
Abbreviations Table.....	8
 Evidence Report	 9
Introduction.....	9
Methods.....	10
Development of Conceptual and Analytic Frameworks	10
Key Questions.....	13
PICO	13
Search Strategy	16
Study Selection	16
Inclusion Criteria	16
Exclusion Criteria	17
Data Abstraction	17
Quality Assessment.....	18
Data Synthesis.....	18
Rating the Body of Evidence	18
Peer Review	18
Results.....	19

Key Question 1: How do Veterans compare to non-Veterans in prevalence and characteristics of social determinants of health?..... 20

Key Question 2: Does variation in social determinants of health account for differences in health services access, health behaviors, and health outcomes between Veterans and non-Veterans? 20

 Key Messages 20

 Evidence Map 20

 Qualitative Synthesis of Results for Rurality, Trauma, and Sexual Orientation and Gender Identity for Veterans and Non-Veterans 21

Key Question 3: How do engaged (ie, enrolled in or utilizing categories of VHA services or benefits) Veterans compare to non-engaged (ie, not enrolled in or utilizing VHA services or benefits) Veterans in prevalence and characteristics of social determinants of health? 25

Key Question 4: Does variation in social determinants of health account for differences in health services access, health-related behaviors, and health outcomes between engaged Veterans and non-engaged Veterans? 25

 Key Messages: 25

 Evidence Map 25

 Qualitative Synthesis of Results for Rurality, Trauma, Sexual Orientation and Gender Identity for Veterans Engaged and Not Engaged in VHA Care 26

Summary and Discussion..... 29

 Summary of Evidence for Key Questions 1 and 2..... 29

 Summary of Evidence for Key Questions 3 and 4..... 29

 Limitations 30

 Applicability and Implications for Policy and Practice 31

 Research Gaps/Future Research 31

 Conclusions..... 33

References 35

Appendix A. Search Strategies 46

Appendix B. Peer Review Comments/Author Responses 49

Appendix C. Evidence Tables 61

TABLES

 Table 1. Social Determinants of Health..... 10

 Table 2. Characteristics of Included Articles for Rurality, Trauma, and Sexual Orientation—Veterans and Non-Veterans 22

Table 3. Characteristics of Included Articles for Rurality and Trauma—Veterans Engaged and Not Engaged in VHA Services or Benefits..... 27

FIGURES

Figure 1. Conceptual Framework for Social Determinants of Veterans’ Health..... 12

Figure 2. Analytic Framework for Key Questions 1 and 2..... 14

Figure 3. Analytic Framework for Key Questions 3 and 4..... 15

Figure 4. Citation Screening and Selection of Included Articles..... 19

Figure 5. Summary of Included Articles Addressing Social Determinants and Various Outcomes for Veterans and non-Veterans^a 21

Figure 6. Summary of Included Articles Addressing Social Determinants and Various Outcomes for Veterans Engaged and Not Engaged in VHA Care^a 26

EVIDENCE REPORT

INTRODUCTION

Social determinants of health are broad and often defined in the context of other factors that also impact health. For example, the Institute of Medicine's (IOM) report, *Capturing Social and Behavioral Domains and Measures in Electronic Health Records*, defined social determinants as “sociocultural, socio-economic, and socio-demographic status; biosocial interactions; and the various levels of social context...”¹ This IOM report differentiated social from behavioral factors in that the latter indicate observable actions, underlying cognitions, and/or other related psychological constructs. Similarly, Tarlov's framework posited “social and societal characteristics” as one of 5 major categories of determinants of population health, with the others being genes and biology, health behaviors, medical care, and the “ecology of all living things.”² Although exact definitions vary somewhat, there is consensus that social determinants include many distinct concepts, and taken as a whole, they substantially influence health outcomes and contribute to health disparities.^{2,3,4-6}

The VHA Office of Patient Care Services—Population Health Services and Office of Rural Health (hereafter, VHA partners) requested an evidence review to examine social determinants of Veterans' health, particularly as to those social determinants which may be more important for Veterans' health outcomes (or for certain Veteran groups), as compared with non-Veterans. The goal for this evidence review was to guide VHA planning for health care services that may be influenced by, or should be targeted to social determinants contributing to poorer health and greater care needs among Veterans. In collaboration with our VHA partners, we developed the scope and conceptual framework for an evidence map, with the focus being social determinants that may be differentially important for Veterans compared with non-Veterans, or between Veterans enrolled in or utilizing certain VHA services, compared with those Veterans who did not. An evidence map is a scoping review that describes key characteristics of existing, published evidence for a broad area of medicine and health.^{7,8} Given our goals focused on Veterans, our evidence map did not seek to identify and review the evidence for all social determinants of health, irrespective of populations. Furthermore, in trying to balance the extensive scope of our review with the goal of providing results that have clear implications for VHA policy and future research, we engaged our VHA partners in a prioritization process after the initial evidence map, and selected those social determinants which would undergo more detailed review and reporting of published results (*ie*, rurality, trauma history, sexual orientation and gender identity).

METHODS

DEVELOPMENT OF CONCEPTUAL AND ANALYTIC FRAMEWORKS

In developing our approach for systematically identifying, describing, and interpreting the evidence base for social determinants of Veterans' health, we worked with our VHA partners to first establish a conceptual framework that depicts the complex relationships between social determinants of health, Veteran status or experiences, and health outcomes (Figure 1). This framework draws upon work from the MacArthur Research Network on Socioeconomic Status and Health⁹ and the IOM report on prioritization of social determinants for capture by health records.¹ We sought to be inclusive and broad in conceptualizing relevant social determinants, but also considered whether particular social determinants have available measures, and whether they are considered as high priority by national groups and our VHA partners (Table 1). We note that while certain social determinants are consistently named but variably defined or measured (*eg*, income), other social determinants are both inconsistently described and measured (*eg*, exposures to trauma and adversity), thus limiting our ability to compare across past reports and existing frameworks. Nevertheless, development of this conceptual framework with our VHA partners and identification of a starting set of social determinants were critical for clarifying the objectives of our partners and informing our search strategies.

Table 1. Social Determinants of Health

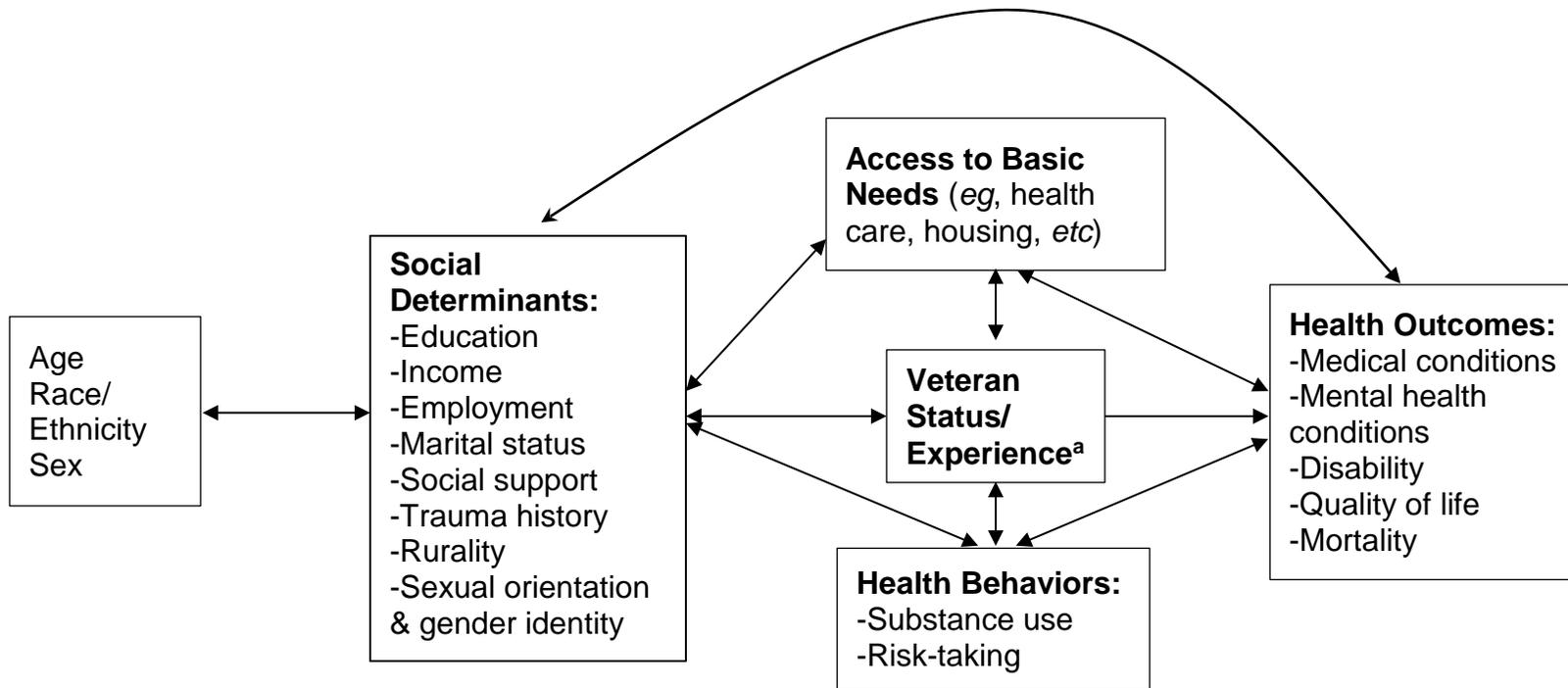
	Standardized Measure Available	High Priority ^a for Capture by Health Records
Individual Factors:		
Education	Ü	Ü
Employment	Ü	Ü
Income	Ü	NR
Sexual Orientation		Ü
Gender Identity		NR
Social Relationships and Living Conditions:		
Marital Status	Ü	NR
Social Support	Ü	Ü
Family SES		Ü
Trauma History	Ü	Ü
Justice Involved		NR
Housing Status		NR
Rurality	Ü	NR
^a Results adapted from report by Institute of Medicine (2014) Capturing social and behavioral domains and measures in electronic health records: Phase 2; NR = not rated in report		

Our conceptual framework highlights some of the complexities arising in the study of social determinants. First, we separated age, race/ethnicity, and sex into their own category, as key demographic characteristics that are distinct from social determinants of health. We acknowledge that these factors have social components (*eg*, definitions of race and ethnicity) and likely interact with social determinants, but they also may be associated with biologic/physiologic variation that impacts health through non-social pathways. The different pathways by which age,

race, and sex impact health are often not distinguished in studies examining outcomes, and attempting to understand the “social” components is beyond the scope of this evidence review. Furthermore, a recent VHA ESP report has focused on health disparities among Veterans, and thus, evaluated the current evidence base for health outcomes associated with these key demographic factors.¹⁰ Thus, our expectation is that robust analyses of impact of social determinants should account for age, race, and sex, in alignment with our main goal of examining the evidence base for social determinants against the backdrop of known impacts of these factors.

Other important considerations include the potential for differential selection of individuals into military service along one or more dimensions of social determinant, nonlinearity in relationships between factors, feedback loops within the complex system of relationships, and interactive dynamic effects due to bidirectionality. Over the life course, pathways are also likely to vary in their influence on health outcomes (*eg*, adversity in childhood vs adulthood). Our model also depicts how social determinants may influence Veteran experiences and engagement with VHA resources, with Veteran status being a mediator of social determinants on health outcomes. For example, a study examining the role of social determinants in health of Veterans compared with non-Veterans addressed the need to distinguish between potential impact of social determinants on differential selection into military service and the other pathways by which social determinants may impact health for Veterans.¹¹ Alternatively, Veteran status or experience may impact social determinants (*eg*, effect on educational attainment or access to affordable housing), in which case social determinants are mediating the health effects of Veteran status. Additionally, social determinants could *moderate* the relationship between Veteran experiences and health (*ie*, differentially modulating the strength or direction of such associations). Importantly, these distinct roles of social determinants would be examined using different analytic techniques (*eg*, tests for mediation vs examining interaction effects). For example, if trauma exposures have moderating effects, we might observe that the association between Veteran status and health outcome is stronger or weaker among Veterans who have experienced trauma, compared with non-Veterans who have similar exposures. In contrast, if trauma mediates the impact of Veteran status on health, we would find that accounting for trauma exposure would decrease or change the associations between Veteran experiences and health outcomes.

Figure 1. Conceptual Framework for Social Determinants of Veterans' Health



^a Veteran Status/Experience refers to whether one is a Veteran, including deployed and non-deployed, and various eras of service

In accordance with our conceptual framework, we developed 2 analytic frameworks (Figures 2 and 3) to further clarify our key questions and inform our search strategies. The analytic frameworks helped to identify the populations of interest, highlight social determinants that are likely relevant, define outcomes of interest, and determine the inclusion/exclusion criteria for the evidence review. In comparing our analytic frameworks with the more complex conceptual framework described above, we note 2 key simplifications. First, we are primarily concerned with social determinants as mediators of the effects of Veteran status, or engagement in VHA services or benefits. Thus, in the analytic frameworks, we have not included the potential impact of social determinants on Veteran status (Figure 2) or engagement with the VHA among Veterans (Figure 3). Second, we have indicated unidirectional relationships throughout (*eg*, social determinants affecting health directly, or affecting health services access which in turn affects health) because these are the associations most likely to be examined by published studies, and they are most relevant to addressing the policy concerns of our VHA partners. Evaluating bidirectional relationships between social determinants and health would require robust longitudinal data and more complex analytic techniques. Although such studies would be highly desirable, we did not expect most of the evidence base to fall into this category.

Below, we provide our 4 key questions, and a summary of these questions in PICO format. In Key Questions 3 and 4, we use the terms “engaged” and “non-engaged” to describe groups of Veterans who differ according to enrollment in VHA or other VA benefits and services, or utilization of categories of VHA services (*eg*, mental health or other specialty care).

Key Questions

Key Question 1: How do *Veterans* compare to *non-Veterans* in prevalence and characteristics of social determinants of health?

Key Question 2: Does variation in social determinants of health account for differences in health services access, health-related behaviors, and health outcomes between Veterans and non-Veterans?

Key Question 3: How do *engaged* (*ie*, enrolled in or utilizing categories of VHA services or benefits) Veterans compare to *non-engaged* (*ie*, not enrolled in or utilizing VHA services or benefits) Veterans in prevalence and characteristics of social determinants of health?

Key Question 4: Does variation in social determinants of health account for differences in health services access, health-related behaviors, and health outcomes between engaged Veterans and non-engaged Veterans?

PICO

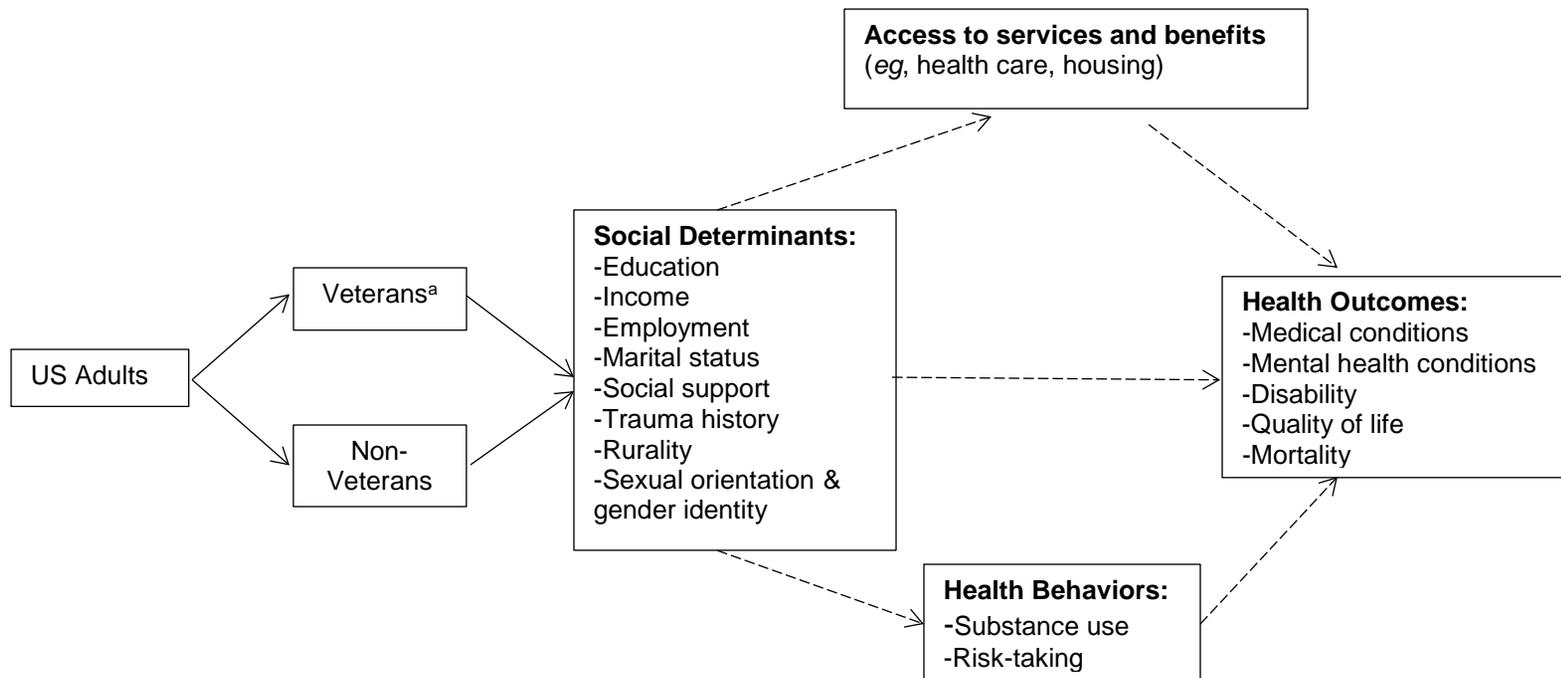
Population: Adult Veterans and non-Veterans

Intervention, Comparator: Not applicable

Primary Outcome: Prevalence and differences in social determinants of health

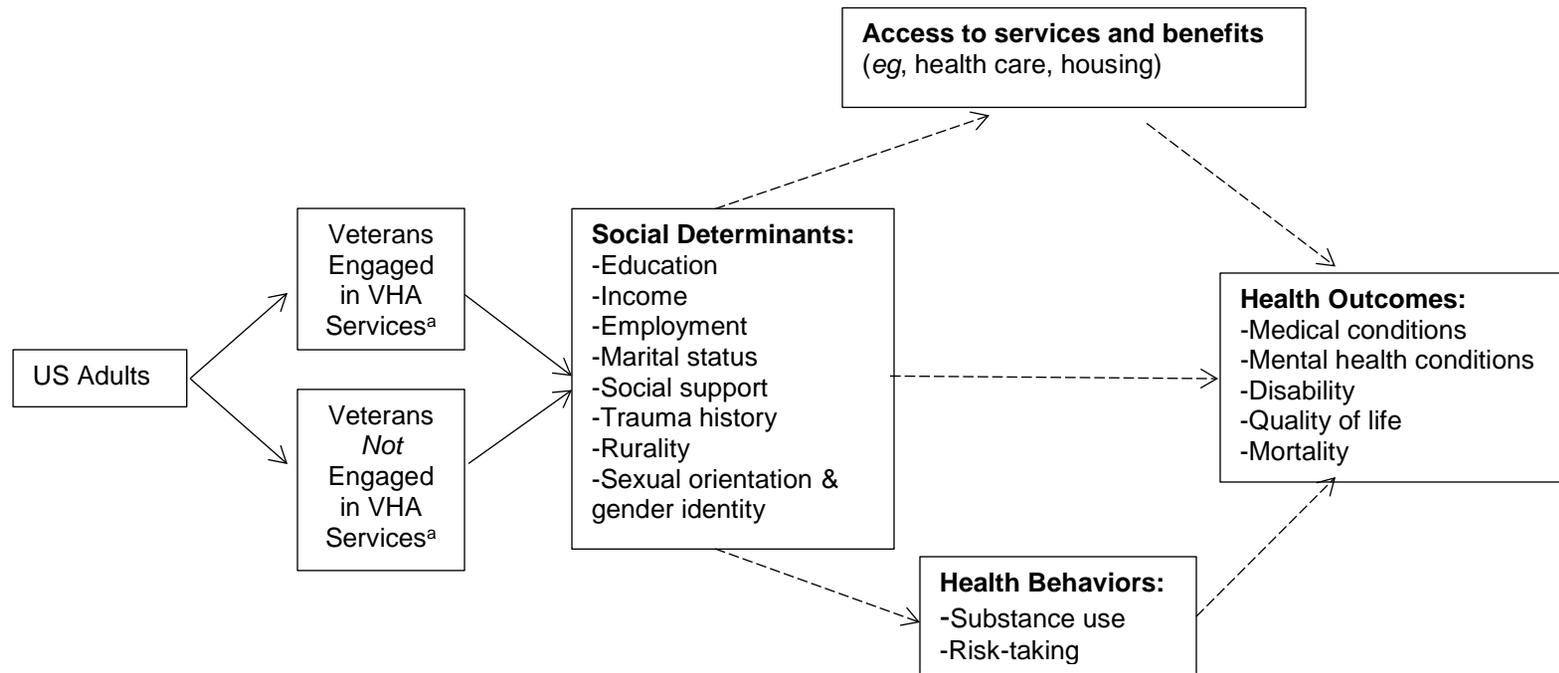
Secondary Outcomes: Differences in health services access, health-related behaviors, and health outcomes, as related to differences in social determinants of health

Figure 2. Analytic Framework for Key Questions 1 and 2



^a Includes deployed and non-deployed, and various eras of service

Figure 3. Analytic Framework for Key Questions 3 and 4



^a Engagement in VHA services included use of any VHA benefits or specific categories of services (eg, mental health care), as defined by authors of articles.

SEARCH STRATEGY

We undertook a multi-faceted approach to identifying published articles that may be relevant to our key questions. First, we searched MEDLINE (OVID), the Cumulative Index to Nursing and Allied Health Literature (CINAHL), PsycINFO, and Sociological Abstracts, from the date of inception for each database to January 2017, for English language publications. Full database search strategies are presented in Appendix A. To these search results, we added references suggested by experts and peer reviewers. To assess our search results, and also to explore grey literature sources (*eg*, white papers) that may contribute to the evidence base, we undertook an evaluation of publications associated with multiple large national cohorts (*eg*, American Community Survey, Behavioral Risk Factor Surveillance System), and some VA research programs. We first reviewed whether our database search results included articles that used data from these cohorts. Then, we screened citations/abstracts and reports that were associated with these cohorts, as indicated by publication lists, bibliographies, or other available information. We applied this same process to articles and other publications associated with the VA Epidemiology Program and the National Center for Veterans Analysis and Statistics. In general, we did not identify robust sources of evidence in the grey literature that substantially added to our original search focused on peer-reviewed journal articles. Finally, in addition to the database searches and evaluation of publications associated with large national cohorts, we also completed an expedited review of citations found through a MEDLINE search with the terms as noted above (Appendix A), except using “trials” instead of selecting for other study designs. We thought it unlikely that randomized controlled trials or controlled clinical trials would address our key questions regarding the social determinants of health, but for completeness, we carried out this additional search.

STUDY SELECTION

Citations/abstracts identified as potentially eligible by at least one reviewer underwent dual-review of the full texts. At the full-text review stage, 2 reviewers needed to agree on eligibility. Discrepancies were resolved by discussion or a third reviewer. Citation/abstract screening, full-text review, and data abstraction were performed in DistillerSR, (Evidence Partners; <https://www.evidencepartners.com/products/distillersr-systematic-review-software/>; accessed 5 July 2017).

We applied the following inclusion and exclusion criteria:

Inclusion Criteria

1. Includes data on:

a. US Veterans and non-Veterans

and/or

b. US Veterans engaged and not engaged in VHA services (NOTE: we use engaged and not-engaged for comparisons of groups of Veterans based on enrollment in VHA or other VA benefits and services, or utilization of categories of services [*eg*, mental health or other specialty care])

2. Includes at least one social determinant of interest (*eg*, employment, education, income, family/social support, past trauma exposure, rural residence, gender identity, or sexual orientation). For trauma, we required an independent assessment of trauma exposure; measurement of symptoms and clinical conditions presumed to be related to trauma was not sufficient. We also added new social determinants as they arose in the identified articles.

Exclusion Criteria

1. Fewer than 100 participants
2. Does not report prevalence, degree, levels, or characteristics of social determinants by population of interest (*ie*, Veteran/non-Veteran, engaged/non-engaged)
3. Not study design of interest (*eg*, narrative review, case report, editorial/viewpoint)

Since our goal was to identify evidence that could address the role of social determinants in health, we required that included articles have valid comparison groups (*eg*, rural and non-rural participants, heterosexual and sexual minority respondents). Thus, studies that recruited all participants with a shared social determinant (*eg*, sexual minorities) were not considered as addressing the key questions for that social determinant. We agree that such studies focused on participants sharing a social determinant may be necessary first steps to understanding the potential roles of emerging social determinants of health, but they would not provide sufficient evidence to rigorously examine our key questions.

DATA ABSTRACTION

We undertook a 2-tiered approach to: 1) provide evidence maps of all included articles, and 2) abstract detailed results for articles addressing **3 high-priority social determinants (*ie*, rurality, trauma, and sexual orientation or gender identity)**, per our discussions with our VHA partners (subsequently referred to as the 3 high-priority social determinants). For selection of these social determinants, we presented our VHA partners with preliminary evidence maps for KQ1/2 and KQ3/4, which described the number of included articles which addressed specific social determinants and any outcomes of interest.

For all included articles, we abstracted study characteristics (*eg*, cross-sectional or cohort design), social determinants addressed, and whether the article examined the role of social determinants in health services access or utilization, health behaviors (*eg*, substance use), or health outcomes of interest (*eg*, mental health conditions, disability). Next, for articles which investigated one of the 3 high-priority social determinants, we further abstracted the data source (*eg*, NHANES), participant number and demographics, measures of social determinant(s), and the prevalence, degree, or level of social determinant(s) for the groups of interest (*ie*, either Veterans and non-Veterans or engaged and non-engaged Veterans). If articles examined the role of social determinants in health services access, health-related behaviors, and/or health outcomes, we also abstracted methods and results from these analyses. This detailed data abstraction was completed by one reviewer with verification by a second reviewer. Discrepancies were resolved by discussion.

QUALITY ASSESSMENT

We performed dual-reviewer quality assessment for included articles which addressed the 3 high-priority social determinants (*ie*, rurality, trauma, and sexual orientation or gender identity). We considered the following elements related to study quality:

- 1) Representativeness and coverage (*ie*, source of data [*eg*, nationally representative cohort], recruitment and selection of participants, concerns about missing data)
- 2) Measurement (*ie*, social determinants assessed in similar manner for groups being compared and using standardized measures; health-related behavior, health services access, and health outcomes assessed in similar manner for groups being compared and using standardized measures)
- 3) Funding source (*ie*, potential for bias).

Each reviewer independently rated the study quality with regard to assessment of prevalence (Key Questions 1 and 3) and with regard to examining the role of social determinants in health services access, health behaviors, or health outcomes (Key Questions 2 and 4). Discrepancies in quality ratings were resolved by discussion.

DATA SYNTHESIS

We provide 2 separate evidence maps of included articles which addressed social determinants for Veterans and non-Veterans (KQ 1 and 2), and for Veterans engaged and not engaged in VA services and benefits (KQ 3 and 4). We use heat maps to summarize information about the number of articles reporting on various social determinants and the role of social determinants on health services access, health behaviors, or health outcomes.

For articles examining the 3 high-priority social determinants, we undertook qualitative syntheses, as described in the text and detailed tables in Appendix C.

RATING THE BODY OF EVIDENCE

For the 3 high-priority social determinants of rurality, trauma, and sexual orientation or gender identity, we assessed overall strength of evidence as guided by the method described by Owens et al.¹² Strength of evidence was rated as high, moderate, low, or insufficient. We based our rating on precision (degree of certainty in estimates), consistency (direction of differences across included studies), directness (whether evidence links social determinants directly to outcomes of interest), and quality rating of the individual studies (as described above).

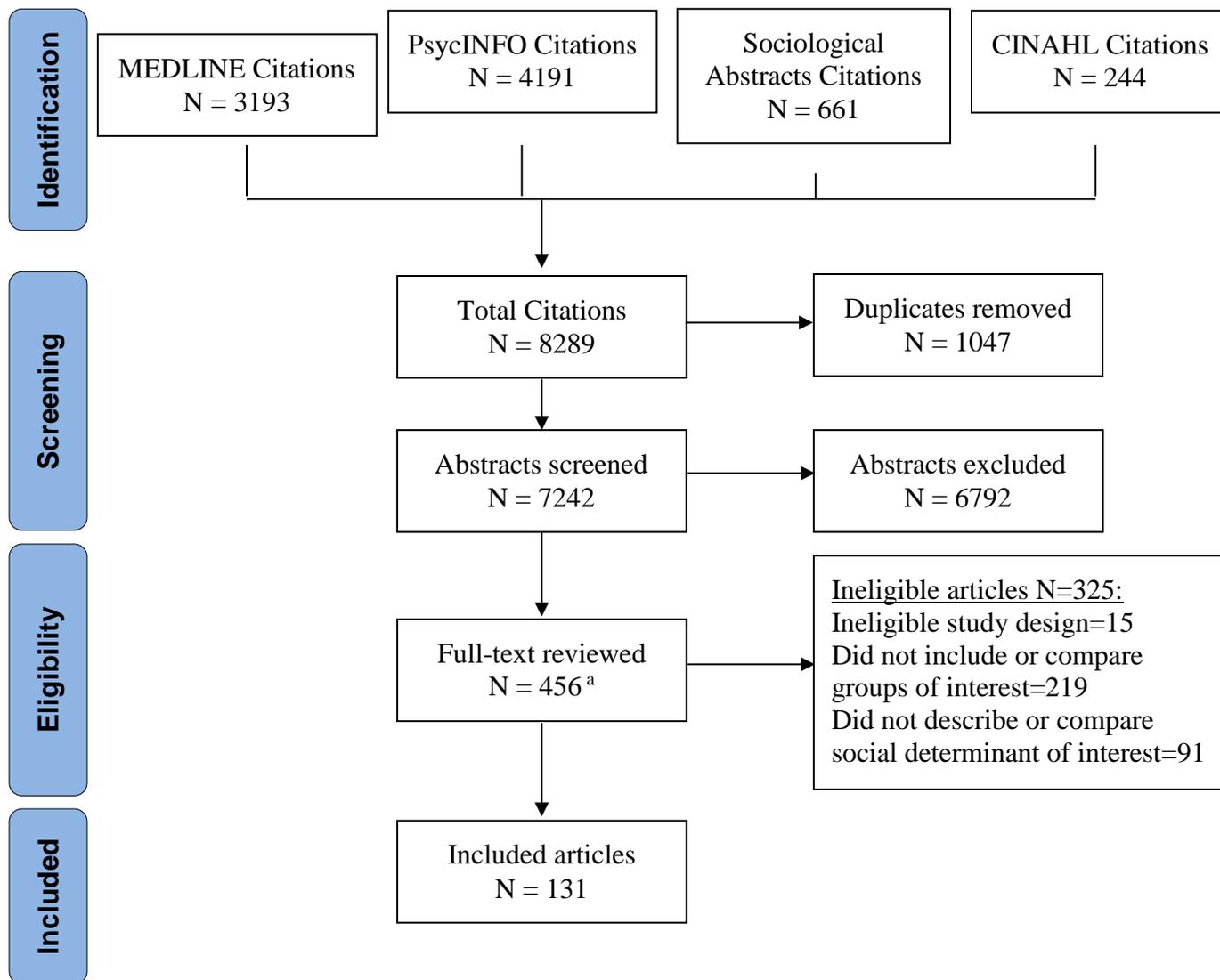
PEER REVIEW

A draft version of this report was reviewed by content experts as well as clinical leadership. Reviewer comments and our responses are presented in Appendix B.

RESULTS

We searched 4 databases and screened over 7000 abstracts to identify 131 articles that addressed at least one of the 4 key questions (Figure 4).^{11,13-142} We provide evidence maps, followed by qualitative syntheses of results for the 3 high-priority social determinants—rurality, history of trauma, and sexual orientation or gender identity. We first describe the evidence map and qualitative synthesis for Veterans and non-Veterans (*ie*, Key Questions 1 and 2), followed by results for Veterans engaged and not engaged in various VHA services and benefits (*ie*, Key Questions 3 and 4).

Figure 4. Citation Screening and Selection of Included Articles



^aTotal includes an additional 3 articles found through an expedited review of MEDLINE citations (N=354) found using same search terms except limited to trials, 1 article found through review of publications from the VA Epidemiology Program, and 2 articles recommended by expert reviewers.

KEY QUESTIONS 1 AND 2:

How do Veterans compare to non-Veterans in prevalence and characteristics of social determinants of health?

Does variation in social determinants of health account for differences in health services access, health behaviors, and health outcomes between Veterans and non-Veterans?

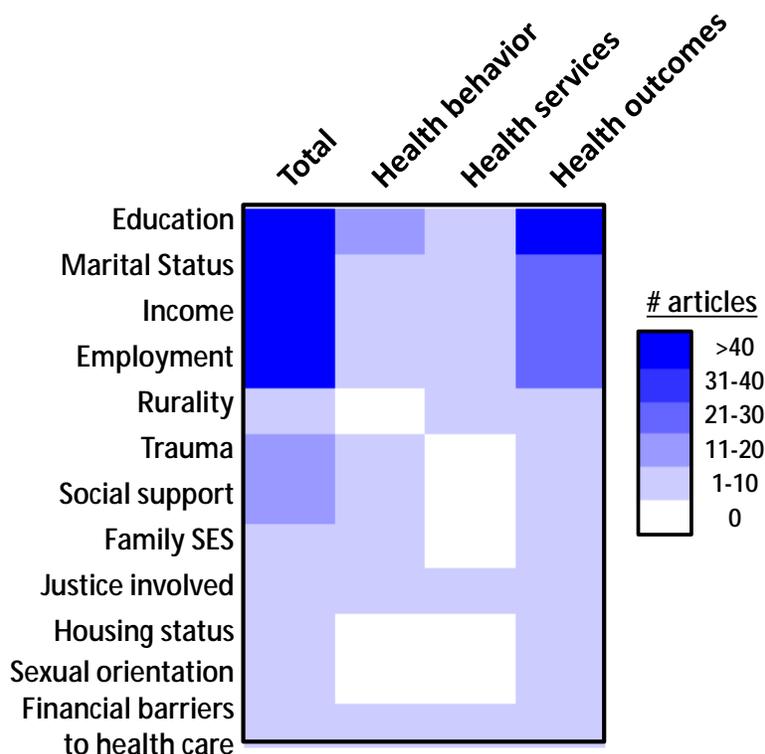
Key Messages

- Most articles examining social determinants of health in Veterans included standard sociodemographics, such as education, marital status, income, and employment.
- There are no substantial differences in proportions of Veterans and non-Veterans who lived in rural settings. Most articles used nationally representative data and were consistent in their results, but rurality definitions varied widely, thus limiting interpretations. (Moderate strength evidence)
- We found insufficient evidence on the effects of rurality on health services utilization, health behaviors, or health outcomes between Veterans and non-Veterans.
- There is higher prevalence of trauma exposure among Veterans, compared with non-Veterans. Half of the articles used nationally representative data, results were somewhat inconsistent, and trauma types and measures varied across articles. (Low strength of evidence)
- Trauma exposure contributes to differences in the smoking prevalence between Veterans and non-Veterans. (Low strength of evidence)
- We found insufficient evidence on whether prevalence differences exist in minority sexual orientation between Veterans and non-Veterans.
- We found insufficient evidence that sexual minority status accounts for mortality differences between Veteran and non-Veteran women.
- No included articles addressed gender identity in comparing Veterans and non-Veterans.

Evidence Map

We identified 99 articles which addressed at least one social determinant of interest for Veterans and non-Veterans. The vast majority of articles used cross-sectional data and included over 1000 participants (Appendix C, Table 1). Education, marital status, income, and employment were addressed by the greatest number of articles, and some of these articles examined the role of these social determinants in health behaviors, health services access or utilization, and/or health outcomes (Figure 5 and Appendix C, Table 1). In contrast, other social determinants were addressed by far fewer articles, and several social determinants were not examined by any articles which considered health behaviors, or health services access or utilization (Figure 5). We found no articles addressing gender identity for Veterans and non-Veterans.

Figure 5. Summary of Included Articles Addressing Social Determinants and Various Outcomes for Veterans and non-Veterans^a



^aShading in a cell represents the number of articles; rows are social determinants of interest and columns are for total number of eligible articles followed by number of eligible article reporting a health-related outcome of interest

Qualitative Synthesis of Results for Rurality, Trauma, and Sexual Orientation and Gender Identity for Veterans and Non-Veterans

We identified 11 articles which examined rurality, 11 which addressed trauma, and 2 on sexual orientation for Veterans and non-Veterans. Most articles on rurality, trauma, and/or sexual orientation used nationally representative datasets, included more than 5000 participants, and were rated low or medium quality (Table 2). One-third of articles included data on only men, and 5 had only women participants. Half of the articles investigated the role of rurality, trauma, and/or sexual orientation in health behaviors, health services access or utilization, or various health outcomes. Detailed results from included articles are provided in Appendix C, Table 2 and described below.

Table 2. Characteristics of Included Articles for Rurality, Trauma, and Sexual Orientation—Veterans and Non-Veterans

	Rurality ^a	Trauma	Sexual Orientation
Total number of articles	11	11	2
Nationally representative dataset	9	6	2
Exclusively men	5	3	—
Exclusively women	—	4	2
Number of participants:			
100-1000	1	3	—
1001-5000	4	3	1
>5000	6	5	1
Quality:			
Low	3	6	—
Medium	7	4	2
High	1	1	—
Examined role of social determinant in:			
Health behaviors	—	4	—
Health services access or utilization	2	—	—
Mental health	2	4	—
General health	1	1	—
Mortality	—	1	1
Other health outcomes	1	2	—

^a Number of participants unclear in one study (Ajmera 2011¹⁴); articles may be included in more than one category

Rurality

Articles that examined rurality were all rated medium or low quality. Articles used a variety of measures, including Metropolitan Statistical Areas (MSA),^{14,92,99,130,132,142} self-reported rural/urban residence,^{26,63,69} and Rural-Urban Continuum (RUC) codes¹²⁹ (Appendix C, Table 2). There were generally no differences in the proportion of rural residence between Veterans and non-Veterans, although actual prevalence estimates were highly variable (*eg*, range 18-47% of Veterans had rural or non-metropolitan residences). This was likely due to variation in rurality definition, participant demographics (*eg*, age and sex), and years of datasets used (range 1986-2012). For example, one article used self-reported rural versus urban residence from a national Pew Center survey in 2008 and found 18% of Veterans and 16% of non-Veterans were “rural”.⁶³ Another article using 2000 BRFSS data defined “non-metropolitan” residence by RUC codes 4-9, and reported 25% of Veterans and 22% of non-Veterans were in this category.¹²⁹

Only 3 articles investigated the role of rurality in health outcomes,^{99,129,132} all were of medium quality, and none found significant effects for either Veteran status or rurality (Appendix C, Table 2). Of 2 articles examining the association of rurality with health services access or utilization, one reported no substantial difference between metropolitan and non-metropolitan participants in proportion having a “checkup” within prior 2 years.¹²⁹ The other article found significant interaction effects between rural residence and a combined Veteran/VHA user categorical variable (*ie*, non-Veteran, Veteran VHA user, and Veteran non-VHA user), when examining associations with total healthcare expenditures, but did not report the magnitude of the interaction effects.¹³⁰ Both of these articles were medium quality.

Trauma

Of 11 articles examining trauma exposures between Veterans and non-Veterans, only one was rated as high quality,⁸² and 5 were rated as medium quality.^{22,27,34,70,93} Articles examining trauma assessed a variety of trauma types, using different measures, with little consistency across studies. Adverse childhood experiences were examined in 6 articles comparing Veterans and non-Veterans,^{22,53,70,93,96,111,137} with the Adverse Childhood Experiences scale (ACEs) being the most commonly used measure.^{22,70,93} This is possibly because the ACEs module was included in BRFSS, which was the data source used in 3 of these articles. One article reported only whether respondents had been “victimized” in the prior 12 months.¹³¹ Adult experience of sexual trauma or intimate partner violence (IPV) was examined in 4 articles comparing Veterans and non-Veterans.^{27,53,96,111} Adult experience of physical trauma was examined in 2 articles comparing Veterans and non-Veterans.^{82,96} Combat-related trauma was examined in one article comparing Veterans and non-Veterans (assessed in Veterans only).⁹⁶

Prevalence estimates were inconsistent across articles comparing Veterans and non-Veterans with 6 finding higher prevalence among Veterans,^{22,34,70,96,111,131} 3 finding higher prevalence among non-Veterans,^{27,53,82} and 2 finding no difference in prevalence between Veterans and non-Veterans.^{93,137} Inconsistencies may be due to a broad range of historical periods and cohorts being studied (*ie*, Vietnam era through OIF/OEF, Appendix C, Table 2). Furthermore, comparison groups of Veterans and non-Veterans often differed in composition with respect to age, sex, race/ethnicity, and other key characteristics. There were also very narrow groups targeted in certain articles (*eg*, homeless smokers only).⁵³

Only 4 articles examined associations of trauma exposure with health behaviors, and all focused on current smoking and binge or heavy drinking.^{27,34,70,93} Trauma exposure was associated with higher prevalence of current smoking, with 2 of these articles examining adult trauma exposure (IPV) and 2 examining childhood trauma exposure (ACEs). Only one of the 4 articles also found a positive association between trauma exposure (ACEs) and binge-drinking.⁷⁰ Three of these articles^{27,34,70} analyzed trauma exposure as a moderating variable between Veteran status and health behaviors (*ie*, something that potentially changes the strength or direction of association between Veteran status and health behaviors). Of these, 2 did not examine the statistical significance of moderating effects, and the remaining article⁷⁰ assessed both smoking (ever smoked) and binge drinking, finding that there were significant interaction effects between Veteran status and ACEs score on having ever smoked (stratified results for women Veterans odds ratio [OR] 1.07 [95% CI 1.03, 1.12] vs women non-Veterans OR 1.14 [95% CI 1.13, 1.15], and comparisons for men, Veterans OR 1.06 [95% CI 1.05, 1.07] vs non-Veterans OR 1.12 [95% CI 1.11, 1.13]). There were no significant interaction effects between Veteran status and trauma exposure (ACEs) in predicting likelihood of binge drinking. Only one article⁹³ considered whether trauma exposure might be a mediating variable between Veteran status and health risk behaviors (*ie*, something that ***might account for*** the relationship between Veteran status and the health risk behavior). In this article, after adjusting for age, race/ethnicity, education, income, and partnership status, Veterans had a higher OR for current smoking vs non-Veterans (1.84 [95% CI 1.18, 2.88]). After further adjusting for ACEs score, the OR associated with Veteran status was no longer significant (1.57 [95% CI 0.96, 2.58]), suggesting that adverse childhood experiences may explain some of the higher prevalence of current smoking associated with Veteran status.

Five articles examined associations of trauma exposure with a range of health outcomes.^{27,34,70,82,93} Several articles found that trauma exposure was positively associated with higher risk for adverse health outcomes. One article found that ACEs scores were associated with poorer health-related quality of life among both males and females, with RRs consistently higher among non-Veterans, compared with Veterans.⁷⁰ One article examined trauma exposure as a mediating factor in associations between Veteran status and diabetes, cardiovascular events, asthma, and disability.⁹³ Veteran status was only significantly associated with disability outcome—adjusted OR 1.83 (95% CI 1.08, 3.10) with covariates including age, race/ethnicity, education, income, and partnership status.⁹³ After adding ACEs score, the OR for Veteran status was no longer significant (1.57 [95% CI 0.90, 2.75]), suggesting that adverse childhood experiences may account for some part of the higher prevalence of disability among Veterans compared with non-Veterans. Two articles employed BRFSS data to examine associations of IPV with depressive symptoms.^{27,34} One reported unadjusted estimates of depressive symptoms comparing Veterans and non-Veterans, with stratification by IPV.³⁴ There were no differences for those who reported no IPV (7% vs 7% for Veterans vs non-Veterans), but among those reporting IPV, depressive symptoms were less prevalent among Veterans than non-Veterans (13% vs 25%, $p < 0.01$).³⁴ The second article used both stratified and adjusted analyses, finding broadly similar results, with IPV being associated with higher odds of having depressive symptoms among Veterans (2.63 [95% CI 1.49, 4.65]), and among non-Veterans (4.37 [95% CI 2.79, 6.86]).²⁷ In the article examining all-cause mortality as the outcome, HRs were significantly higher for certain types of trauma in certain groups but not others; for example, higher HR associated with exposure to physical abuse among heterosexual non-Veterans (1.17 [95% CI 1.02, 1.33]), and higher HR associated with “other trauma” among sexual-minority Veterans (4.31 [95% CI 1.38, 3.47]), but not among other sub-groups.⁸² Verbal abuse was not associated with all-cause mortality in any of the 4 sub-groups assessed.⁸²

Sexual Orientation

Both articles examining sexual orientation used nationally representative data, had only women participants, and were rated medium quality (Appendix C, Table 2).^{80,82} One article used data from the Women’s Health Initiative (WHI) and found a higher proportion of women Veterans identified as sexual minorities (*ie*, non-heterosexual) compared to women non-Veterans (4% vs 1%).⁸² The other article used NHANES data (1999-2010) and reported no significant difference in prevalence of non-heterosexual orientation (7% among Veterans, 5% for non-Veterans).⁸⁰ The 2 study populations differed in age (mean age 63 years in the WHI study and 40 years in the NHANES study) and race/ethnicity (85% non-Hispanic white in WHI study and 70% in the NHANES study).

The article using WHI data found that sexual minority status (HR 1.20 [95% CI 1.07, 1.36]) and Veteran status (HR 1.14 [95% CI 1.06, 1.22]) were independently associated with increased risk for all-cause mortality in adjusted analyses.⁸² Authors examined interaction effects between sexual minority status and Veteran status for predicting risk of all-cause mortality, cancer-specific mortality, and cardiovascular disease-related mortality; there were no significant interactions in any of the models for all-cause or cardiovascular mortality, and some inconsistent interaction effects in models evaluating risk for cancer mortality (significant in only half of models).

KEY QUESTIONS 3 AND 4:

How do *engaged* (ie, enrolled in or utilizing categories of VHA services or benefits) Veterans compare to *non-engaged* (ie, not enrolled in or utilizing VHA services or benefits) Veterans in prevalence and characteristics of social determinants of health?

Does variation in social determinants of health account for differences in health services access, health-related behaviors, and health outcomes between engaged Veterans and non-engaged Veterans?

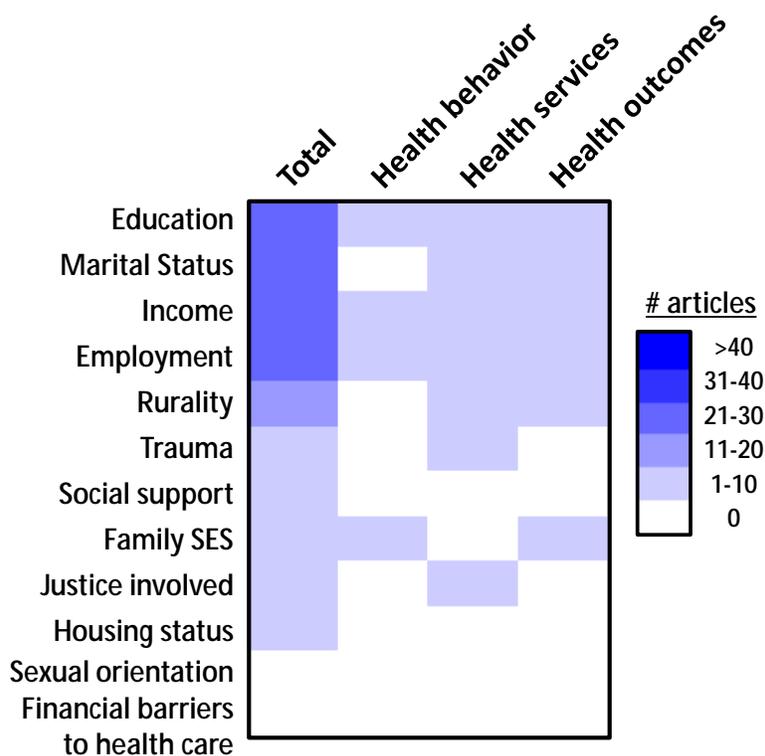
Key Messages:

- Most articles examining social determinants of health in engaged and non-engaged Veterans included standard sociodemographics, such as education, marital status, income, and employment.
- There were no substantial differences in rurality between engaged and non-engaged Veterans, but for certain specific services (*eg*, VHA homeless services), there may be differences in proportion with rural residence. (Moderate strength evidence)
- We found insufficient evidence on the effects of rurality on differences in health services utilization, health behaviors, or health outcomes between engaged and non-engaged Veterans.
- Trauma exposure is higher for Veterans engaged versus not engaged in VHA care. (Low strength of evidence)
- No articles addressed the role of trauma exposure in differences in health services access, health behaviors, or health outcomes between engaged and non-engaged Veterans.
- No included articles investigated sexual orientation or gender identity among engaged and non-engaged Veterans.

Evidence Map

Forty included articles examined social determinants of interest for Veterans engaged and not engaged in VHA services and/or benefits. Most articles used cross-sectional data and education, marital status, income, and employment were the most frequently included determinants (Appendix C, Table 3). Fewer articles examined the role of social determinants in health behaviors, health services access or utilization, and/or health outcomes (Figure 6 and Appendix C, Table 3). Several of the social determinants were examined in less than 10 articles, including trauma exposure and social support.

Figure 6. Summary of Included Articles Addressing Social Determinants and Various Outcomes for Veterans Engaged and Not Engaged in VHA Care^a



^aShading in a cell represents the number of articles; rows are social determinants of interest and columns are for total number of eligible articles followed by number of eligible article reporting a health-related outcome of interest

Qualitative Synthesis of Results for Rurality, Trauma, Sexual Orientation and Gender Identity for Veterans Engaged and Not Engaged in VHA Care

We found 14 articles which examined rurality, 6 which addressed trauma, and none for sexual orientation or gender identity (Table 3). Most articles on rurality and/or trauma used nationally representative datasets. While most articles on rurality included more than 5000 participants and included both men and women, most articles on trauma had 1000 or fewer participants and 4 included only women. Two articles investigated the role of rurality on health services access or utilization, and/or various health outcomes; no rurality articles examined health behaviors. No articles addressed the role of trauma exposure in health services utilization, health behaviors, or health outcomes of interest. Detailed results from included articles on rurality and trauma are provided in Appendix C, Table 4 and described below.

Table 3. Characteristics of Included Articles for Rurality and Trauma—Veterans Engaged and Not Engaged in VHA Services or Benefits

	Rurality ^{a*}	Trauma
Total number of articles	14	6
Nationally representative dataset	12	4
Exclusively men	2	—
Exclusively women	—	4
Number of participants:		2
100-1000	2	4
1001-5000	2	2
>5000	9	—
Quality:		
Low	4	4
Medium	8	2
High	2	—
Examined role of social determinant in:		
Health behaviors	—	—
Health services access or utilization	2	—
Mental health	—	—
General health	1	—
Mortality	—	—
Other health outcomes	1	—

^a Number of participants unclear in one study (Ajmera 2011¹⁴); articles may be included in more than one category

Rurality

Articles on rurality for engaged and non-engaged Veterans were mostly of medium or low quality, with only 2 being high quality. As in articles examining rurality for Veterans and non-Veterans, these articles used a variety of measures of rurality (eg, MSA,^{14,48,130} self-reported rural/urban residence,^{63,100,113} and RUC codes,^{74,129} Appendix C, Table 4). Additionally, several articles used Rural-Urban Commuting Area (RUCA) codes^{19,40,41} and one assessed straight-line distances between participant homes and the nearest VHA facility.⁹¹ Articles used datasets across 3 decades (1997-2013) and a variety of sources, including large nationally representative surveys, VHA administrative data, and local surveys. In general, articles found small or no difference in the proportion of rural residence between engaged and non-engaged Veterans, with prevalence estimates ranging from 6-26%. For example, one article using 2000 BRFSS data reported 30% of engaged Veterans and 24% of non-Veterans resided in “non-metropolitan” areas (defined by RUC codes).¹²⁹ One article found differences in rural residence (engaged Veterans 18% rural vs non-engaged 28%), but focused exclusively on Native Americans who were enrolled in VHA and the Indian Health Service, and also included non-Veterans in the non-engaged group.⁷⁴ Two articles which were rated high quality both used VHA data, and one used VHA classification of rural vs urban,⁶⁶ and the other employed zipcode-based approximations of RUCA.¹⁹ Hynes et al⁶⁶ compared Veterans who utilized VHA services with those who used services paid by Medicare, finding little difference in rural residence (21% vs 19%). Blackstock et al¹⁹ compared Veterans who used or did not use VHA homeless service, and reported 15% rural residence among those who accessed these services compared with 21% for Veterans who did not.

Only 3 articles investigated the role of rurality in health services access or utilization and/or health outcomes, and all were of medium quality.^{14,129,130} No articles examined the role of rurality in health behaviors (Appendix C Table 4). One article reported no substantial difference

between metropolitan and non-metropolitan participants in proportion having a “checkup” within prior 2 years,¹²⁹ and the other article found significant interaction effects between rural residence and a combined Veteran/VHA user categorical variable (*ie*, non-Veteran, Veteran VHA user, and Veteran non-VHA user) in associations with total healthcare expenditures but did not report the magnitude of the interaction effect.¹³⁰ Both articles examining the role of rurality in health outcomes^{14,129} found no significant effects for rurality; one looked at days of poor physical or mental health or otherwise limited by health,¹²⁹ and the other determined associations with hospitalization for ambulatory-care sensitive conditions (Appendix C, Table 4).¹⁴

Trauma

None of the 6 articles examining trauma exposures for engaged and non-engaged Veterans were rated as being high quality; 3 articles^{100,108,113} were rated as being medium quality. Across all articles, engagement with VHA was based on self-report of whether individuals were current or recent users of VHA services vs past or never users. As with articles comparing Veterans and non-Veterans, a variety of trauma types and measures were studied, with little consistency across studies. One article examined adverse childhood experiences and adult experience of sexual trauma or IPV,⁸¹ 3 articles addressed combat-related trauma and sexual or non-combat related physical trauma specific to military service,^{81,100,108} one article examined history of military sexual assault,⁵² and one article examined Vietnam war-zone service.⁵² One article investigated military trauma related to sexual minority status.¹¹³

Estimates of trauma prevalence were primarily unadjusted and somewhat consistent across articles comparing engaged and non-engaged Veterans, with 5 finding higher prevalence among engaged,^{45,52,81,108,113} and one finding no difference in prevalence between engaged and non-engaged.¹⁰⁰ One article addressed combat trauma, reporting higher prevalence among engaged in unadjusted estimates, but no significant differences in adjusted estimates.¹⁰⁸ Another article examined prevalence of military trauma related to sexual orientation, finding no difference in unadjusted estimates, but positive associations with VHA use in adjusted analyses.¹¹³

SUMMARY AND DISCUSSION

SUMMARY OF EVIDENCE FOR KEY QUESTIONS 1 AND 2

Most articles examining social determinants of health in Veterans and non-Veterans addressed standard sociodemographics, such as education, marital status, income, and employment. Fewer articles addressed other social determinants, including those that were high priority for our operational partners.

Included articles that examined rural residence had wide variation in the definition of rurality, limiting interpretations. However, most articles used nationally representative data and were consistent in reporting little or no differences in proportions of Veterans and non-Veterans who lived in rural settings. Thus, we found moderate strength evidence of no substantial differences in rurality between Veterans and non-Veterans. In contrast, we found insufficient evidence on the effects of rurality on differences in health services utilization, health behaviors, or health outcomes between Veterans and non-Veterans. We identified only 5 articles that pertained to these important questions, and these articles varied in data sources, participant demographics, measures of rurality, analytic strategies, and outcomes examined.

Included articles on trauma examined a wide variety of exposures, including type, timing, and measures used. Overall, we found low strength evidence that there is higher prevalence of trauma exposure among Veterans, as compared with non-Veterans. We found low strength evidence that trauma exposure contributes to differences in prevalence of smoking between Veterans and non-Veterans. While several articles examined these associations,^{27,34,70} only one reported testing for statistical significance of moderating effects (*ie*, interaction between Veteran status and trauma exposure in predicting smoking).⁷⁰ Results from all 3 articles supported an increased effect of trauma in non-Veterans in predicting smoking. Thus, there were consistent associations of current smoking with prior trauma exposure, regardless of whether the type of trauma being assessed was childhood adversity, adult sexual trauma, or physical trauma. In addition, one article also found that childhood adversity mediated associations between Veteran status and smoking and between Veteran status and disability.

Only 2 articles addressed sexual orientation for Veterans and non-Veterans. These included only women, had very different demographics (*eg*, age), and small numbers reporting minority sexual orientation. While one article found a higher proportion of women Veterans identifying as sexual minorities, the other article reported no differences. Thus, we found insufficient evidence on whether there are differences in prevalence of sexual minorities between Veterans and non-Veterans. Only one article assessed the role of sexual minority status on health outcomes, and while it found independent associations between sexual orientation and mortality, the analyses did not examine whether sexual minority status accounted for differences in mortality between Veterans and non-Veterans.

SUMMARY OF EVIDENCE FOR KEY QUESTIONS 3 AND 4

Most articles examining social determinants of health in engaged and non-engaged Veterans included standard sociodemographics, such as education, marital status, income, and employment. Very few articles addressed other social determinants, and we found none that investigated sexual orientation, gender identity, or financial barriers to health care.

Similar to articles that examined rurality among Veterans and non-Veterans, variation in the definition of rurality and participant demographics limit interpretations. However, most articles were consistent in reporting little or no differences in proportions of engaged and non-engaged Veterans who lived in rural settings. We found moderate strength evidence of no substantial differences in rurality between engaged and non-engaged Veterans, but for certain specific services (eg, VHA homeless services), there may be differences in proportion with rural residence. We found insufficient evidence on the effects of rurality on differences in health services utilization, health behaviors, or health outcomes between engaged and non-engaged Veterans. We found only 3 articles that were applicable to any of these questions, and there was variation in data sources, participant demographics, measures of rurality, analytic strategies, and outcomes examined.

Articles addressing trauma exposure for engaged and non-engaged Veterans also examined many types of trauma experienced over different time periods. Overall, we found low strength evidence that there is increased trauma exposure for engaged Veterans, as compared with non-engaged Veterans. Most articles found higher levels of trauma reported among engaged Veterans, compared with non-engaged Veterans, but they were of low or moderate quality.

We identified no articles that addressed the role of trauma exposure in differences in health services access, health behaviors, or health outcomes between engaged and non-engaged Veterans. Similarly, we found no articles that examined sexual orientation or gender identity for engaged and non-engaged Veterans.

LIMITATIONS

We provide an evidence map and qualitative syntheses of results from a subset of articles which addressed high-priority social determinants for our VHA partners. Evidence maps are designed to give a broad overview of the evidence base rather than provide in-depth data analyses and outcome summary estimates. Results from evidence maps are best used to describe areas where research has been conducted and where major gaps exist. Articles were excluded if they did not compare the populations of interest (*ie*, Veteran/non-Veteran, engaged/non-engaged), as it was beyond the scope of this work to compare results for these groups when presented in separate studies. Thus, lack of evidence for any given social determinant and outcome of interest speaks only to whether published studies compared the impacts of social determinants for our groups of interest, and our results do not imply that evidence is lacking for effects of social determinants on health overall or within each of these populations. We limited quality assessment to included articles that examined at least one of the 3 high-priority social determinants (rurality, trauma, and sexual orientation or gender identity). Publication bias may have affected our results if articles were less likely to be published if they found no evidence of differences in social determinants or lack of a role for social determinants on health behaviors, health access, or health outcomes. We acknowledge some variation in defining Veteran status, particularly for articles using data from large national cohorts of the general US population. These cohorts used slightly different questions in describing service in the military (*eg*, US armed forces instead of US military) but were very similar in general. Some excluded individuals in active service (*eg*, NHIS), while others obtained more information about current vs past service (*eg*, BRFSS). WHI was the only dataset that had a time criterion (*ie*, 180 days of active service) for qualifying as a Veteran. Finally, although we aimed to be broad and inclusive in addressing social determinants of health,

we needed to limit the scope and therefore focused our search on social determinants with available measures and of high interest to our VHA partners.

APPLICABILITY AND IMPLICATIONS FOR POLICY AND PRACTICE

Our evidence review directly contributes to several essential strategies for improving VHA services and enhancing Veteran health, as outlined in the Blueprint for Excellence.¹⁴³ For example, the first essential strategy seeks to meet the needs of the most vulnerable Veterans, including those with low socioeconomic status. Other strategies emphasize the personalization of care and promote the delivery of patient-centered care, which requires understanding the contribution of social determinants, particularly regarding implications for tailoring and targeting of VHA services. Our evidence review has demonstrated that the evidence base for social determinants of Veterans health largely mirrors what is known about the general population. Namely, there is a large body of evidence addressing classic socioeconomic factors, but there is a lack of evidence about more recently developed and conceptualized social determinants, such as trauma exposures, sexual orientation, and gender identity. The policy implication of this result is to support development and implementation of consistent, accurate measures of these social determinants for Veterans. This would enable future work to understand the effects of such social determinants on health behaviors, health services utilization, and health outcomes.

In areas where we did not identify sufficient evidence that examined the differential impact of certain social determinants (*eg*, rurality) on our outcomes of interest, for either Veterans compared with non-Veterans or for engaged and non-engaged Veterans, our evidence review provides indirect support for policies that apply knowledge of the effects of these social determinants in the general US population. For example, both Veterans and non-Veterans, and engaged and non-engaged Veterans appear similar in proportions residing in rural settings, and thus, it would be reasonable to use information about challenges to health and health care in rural US communities, to help direct VHA policies addressing health care access for Veterans in rural settings.

In contrast, we found some evidence that trauma exposures may be different between Veterans and non-Veterans, and between engaged and non-engaged Veterans, suggesting that understanding the impacts of trauma on health care utilization and outcomes could help inform VHA policies for current and future service needs. This also highlights the importance of establishing consistent, accurate, and meaningful measures of trauma exposure in VHA data systems, in order to improve outcomes for Veterans now and in the future.

RESEARCH GAPS/FUTURE RESEARCH

This evidence review represents an extensive and thorough examination of available sources of evidence to address the role of a variety of social determinant. In addition to systematic searches of large databases of published articles, we also examined grey literature (*eg*, white papers) associated with nationally representative cohorts and large VA research studies and programs. Because we found no additional substantial contribution from the grey literature, our review provides a guide to the existing peer-reviewed scientific literature that address a variety of important social determinants. Thus, this work enables future evaluations and syntheses of the evidence supporting the role of social determinants in health, beyond the 3 high-priority determinants that we examined in detail. Another important contribution of this evidence review is to identify major gaps in clinical evidence and guide future research to improve care quality,

delivery, and policy. The first major evidence gap is the lack of articles that addressed certain social determinants, such as gender identity; the evidence gap is even greater with regard to the role of social determinants in health care access, health behaviors, and health outcomes. In the context of our main goals to understand social determinants for Veterans and non-Veterans, and engaged and non-engaged Veterans, the ability to conduct research and generate evidence depends on whether these determinants are being assessed by national studies that also characterize Veteran status, or Veteran utilization of and engagement with VHA services. Thus, some of the areas which lack published articles would greatly benefit from inclusion of consistent measures of social determinants and military experience. To that end, it may be easiest to promote the addition of assessments for certain social determinants (*eg*, sexual orientation) to existing national studies that already collect information about Veterans (*eg*, American Community Surveys). To address lack of evidence for social determinants affecting health of Veterans engaged and not engaged in VHA services, we need data sources that provide information on social determinants and non-VHA health care access and utilization for both engaged and non-engaged Veterans. Included articles that examined social determinants have largely used VHA data, in combination with other administrative or health data collected for a limited group (*eg*, Medicare patients or Indian Health Service).

In addition to the major gaps related to lack of existing data, our evidence review brought to light several challenges to understanding the role of social determinants, even when there are published studies. First, in our detailed review of rurality and trauma, we found that measurement diversity led to inconsistent results and interpretation challenges. Past work has also shown that rurality measure variability leads to substantially different estimates of rural residence among Veterans engaged in VHA care.¹⁴⁴ Moreover, measures for both rurality and trauma actually encompass conceptually related but distinct aspects within these broader constructs. Rural communities are not just defined by distance and/or population density, but also by social connections, cultural norms, and attitudes.¹⁴⁵ As we seek to understand the mechanism by which rural Veterans may experience worse health outcomes, so that we can improve those outcomes, we need direct measures of the aspects of rural communities that matter for health. Similarly, although a variety of adverse circumstances and traumatic events could all plausibly affect Veterans' health, if we fail to make conceptually important distinctions between types of trauma, then it will be harder to clearly define relationships and target pathways for improving health outcomes.

Second, it is important to consider that the relationships between Veteran experiences and social determinants are likely bidirectional and dynamic over the lifespan (Figure 1). One example of these complex relationships is with educational status, where education can affect selection into the military and being a Veteran could in turn impact educational attainment (either in the military or after military service).¹⁴⁶ In the modern era of military service without conscription, social determinants may have even stronger effects on who joins the military and their military experiences. For example, one trauma article examined this potential complexity by carefully accounting for differences between “draft era” Veterans and “all volunteer era” Veterans.²² In adjusted analyses using BRFSS data, this article found that the number of ACEs was significantly different between Veterans and non-Veterans in the “all volunteer” period ($p < 0.001$) but not in the draft era ($p = 0.96$). The article also stratified analyses by men and women, finding that the differences in trauma results between these different time periods were mainly in men (who could be drafted before 1973), but not in women (who were never eligible

for conscription). For rurality, it may be that both rural residence in childhood and current rural residence are important for health, but not in the same ways.

Third, a major challenge in this field is to accurately and efficiently identify literature that addresses the questions posed. To refine our scope, we devoted extensive effort to develop conceptual and analytic frameworks to better understand and define the roles of social determinants as they might differentially vary in prevalence or impact among Veterans versus non-Veterans and engaged versus non-engaged Veterans. We used broad search terms to query several databases, and we examined multiple sources of “gray literature.” We searched and screened over 8000 citations, and less than 2% met eligibility criteria. Many studies assessed social determinants but did not provide information on the independent and differential effect or prevalence of social determinants in the populations of interest. We encourage others to review our conceptual and analytic frameworks and provide suggestions for future refinement. Having clear conceptualizations of how social determinants may affect health is central for developing knowledge of causal pathways and understanding the independent role of social determinants in health, healthcare delivery, and healthcare policy for Veterans.

While longitudinal and nationally representative cohort studies would be the ideal design for examining the complex interplay of social determinants of health and Veteran experiences, conceptually clear and innovative analyses of cross-sectional data also have the potential to substantially advance our understanding. Such analyses should address potential selection effects of social determinants and other mechanisms that predate military service, as well as social determinants that are affected by Veteran experiences and may mediate the differences in health after those experiences. To support such work, we need multidisciplinary teams that include content and methodologic experts in the diversity of social determinants, as well as investigators with experience in clinical, operational, and policy settings.

Summary of Major Research Gaps and Recommendations:

- Promote inclusion of consistent and accurate assessments of high-priority social determinants (*eg*, trauma exposures, sexual orientation) for existing or ongoing national datasets that also capture Veteran status.
- Develop new data sources and/or improve ability to link with existing non-VHA data sources, in order to address social determinants and outcomes for Veterans engaged and not engaged in VHA services or benefits.
- Apply measures of social determinants more consistently and whenever possible, provide sufficient detail to address how social determinants may be affecting outcomes.
- Develop and utilize clear conceptual frameworks that guide analytic decisions and interpretation of results.

CONCLUSIONS

While extensive literature addresses education, marital status, income, and/or employment, little published work exists on other social determinants of health (*eg*, trauma and sexual orientation). We found no differences in rural residence between Veterans and non-Veterans, and between engaged and non-engaged Veterans. Trauma exposure among Veterans was higher in engaged

versus non-engaged Veterans. We found insufficient evidence to determine if there are differences in sexual orientation or gender identity between Veterans and non-Veterans or between engaged and non-engaged Veterans. Social determinant knowledge gaps could be addressed by clear conceptual frameworks and innovative analytic strategies, even if limited by using cross-sectional data. Direct standardized measurement of key community characteristics of rural settings and focused assessment of specific types of trauma may be more informative for defining pathways that could be targeted for improving the health of Veterans.

REFERENCES

1. Institute of Medicine. *Capturing social and behavioral domains and measures in electronic health records: Phase 2*. Washington DC: The National Academies Press; 2014.
2. Tarlov AR. Public policy frameworks for improving population health. *Ann NY Acad Sci*. 1999;896(1):281-293.
3. Phelan JC, Link BG, Tehranifar P. Social conditions as fundamental causes of health inequalities: theory, evidence, and policy implications. *J Health Soc Behav*. 2010;51(1 Suppl):S28-S40.
4. Marmot MG, Shipley MJ, Rose G. Inequalities in death—specific explanations of a general pattern? *Lancet*. 1984;323(8384):1003-1006.
5. Marmot MG, Stansfeld S, Patel C, et al. Health inequalities among British civil servants: the Whitehall II study. *Lancet*. 1991;337(8754):1387-1393.
6. Adler NE, Stewart J. Health disparities across the lifespan: meaning, methods, and mechanisms. *Ann NY Acad Sci*. 2010;1186:5-23.
7. Bragge P, Clavisi O, Turner T, Tavender E, Collie A, Gruen RL. The Global Evidence Mapping Initiative: scoping research in broad topic areas. *BMC Med Res Methodol*. 2010;11:92.
8. Ryan RE, Kaufman CA, Hill SJ. Building blocks for meta-synthesis: data integration tables for summarising, mapping, and synthesising evidence on interventions for communicating with health consumers. *BMC Med Res Methodol*. 2009;9:16.
9. MacArthur Foundation. *Research Network on Socioeconomic Status & Health*. Available at: <https://www.macfound.org/networks/research-network-on-socioeconomic-status-health/>, Accessed 20 September 2017.
10. Kondo K, Low A, Everson T, et al. *Prevalence of and Interventions to Reduce Health Disparities in Vulnerable Veteran Populations: A Map of the Evidence*. VA Evidence-based Synthesis Program Report, 2017. Available at <https://www.hsrd.research.va.gov/publications/esp/DisparitiesInterventions.pdf>, Accessed 20 September 2017.
11. Teachman J. Are veterans healthier? Military service and health at age 40 in the all-volunteer era. *Soc Sci Res*. 2011;40:326-335.
12. Owens DK, Lohr KN, Atkins D, et al. AHRQ series paper 5: grading the strength of a body of evidence when comparing medical interventions—Agency for Healthcare Research and Quality and the Effective Health-Care Program. *J Clin Epidemiol*. 2010;63(5):513-523.
13. Abraham KM, Ganoczy D, Yosef M, Resnick SG, Zivin K. Receipt of employment services among Veterans Health Administration users with psychiatric diagnoses. *J Rehabil R D*. 2014;51(3):401-414.

14. Ajmera M, Wilkins TL, Sambamoorthi U. Dual Medicare and Veteran Health Administration use and ambulatory care sensitive hospitalizations. *J Gen Intern Med.* 2011;26(Suppl 2):669-675.
15. Baldwin CM, Long K, Kroesen K, Brooks AJ, Bell IR. A profile of military Veterans in the southwestern United States who use complementary and alternative medicine. *Arch Intern Med.* 2002;162(15):1697-1704.
16. Bareis N, Mezuk B. The relationship between childhood poverty, military service, and later life depression among men: evidence from the Health and Retirement Study. *J Affect Disord.* 2016;206:1-7.
17. Barrera TL, Cully JA., Amspoker AB, et al.. Cognitive-behavioral therapy for late-life anxiety: Similarities and differences between Veteran and community participants. *J Anxiety Disord.* 2015;33:72-80.
18. Bastian LA, Gray KE, DeRycke E, et al. Differences in active and passive smoking exposures and lung cancer incidence between Veterans and non-Veterans in the Women's Health Initiative. *Gerontologist.* 2016;56:S102-S111.
19. Blackstock OJ, Haskell SG., Brandt CA, Desai RA. Gender and the use of veterans health administration homeless services programs among Iraq/Afghanistan veterans. *Med Care.* 2012;50(4):347-352.
20. Blosnich J, Foyne MM, Shipherd JC. Health disparities among sexual minority women veterans. *J Womens Health.* 2013;22(7):631-636.
21. Blosnich J, Bossarte R, Silver E, Silenzio V. Health care utilization and health indicators among a national sample of US veterans in same-sex partnerships. *Mil Med.* 2013;178(2):207-212.
22. Blosnich JR, Dichter ME, Cerulli C, Batten SV, Bossarte RM. Disparities in adverse childhood experiences among individuals with a history of military service. *JAMA Psychiatry.* 2014;71(9):1041-1048.
23. Bohnert ASB, Ilgen MA, Bossarte RM, Britton PC, Chermack ST, Blow FC. Veteran status and alcohol use in men in the United States. *Mil Med.* 2012;177(2):98-203.
24. Bookwala J, Frieze IH, Grote N. The long-term effects of military service on quality of life: The Vietnam experience. *J Appl Soc Psychol.* 1994;24(6):529-545.
25. Boscarino JA, Sitarik A, Gordon SC, et al. Risk factors for hepatitis C infection among Vietnam era veterans versus nonveterans: results from the Chronic Hepatitis Cohort Study (CHeCS). *J Community Health.* 2014;39(5):914-921.
26. Brown C, Routon PW. Military service and the civilian labor force: time- and income-based evidence. *Armed Forces Soc.* 2016;42(3):562-584.

27. Cerulli C, Bossarte RM, Dichter ME. Exploring intimate partner violence status among male veterans and associated health outcomes. *Am J Mens Health*. 2014;8(1):66-73.
28. Chi RC, Reiber GE, Neuzil KM. Influenza and pneumococcal vaccination in older veterans: results from the behavioral risk factor surveillance system. *J Am Geriatr Soc*. 2006;54(2):217-223.
29. Cordray SM, Polk KR, Britton BM. Premilitary antecedents of post-traumatic stress disorder in an Oregon cohort. *J Clin Psychol*. 1992;48(3):271-280.
30. Cowper DC, Longino CF, Kubal JD, Manheim LM, Dienstfrey SJ, Palmer JM. The retirement migration of US Veterans, 1960, 1970, 1980, and 1990. *J Appl Gerontol*. 2000;19:123-137.
31. Culp R, Youstin TJ, Englander K, Lynch J. From war to prison: examining the relationship between military service and criminal activity. *Justice Q*. 2013;30(4):651-680.
32. Currier JM, McDermott RC, Sims BM. Patterns of help-seeking in a national sample of student veterans: A matched control group investigation. *Gen Hosp Psychiatry*. 2016;43:58-62.
33. De Luca SM, Blossnich JR, Hentschel EAW, King E, Amen S. Mental health care utilization: how race, ethnicity and veteran status are associated with seeking help. *Community Ment Health J*. 2016;52(2):174-179.
34. Dichter ME, Cerulli C, Bossarte RM. Intimate partner violence victimization among women veterans and associated heart health risks. *Womens Health Issues*. 2011;21(4 Suppl):S190-S194..
35. Dunne EM, Burrell LE, Diggins AD, Whitehead NE, Latimer WW. Increased risk for substance use and health-related problems among homeless veterans. *Am J Addict*. 2015;24(7):676-680.
36. Dursa EK, Bart SK, Bossarte RM, Schneiderman AI. Demographic, military, and health characteristics of VA health care users and nonusers who served in or during Operation Enduring Freedom or Operation Iraqi Freedom, 2009-2011. *Public Health Rep*. 2016;131(6):839-843.
37. Elder GH, Shanahan MJ, Clipp EC. When war comes to men's lives: life-course patterns in family, work, and health. *Psychol Aging*. 1994;9(1):5-16.
38. Elhai JD, Frueh BC, Gold PB, Gold SN, Hamner MB. Clinical presentations of posttraumatic stress disorder across trauma populations: A comparison of MMPI-2 profiles of combat veterans and adult survivors of child sexual abuse. *J Nerv Ment Dis*. 2000;188(10):708-713.
39. Faestel PM, Littell CT, Vitiello MV, Forsberg CW, Littman AJ. Perceived insufficient rest or sleep among veterans: Behavioral Risk Factor Surveillance System 2009. *J Clin Sleep Med*. 2013;9(6):577-584.

40. French DD, Margo CE. Factors associated with the utilization of cataract surgery for veterans dually enrolled in Medicare. *Mil Med.* 2012;177(6):752-756.
41. French DD, Bradham DD, Campbell RR, et al. Factors associated with program utilization of radiation therapy treatment for VHA and medicare dually enrolled patients. *J Community Health.* 2012;37(4):882-887.
42. Fulton LV, Belote JM, Brooks MS, Coppola MN. A comparison of disabled veteran and nonveteran income: time to revise the law? *J Disabil Policy Stud.* 2009;20(3):184-191.
43. Gabrielian S, Yuan AH, Andersen RM, Rubenstein LV, Gelberg L. VA health service utilization for homeless and low-income veterans: a spotlight on the VA Supportive Housing (VASH) program in greater Los Angeles. *Med Care.* 2014;52(5):454-461.
44. Gabrielian S, Burns AV, Nanda N, Hellemann G, Kane V, Young AS. Factors associated with premature exits from supported housing. *Psychiatr Serv.* 2016;67(1):86-93.
45. Gamache G, Rosenheck RA, Tessler R. Factors predicting choice of provider among homeless veterans with mental illness. *Psychiatr Serv.* 2000;51(8):1024-1028.
46. Gamache G, Rosenheck R, Tessler R. The proportion of veterans among homeless men: a decade later. *Soc Psychiatry Psychiatr Epidemiol.* 2001;36(10):481-485.
47. Gfeller JD, Roskos PT. A comparison of insufficient effort rates, neuropsychological functioning, and neuropsychiatric symptom reporting in military veterans and civilians with chronic traumatic brain injury. *Behav Sci Law.* 2013;31(6):833-849.
48. Gorman LA, Sripada RK, Ganoczy D, et al. Determinants of National Guard mental health service utilization in VA versus non-VA settings. *Health Serv Res.* 2016;51(5):1814-1837.
49. Gould CE, Rideaux T, Spira AP, Beaudreau SA. Depression and anxiety symptoms in male veterans and non-veterans: The Health and Retirement study. *Int J Geriatr Psychiatry.* 2015;30(6):623-630.
50. Greenberg GA, Rosenheck RA, Desai RA. Risk of Incarceration among male veterans and nonveterans: are veterans of the all volunteer force at greater risk? *Armed Forces Soc.* 2007;33(3):337-350.
51. Grossbard JR, Lehavot K, Hoerster KD, Jakupcak M, Seal KH, Simpson TL. Relationships among veteran status, gender, and key health indicators in a national young adult sample. *Psychiatr Serv.* 2013;64(6):547-553.
52. Hamilton AB, Frayne SM, Cordasco KM, Washington DL. Factors related to attrition from VA healthcare use: findings from the National Survey of Women Veterans. *J Gen Intern Med.* 2013;28(Suppl 2):510-516.
53. Hammett P, Fu SS, Lando HA, Owen G, Okuyemi KS. The association of military discharge variables with smoking status among homeless Veterans. *Prev Med.* 2015;81:275-280.

54. Hardy MA, Reyes AM. The longevity legacy of World War II: the intersection of GI status and mortality. *Gerontologist*. 2016;56(1):104-114.
55. Hartley TA, Violanti JM, Mnatsakanova A, Andrew ME, Burchfiel CM. Military experience and levels of stress and coping in police officers. *Int J Emerg Ment Health*. 2013;15(4):229-239.
56. Hedrick B, Pape TL, Heinemann AW, Ruddell JL, Reis J. Employment issues and assistive technology use for persons with spinal cord injury. *J Rehabil R D*. 2006;43(2):185-198.
57. Henderson C, Bainbridge J, Keaton K, Kenton M, Guz M, Kanis B. The use of data to assist in the design of a new service system for homeless veterans in New York City. *Psychiatr Q*. 2008;79(1):3-17.
58. Heslin KC, Guerrero EG, Mitchell MN, Afable MK, Dobalian A. Explaining differences in hepatitis C between US veterans and nonveterans in treatment for substance abuse: results from a regression decomposition. *Subst Use Misuse*. 2013;48(10):854-862.
59. Hisnanick JJ. Changes over time in the ADL status of elderly US veterans. *Age Ageing*. 1994;23(6):505-511.
60. Hoerster KD, Lehavot K, Simpson T, McFall M, Reiber G, Nelson KM. Health and health behavior differences: US Military, veteran, and civilian men. *Am J Prev Med*. 2012;43(5):483-489.
61. Hoff RA, Rosenheck RA. The use of VA and non-VA mental health services by female veterans. *Med Care*. 1998;36(11):1524-1533.
62. Hoglund MW, Schwartz RM. Mental health in deployed and nondeployed veteran men and women in Comparison with their civilian counterparts. *Mil Med*. 2014;179(1):19-25.
63. Houston TK, Volkman JE, Feng H, Nazi KM, Shimada SL, Fox S. Veteran Internet use and engagement with health information online. *Mil Med*. 2013;178(4):394-400.
64. Howren MB, Cai X, Rosenthal G, Vander Weg MW. Associations of health-related quality of life with healthcare utilization status in veterans. *Appl Res Qual Life*. 2012;7(1):83-92.
65. Hoy-Ellis CP, Shiu C, Sullivan KM, Kim H-J, Sturges AM, Fredriksen-Goldsen KI. Prior military service, identity stigma, and mental health among transgender older adults. *Gerontologist*. 2017;57(Suppl 1):S63-S71.
66. Hynes DM, Koelling K, Stroupe K, et al. Veterans' access to and use of Medicare and Veterans Affairs health care. *Med Care*. 2007;45(3):214-223.
67. Johnson AM, Rose KM, Elder GH, Chambless LE, Kaufman JS, Heiss G. Military combat and burden of subclinical atherosclerosis in middle aged men: the ARIC study. *Prev Med*. 2010;50:277-281.

68. Johnson AM, Rose KM, Elder GH, Chambless LE, Kaufman JS, Heiss G. Military combat and risk of coronary heart disease and ischemic stroke in aging men: The Atherosclerosis Risk in Communities (ARIC) study. *Ann Epidemiol.* 2010;20(2):143-150.
69. Kaplan MS, Huguot N, McFarland BH, Newsom JT. Suicide among male veterans: a prospective population-based study. *J Epidemiol Community Health.* 2007;61(7):619-624.
70. Katon JG, Lehavot K, Simpson T, et al. Adverse childhood experiences, military service, and adult health. *Am J Prev Med* 2015;49(4):573-582.
71. Kleykamp M. Unemployment, earnings and enrollment among post 9/11 veterans. *Soc Sci Res.* 2013;42(3):836-851.
72. Koepsell T, Reiber G, Simmons KW. Behavioral risk factors and use of preventive services among veterans in Washington State. *Prev Med.* 2002;35(6):557-562..
73. Koepsell TD, Littman AJ, Forsberg CW. Obesity, overweight, and their life course trajectories in veterans and non-veterans. *Obesity.* 2012;20(2):434-439.
74. Kramer BJ, Wang M, Jouldjian S, Lee ML, Finke B, Saliba D. Veterans Health Administration and Indian Health Service: healthcare utilization by Indian Health Service enrollees. *Med Care.* 2009;47(6):670-676.
75. Kramer BJ, Jouldjian S, Wang M et al.. Do correlates of dual use by American Indian and Alaska Native veterans operate uniformly across the Veterans Health Administration and the Indian Health Service? *J Gen Intern Med.* 2011;26(Suppl 2):662-668.
76. LaCroix AZ, Rillamas-Sun E, Woods NF, et al. Aging well among women Veterans compared with non-Veterans in the Women's Health Initiative. *Gerontologist.* 2016;56(Suppl 1):S14-S26.
77. Laudet A, Timko C, Hill T. Comparing life experiences in active addiction and recovery between veterans and non-veterans: a national study. *J Addict Dis.* 2014;33(2):148-162.
78. LaVela SL, Prohaska TR, Furner S, Weaver FM. Preventive healthcare use among males with multiple sclerosis. *Public Health.* 2012;126(10):896-903.
79. Lehavot K, Hoerster KD, Nelson KM, Jakupcak M, Simpson TL. Health indicators for military, veteran, and civilian women. *Am J Prev Med.* 2012;42(5):473-480.
80. Lehavot K, Katon JG, Williams EC, et al. Sexual behaviors and sexually transmitted infections in a nationally representative sample of women veterans and nonveterans. *J Womens Health.* 2014;23(3):246-252.
81. Lehavot K, O'Hara R, Washington DL, Yano EM, Simpson TL. Posttraumatic stress disorder symptom severity and socioeconomic factors associated with Veterans Health Administration use among women veterans. *Womens Health Issues.* 2015;25(5):535-541.
82. Lehavot K, Rillamas-Sun E, Weitlauf J, et al. Mortality in postmenopausal women by sexual orientation and veteran status. *Gerontologist.* 2016;56(Suppl 1):S150-S162.

83. Little RD, Fredland JE. Veteran status, earnings, and race: some long term results. *Armed Forces Soc.* 1979;5(2):244-260.
84. London AS, Heflin CM, Wilmoth JM. Work-related disability, veteran status, and poverty: implications for family well-being. *J Poverty.* 2011;15(3):330-349.
85. Long JA, Polsky D, Asch DA. Receipt of health services by low-income veterans. *J Health Care Poor Underserved.* 2003;14(3):305-317.
86. Lopreato SC, Poston DL. Differences in earnings and earnings ability between black veterans and nonveterans in the United States. *Soc Sci Q.* 1977;57(4):750-766.
87. MacLean A. Lessons from the cold war: military service and college education. *Sociol Educ.* 2005;78(3):250-266.
88. MacLean A, Kleykamp M. Income inequality and the veteran experience. *Ann Am Acad Pol Soc Sci.* 2016;663:99-116.
89. Marrie RA, Cutter G, Tyry T, Campagnolo D, Vollmer T. Differences in bladder care for veterans with multiple sclerosis by treatment location. *Int J MS Care.* 2009;11(2):91-97.
90. Martindale M, Poston DL. Variations in veteran/nonveteran earnings patterns among World War II, Korea, and Vietnam War cohorts. *Armed Forces Soc.* 1979;5(2):219-243.
91. McCarthy JF, Valenstein M, Dixon L, Visnic S, Blow FC, Slade E. Initiation of assertive community treatment among veterans with serious mental illness: client and program factors. *Psychiatr Serv.* 2009;60(2):196-201.
92. McCaskill GM, Sawyer P, Burgio KL, et al. The impact of veteran status on life-space mobility among older black and white men in the deep south. *Ethn Dis.* 2015;25(3):255-262.
93. McCauley HL, Blosnich JR, Dichter ME. Adverse childhood experiences and adult health outcomes among veteran and non-veteran women. *J Womens Health.* 2015;24(9):723-729.
94. McLay RN, Lyketsos CG. Veterans have less age-related cognitive decline. *Mil Med.* 2000;165(8):622-625.
95. Murdoch M, Sayer NA, Spont M, et al. Long-term outcomes of disability benefits in US veterans with posttraumatic stress disorder. *Arch Gen Psychiatry.* 2011;68(10):1072-1080.
96. Naifeh JA, North TC, Davis JL, Reyes G, Logan CA, Elhai JD. Clinical profile differences between PTSD-diagnosed military veterans and crime victims. *J Trauma Dissociation.* 2008;9(3):321-334.
97. Nelson KM. The burden of obesity among a national probability sample of veterans. *J Gen Intern Med.* 2006;21(9):915-919.
98. Nyamathi A, Sands H, Pattatucci-Aragón A, et al. Perception of health status by homeless US veterans. *Fam Community Health.* 2004;27(1):65-74.

99. O'Donnell JC. Military service and mental health in later life. *Mil Med.* 2000;165(3):219-223.
100. Ouimette P, Wolfe J, Daley J, G K. Use of VA health care services by women veterans: findings from a national sample. *Women Health.* 2003;38(2):77-91.
101. Padula CB, Weitlauf JC, Rosen AC, et al. Longitudinal cognitive trajectories of women veterans from the Women's Health Initiative Memory Study. *Gerontologist.* 2016;56(1):115-125.
102. Petrovich JC, Pollio DE, North CS. Characteristics and service use of homeless veterans and nonveterans residing in a low-demand emergency shelter. *Psychiatr Serv.* 2014;65(6):751-757.
103. Phillips BR, Shahoumian TA, Backus LI. Surveyed enrollees in veterans affairs health care: How they differ from eligible veterans surveyed by BRFSS. *Mil Med.* 2015;180(11):1161-1169.
104. Prokos A, Padavic I. Earn all that you can earn: income differences between women veterans and non-veterans. *J Polit Mil Soc.* 2000;28(1):60-74.
105. Randall M, Kilpatrick KE, Pendergast JF, Jones KR, Vogel B. Differences in patient characteristics between Veterans Administration and community hospitals. *Med Care.* 1987;25(11):1099-1104.
106. Rosenheck R, Koegel P. Characteristics of veterans and nonveterans in three samples of homeless men. *Hosp Community Psychiatry.* 1993;44(9):858-863.
107. Rosenheck R, Frisman L, Chung A-M. The proportion of veterans among homeless men. *Am J Public Health.* 1994;84(3):466-469.
108. Ryan ET, McGrath A, Creech SK, Borsari B. Predicting utilization of healthcare services in the Veterans Health Administration by returning women veterans: the role of trauma exposure and symptoms of posttraumatic stress. *Psychol Serv.* 2015;12(4):412-419.
109. Saban KL, Bryant FB, Reda DJ, Stroupe KT, Hynes DM. Measurement invariance of the kidney disease and quality of life instrument (KDQOL-SF) across veterans and non-veterans. *Health Qual Life Outcomes.* 2010;8:120.
110. Sayer NA, Orazem RJ, Noorbaloochi S, et al. Iraq and Afghanistan War veterans with reintegration problems: differences by Veterans Affairs healthcare user status. *Adm Policy Ment Health.* 2015;42(4):493-503.
111. Schultz JR, Bell KM, Naugle AE, Polusny MA. Child sexual abuse and adulthood Sexual assault among military veteran and civilian women. *Mil Med.* 2006;171(8):723-728.
112. Shen C, Sambamoorthi U. Associations between health-related quality of life and financial barriers to care among women veterans and women non-veterans. *Women Health.* 2012;52(1):1-17.

113. Simpson TL, Balsam KF, Cochran BN, Lehavot K, Gold SD. Veterans administration health care utilization among sexual minority veterans. *Psychol Serv*. 2013;10(2):223-232.
114. Smith I, Marsh K, Segal DR. The World War II veteran advantage? a lifetime cross-sectional study of social status attainment. *Armed Forces Soc*. 2012;38(1):5-26.
115. Smith RW, Young HH. Symptom patterns of psychiatrically diagnosed veterans who request treatment and those who do not. *Psychol Rep*. 1968;22(3):1001-1005.
116. Sparks PJ, Bollinger M. A demographic profile of obesity in the adult and veteran US populations in 2008. *Popul Res Policy Rev*. 2011;30(3):211-233.
117. Teachman J. Military service in the Vietnam era and educational attainment. *Sociol Educ* 2005;78(1):60-68.
118. Teachman JD, Call VRA. The effect of military service on educational, occupational, and income attainment. *Soc Sci Res*. 1996;25(1):1-31.
119. Tessler R, Rosenheck R, Gamache G. Comparison of homeless veterans with other homeless men in a large clinical outreach program. *Psychiatr Q*. 2002;73(2):109-119.
120. Tessler R, Rosenheck R, Gamache G. Homeless veterans of the all-volunteer force: a social selection perspective. *Armed Forces Soc*. 2003;29(4):509-524.
121. Tran TV, Canfield J, Chan K. The association between unemployment status and physical health among veterans and civilians in the United States. *Soc Work Health Care*. 2016;55(9):720-731.
122. Tsai J, Mares AS, Rosenheck RA. Do homeless veterans have the same needs and outcomes as non-veterans? *Mil Med*. 2012;177(1):27-31.
123. Tsai J, Mota NP, Pietrzak RH. US Female veterans who do and do not rely on VA health care: needs and barriers to mental health treatment. *Psychiatr Serv*. 2015;66(11):1200-1206.
124. Vinokur A, Caplan RD, Williams CC. Effects of recent and past stress on mental health: coping with unemployment among Vietnam veterans and nonveterans. *J Appl Soc Psychol*. 1987;17(8):710-730.
125. Vollmer TL, Hadjimichael O, Preiningerova J, Ni W, Buenconsejo J. Disability and treatment patterns of multiple sclerosis patients in United States: a comparison of veterans and nonveterans. *J Rehabil R D*. 2002;39(2):163-174.
126. Washington DL, Yano EM, Simon B, Sun S. To use or not to use. what influences why women veterans choose VA health care. *J Gen Intern Med*. 2006;21(Suppl 3):S11-S18.
127. Washington DL, Gray K, Hoerster KD, et al. Trajectories in physical activity and sedentary time among women veterans in the Women's Health Initiative. *Gerontologist*. 2016;56(Suppl 1):S27-S39.

128. Washington DL, Bird CE, LaMonte MJ, et al. Military generation and its relationship to Mortality in women veterans in the Women's Health Initiative. *Gerontologist*. 2016;56(Suppl 1):S126-S137.
129. West A, Weeks WB. Physical and mental health and access to care among nonmetropolitan Veterans Health Administration patients younger than 65 years. *J Rural Health*. 2006;22(1):9-16.
130. West AN, Weeks WB. Health care expenditures for urban and rural veterans in Veterans Health Administration care. *Health Serv Res*. 2009;44(5 Pt 1):1718-1734.
131. White MD, Mulvey P, Fox AM, Choate D. A hero's welcome? Exploring the prevalence and problems of military veterans in the arrestee population. *Justice Q*. 2012;29(2):258-286.
132. White R, Barber C, Azrael D, Mukamal KJ, Miller M. History of military service and the risk of suicidal ideation: findings from the 2008 National Survey on Drug Use and Health. *Suicide LifeThreat Behav*. 2011;41(5):554-561.
133. Whiteman SD, Barry AE, Mroczek DK, Macdermid Wadsworth S. The development and implications of peer emotional support for student service members/veterans and civilian college students. *J Couns Psychol*. 2013;60(2):265-278.
134. Widome R, Laska MN, Gulden A, Fu SS, Lust K. Health risk behaviors of Afghanistan and Iraq war veterans attending college. *Am J Health Promot*. 2011;26(2):101-108.
135. Williams BA, McGuire J, Lindsay RG, et al. Coming home: health status and homelessness risk of older pre-release prisoners. *J Gen Intern Med*. 2010;25(10):1038-1044.
136. Wilmoth JM, London AS, Heflin CM. Economic well-being among older-adult households: variation by veteran and disability status. *J Gerontol Soc Work*. 2015;58(4):399-419.
137. Winkleby MA, Fleshin D. Physical, addictive, and psychiatric disorders among homeless veterans and nonveterans. *Public Health Rep*. 1993;108(1):30-36.
138. Wittrock S, Ono S, Stewart K, Reisinger HS, Charlton M. Unclaimed health care benefits: a mixed-method analysis of rural veterans. *J Rural Health*. 2015;31(1):35-46.
139. Wong ES, Wang V, Liu C-F, Hebert PL, Maciejewski ML. Do Veterans Health Administration enrollees generalize to other populations? *Med Care Res Rev*. 2016;73(4):493-507.
140. Zemencuk JK, Hayward RA, Skarupski KA, Katz SJ. Patients' desires and expectations for medical care: a challenge to improving patient satisfaction. *Am J Med Qual*. 1999;14(1):21-27.
141. Smith DL. The relationship of disability and employment for veterans from the 2010 Medical Expenditure Panel Survey (MEPS). *Work*. 2015;51(2):349-363.
142. Bernard DM, Selden TM. Access to care among nonelderly Veterans. *Med Care*. 2016;54(3):243-252.

143. Department of Veterans Affairs. *Blueprint for Excellence: Veterans Health Administration*. Available at: https://www.va.gov/health/docs/vha_blueprint_for_excellence.pdf, Accessed 20 September 2017.
144. Berke EM, West AN, Wallace AE, Weeks WB. Practical and policy implications of using different rural-urban classification systems: A case study of inpatient service utilization among Veterans Administration users. *J Rural Health*. 2009;25(3):259-266.
145. Hartley D. Rural health disparities, population health, and rural culture. *Am J Public Health*. 2004;94(10):1675-1678.
146. Wang L, Elder GH, Spence NJ. Status configurations, military service and higher education. *Soc Forces*. 2012;91(2):397-422.