REVIEWS

Evidence Review—Social Determinants of Health for Veterans

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BACKGROUND: Veterans Health Administration (VHA) is committed to providing high-quality care and addressing health disparities for vulnerable Veterans. To meet these goals, VA policymakers need guidance on how to address social determinants in operations planning and day-to-day clinical care for Veterans.

METHOD: MEDLINE (OVID), CINAHL, PsycINFO, and Sociological Abstracts were searched from inception to January 2017. Additional articles were suggested by peer reviewers and/or found through search of work associated with US and VA cohorts. Eligible articles compared Veterans vs non-Veterans, and/or Veterans engaged with those not engaged in VA healthcare. Our evidence maps summarized study characteristics, social determinant(s) addressed, and whether health behaviors, health services utilization, and/or health outcomes were examined. Qualitative syntheses and quality assessment were performed for articles on rurality, trauma exposure, and sexual orientation.

RESULTS: We screened 7242 citations and found 131 eligible articles—99 compared Veterans vs non-Veterans, and 40 included engaged vs non-engaged Veterans. Most articles were cross-sectional and addressed socioeconomic factors (e.g., education and income). Fewer articles addressed rurality ($N = 20$), trauma exposure ($N = 17$), or sexual orientation ($N = 2$); none examined gender identity. We found no differences in rural residence between Veterans and non-Veterans, nor between engaged and non-engaged Veterans (moderate strength evidence). There was insufficient evidence for role of rurality in health behaviors, health services utilization, or health outcomes. Trauma exposures, including from events preceding military service, were more prevalent for Veterans vs non-Veterans and for engaged vs non-engaged Veterans (low-strength evidence); exposures were associated with smoking (low-strength evidence).

DISCUSSION: Little published literature exists on some emerging social determinants. We found no differences in rural residence between our groups of interest, but trauma exposure was higher in Veterans (vs non-Veterans) and engaged (vs non-engaged). We recommend consistent measures for social determinants, clear conceptual frameworks, and analytic strategies that account for the complex relationships between social determinants and health.

KEY WORDS: vulnerable populations; socioeconomic factors; population health.

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INTRODUCTION

Social determinants of health, especially those factors which define socioeconomic status (e.g., education and income), substantially influence health outcomes and healthcare utilization across the lifecourse, contributing to health disparities for disadvantaged groups.[1–7] While acknowledging the importance of social determinants for population health, healthcare organizations and providers need guidance on how to assess and incorporate social determinants into policy, operations planning, and day-to-day clinical care.[1, 8]

Veterans Health Administration (VHA) is committed to providing high-quality care and addressing disparities in health outcomes for vulnerable Veterans.[9, 10] VHA Office of Patient Care Services—Population Health Services, and VHA Office of Rural Health (hereafter, VHA partners) requested an evidence review of social determinants of health for Veterans, to help develop policy for healthcare services which may be influenced by social determinants. Veterans enrolled in VHA services are more medically complex, have lower physical and mental health functioning, and have lower socioeconomic resources, as compared with either non-Veterans or Veterans not engaged in VHA care.[11–13] Our VHA partners were especially interested in understanding whether certain social determinants may help explain differences in health outcomes between Veterans and

non-Veterans, or between certain groups of Veterans (e.g., engaged or not engaged in VHA services).

Here, we present results from a larger evidence report[14] prepared by the VA Evidence-based Synthesis Program (ESP) in response to our VHA partners, as noted above. We first developed evidence maps [15, 16] to describe the existing literature on how social determinants may contribute to differences in health behaviors, health services utilization, and health outcomes for Veterans vs non-Veterans, and Veterans engaged vs non-engaged in VHA care. We used these maps to engage our VHA partners in a prioritization process, leading to the selection of four high-priority social determinants for more detailed review and qualitative syntheses—rurality, trauma exposure, sexual orientation, and gender identity.

METHODS

The protocol for this evidence review is registered at PROSPERO, no. CRD42017060165.[17]

Conceptual Frameworks and Key Questions

In collaboration with our VHA partners, we developed conceptual and analytic frameworks of the relationships between social determinants, Veteran experiences, health behaviors, health services utilization, and health outcomes (online Appendix Figure and[14]). We reviewed prior work from the MacArthur Research Network on Socioeconomic Status and Health[18] and the Institute of Medicine (now National Academy of Medicine).[1] We also considered whether particular social determinants were more likely relevant for Veterans' health. We were primarily concerned with social determinants as mediators of the effects of Veteran experiences, but recognized at the outset that there may not be many studies which used appropriate analytic tests of mediation. Therefore, we planned to include articles that only compared prevalence, levels, and/or characteristics of social determinants between our groups of interest (e.g., Veterans vs. non-Veterans), as these may still indicate whether certain social determinants are particularly important for VHA policy and deserve further attention from VHA research. We developed the following key questions (KQ):

KQ1 and KQ2—For Veterans compared with non-Veterans, are there differences in prevalence and/or characteristics of social determinants (KQ1), and does such variation account for differences in health behaviors, health services utilization, and/or health outcomes (KQ2)?

KQ3 and KQ4—For engaged (i.e., enrolled in or utilizing categories of VHA services or benefits) compared with non-engaged Veterans, are there differences in prevalence and/or characteristics of social determinants (KQ3), and does such variation account for differences in health behaviors, health services utilization, and/or health outcomes (KQ4)?

Search Strategy and Article Selection

MEDLINE (OVID), CINAHL, PsycINFO, and Sociological Abstracts were searched from the date of inception to January 2017 (see online Appendix Table 1 and[14] for detailed search strategies). We also included references (1) referred by expert peer reviewers; (2) associated with large national observational cohorts or cross-sectional surveys (e.g., American Community Survey); and (3) associated with large VA studies and programs (e.g., National Center for Veterans Analysis and Statistics). We considered gray literature (e.g., white papers and presentations), but found this did not add substantially to evidence from peer-reviewed, published articles; moreover, these sources frequently lacked sufficient information to assess quality. We also conducted a MEDLINE search with the same terms for Veterans and social determinants, but targeted to clinical trials instead of other study designs. We thought it unlikely that controlled clinical trials would address social determinants, but we carried out this additional search for completeness.

Citation/abstract screening was undertaken by 1–2 independent reviewers, with exclusion requiring consensus of both reviewers. Two independent reviewers conducted full-text review and discrepancies were resolved by discussion or referred to a third reviewer. Eligible English-language articles met the following criteria: (1) compared Veterans vs non-Veterans, and/or engaged vs non-engaged Veterans; (2) addressed at least one social determinant; (3) ≥ 100 participants; and (4) had eligible study design (e.g., cohort or cross-sectional study) (see Online Appendix Table 2 for detailed criteria). We also required valid comparison groups for social determinants (e.g., rural and non-rural participants); studies with only participants sharing a social determinant (e.g., all rural residents) were not considered as addressing comparisons for that social determinant.

We performed citation/abstract screening, full-text review, and data abstraction in DistillerSR, (https://www.evidence-partners.com/products/distillersr-systematic-review-software/ accessed 5 July 2017).

Data Abstraction, Quality Assessment, and Qualitative Synthesis

Evidence maps: For all included articles ($N = 131$), we abstracted study design (e.g., cross-sectional or cohort); social determinants addressed; and whether analyses examined the role of social determinants in health behaviors, health services utilization, or health outcomes of interest.

Focused review and qualitative synthesis: For articles ($N = 37$) which investigated at least one of the four selected social determinants (i.e., rurality, trauma exposure, sexual orientation, and gender identity), we additionally abstracted data source(s); participant number and demographics; measure(s) of social determinant(s); the prevalence, degree, or level of social determinant(s) for the groups of interest (i.e., Veterans and non-

Veterans, and/or engaged and non-engaged Veterans); and, if provided, the role of social determinants in health behaviors, health services utilization, and/or health outcomes. One reviewer completed data abstraction with verification by a second reviewer. Discrepancies were resolved by discussion between reviewers.

Two reviewers independently conducted quality assessments of included articles, with discrepancies resolved by discussion. We considered the following elements related to study quality:

(1) Representativeness and coverage (i.e., nationally representative sample, recruitment and selection, and concerns about missing data)
(2) Measurement (i.e., social determinants and outcomes assessed in similar manner for groups being compared and using standardized measures)
(3) Funding source (i.e., potential for bias).

Given substantial heterogeneity of published articles and very limited evidence addressing these social determinants, quantitative synthesis was not appropriate. We rated overall strength of evidence as high, moderate, low, or insufficient, per Owens et al.[19] We considered precision (degree of certainty in estimates), consistency (direction of differences across included articles), directness (whether evidence links social determinants directly to outcomes of interest), and individual article quality (as described above).

RESULTS

Evidence Map

We screened 7242 abstracts, full-text reviewed 456 articles, and included 131 eligible articles (Fig. 1).[20–150] Overall, most articles addressed classic socioeconomic factors, such as education, income, and employment; a substantial number of these articles examined the role of these factors in health outcomes, particularly for Veterans and non-Veterans, but fewer looked at health behaviors and health services utilization (Fig. 2, online Appendix Tables 3 and 4). For some social determinants, published evidence was lacking (e.g., sexual orientation and gender identity) (Fig. 2, online Appendix Tables 3 and 4). Ninety-nine articles addressed social determinants for Veterans and non-Veterans, and 40 articles for engaged and non-engaged Veterans. Most articles used cross-sectional data and included over 1000 participants (online Appendix Tables 3 and 4).

Qualitative Synthesis of Evidence on Rurality, Trauma, and Sexual Orientation

Twenty articles examined rurality, 17 addressed trauma, and 2 were on sexual orientation; no articles addressed gender identity. Most articles on rurality, trauma, and sexual orientation used nationally representative datasets, included more than 5000 participants, and were rated low or medium quality

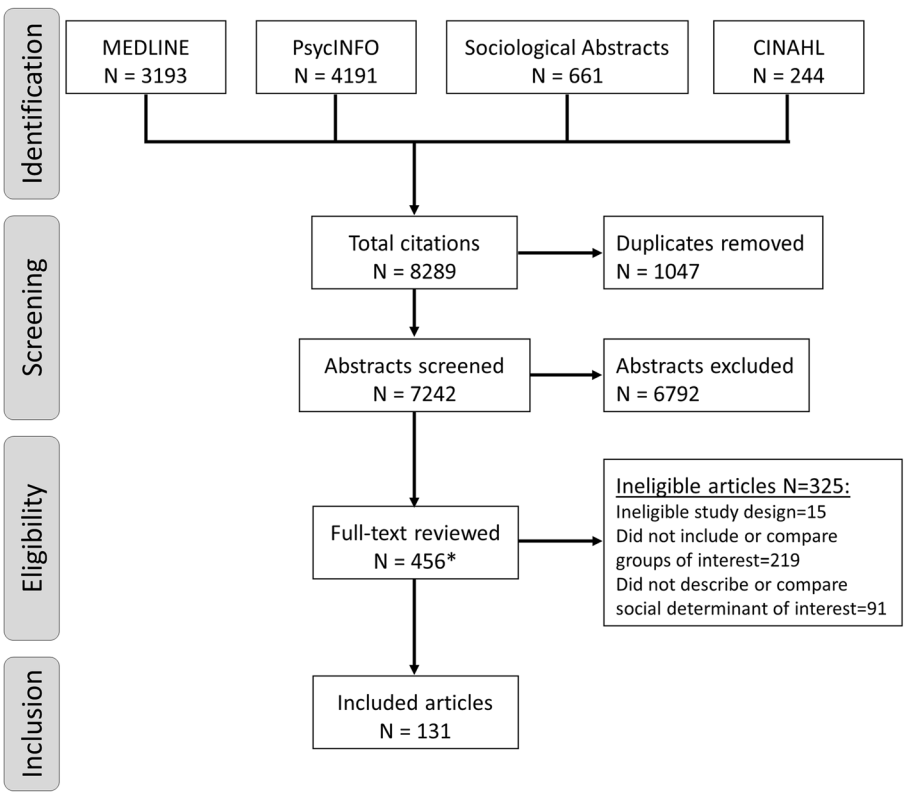

Figure 1 Citation screening and selection of included articles. Asterisk symbol indicates total articles reviewed includ an additional three articles found through an expedited review of MEDLINE citations ($N = 354$) identified using the same search terms except limited to trials, one article found through review of publications from the VA Epidemiology Program, and two articles recommended by expert reviewers.

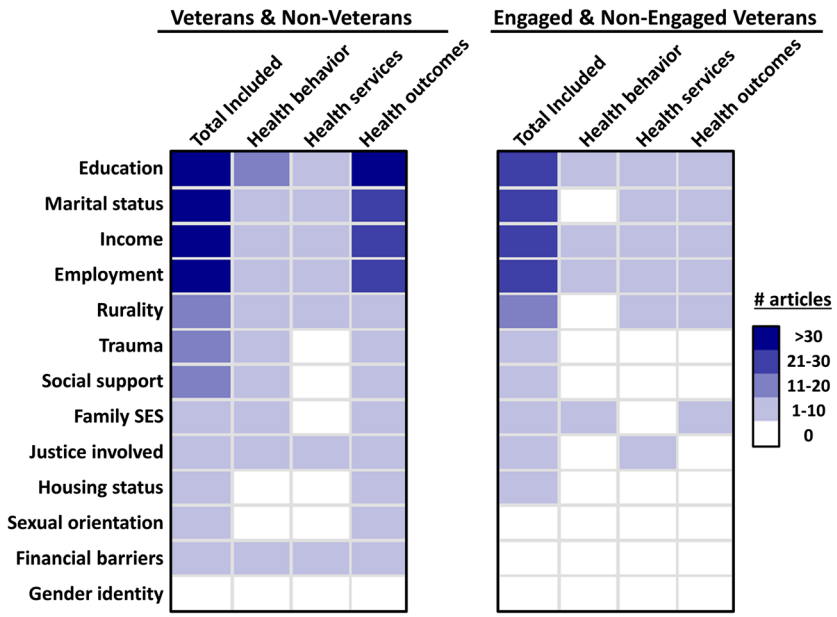

Figure 2 Heatmaps of included articles addressing social determinants and various outcomes for Veterans vs. non-Veterans, and for engaged vs. non-engaged Veterans. Articles may have addressed more than one social determinant, included comparisons of Veterans vs. non-Veterans and/or engaged vs. non-engaged Veterans, and may or may not have examined the role of social determinants in health behaviors, services access, and/or various health outcomes. Of 131 total included articles, 99 compared Veterans with non-Veterans, and 40 articles addressed engaged and non-engaged Veterans. SES, socioeconomic status.

(Table 1). More than half of articles included only men or only women. Less than half of articles on rurality and trauma examined health behaviors, health services access or utilization, or health outcomes. One of two articles on sexual orientation addressed mortality risk.

Rurality

We found moderate strength of evidence indicating no or very small differences in the proportion of Veterans and non-Veterans who reside in rural areas. Articles comparing Veterans with non-Veterans used different rurality measures, including Metropolitan Statistical Areas (MSA),[21, 99, 106, 138, 140, 150] self-reported rural/urban residence,[33, 70, 76] and Rural-Urban Continuum (RUC) codes[137] (online Appendix Table 5). Most articles reported no differences in rural residence between Veterans and non-Veterans, although actual estimates varied widely (e.g., 18–47% of Veterans with rural or non-metropolitan residences). This was likely due to differences in rurality definition, participant demographics (e.g., age and sex), and study timeframes (range 1986–2012). Only one article reported higher rural residence in Veterans,[84] and one found lower rurality in Veterans[99]; both were low quality (Table 2).

We found insufficient evidence for the effects of rurality on differences in health behaviors, health services utilization, or health outcomes between Veterans and non-Veterans. While no articles examined the role of rurality in health behaviors, two medium-quality articles addressed utilization (Table 2). One article reported no differences between metropolitan and

Table 1 Summary of Characteristics of Included Articles for Rurality and Trauma

	Veterans and non-Veterans		Engaged and non-engaged	
	Rurality	Trauma	Rurality	Trauma
Total number of articles	11	11	14	6
Nationally representative dataset	9	6	12	2
Exclusively men	5	2	2	–
Exclusively women	–	4	–	4
Number of participants*				
100–1000	1	3	2	4
1001–5000	3	2	2	2
> 5000	6	6	9	–
Quality				
Low	4	5	4	4
Medium	6	5	8	2
High	1	1	2	–
Examined role of social determinant in				
Health behaviors	–	5	–	–
Health services access/utilization	2	–	2	–
Mental health	3	3	1	–
General health	1	1	1	–
Mortality	–	1	–	–
Other health outcomes	1	1	1	–

Articles may have addressed more than one social determinant, and may or may not have examined the role of social determinants in health behaviors, health services access, and/or various health outcomes. There were also two included articles[87, 89] on sexual orientation both compared Veterans and non-Veterans, using data from national cohorts, included only women, had more than 1000 participants, and were medium quality; one of these examined the role of sexual orientation on mortality and also addressed trauma exposure[89]

**Number of participants unclear in one article on rurality[21]*

Table 2 Summary of Results Reported by Included Articles on Rurality, Trauma, and Sexual Orientation

			Number of articles reporting results			
	Category	Results description	Veterans and non-Veterans		Engaged and non-engaged	
			Low quality	Medium or high quality	Low quality	Medium or high quality
Rurality	Prevalence	No difference*	2	6	3	5
		Higher for Veterans/engaged	1	–	–	1
		Higher for non-Veterans/non-engaged	1	–	1	2
		Mixed or unclear results	–	1	–	2
	Health behaviors		–	–	–	–
	Health services access/utilization	Rurality associated with lower utilization	–	1	–	1
		Mixed or unclear results	–	1	–	1
	Health outcomes	No association of rurality with general health	–	1	–	1
		No association of rurality with mental health	–	3	–	1
		No association of rurality with risk of hospitalization due to ambulatory care sensitive conditions	–	1	–	1
Trauma exposure	Prevalence	No difference*	2	–	–	1
		Higher for Veterans/engaged	–	4	4	1
		Higher for non-Veterans/non-engaged	3	1	–	–
	Health behaviors	Trauma associated with more smoking	–	3	–	–
		Trauma associated with more heavy drinking	–	2	–	–
		Unclear association with heavy drinking	–	1	–	–
		Unclear association with lack of exercise	–	1	–	–
		No association with drug use	1	–	–	–
		Accounting for trauma reduced association of Veteran status with more smoking	–	1	–	–
	Health services access/utilization		–	–	–	–
	Health outcomes	Trauma associated with more depression	–	2	–	–
		Trauma associated with worse general health, days of poor physical health, and days of poor mental health	–	1	–	–
		Accounting for trauma reduced association of Veteran status with greater disability	–	1	–	–
		Unclear association with mortality risk	–	1	–	–
Sexual orientation	Prevalence health behaviors	No difference*	–	2	–	–
			–	–	–	–
	Health services access/utilization		–	–	–	–
	Health outcomes	Sexual minority status associated with higher risk for all-cause mortality	–	1	–	–

Articles may have addressed more than one social determinant, and may or may not have examined the role of social determinants in health behaviors, health services access, and/or various health outcomes
**Non-significant difference or if no statistical testing, < 5% difference*

non-metropolitan participants in proportion having a "checkup" within the prior 2 years.[137] The other article examined associations with total healthcare expenditures and found significant interaction effects between rural residence and a combined Veteran/VHA-user categorical variable (i.e., non-Veteran, Veteran VHA user, and Veteran non-VHA user); the magnitude of interaction effects was not reported.[138] Three medium-quality articles investigated a variety of health outcomes,[106, 137, 140] and none found significant associations for either Veteran status or rurality (Table 2).

We found moderate strength of evidence indicating no or very small differences in the proportion of engaged and non-engaged Veterans who reside in rural areas. Articles including engaged and non-engaged Veterans also employed varying measures of rurality, including MSA,[21, 55, 138] self-reported rural/urban residence,[70, 107, 120] RUC codes,[81, 137] Rural-Urban Commuting Area (RUCA) codes,[26, 47, 48] and straight-line distances between participant homes and nearest VHA facility[98] (online Appendix Table 6). More than half of articles reported no difference in rural residence between engaged and non-engaged Veterans (actual estimates 6–26%).[47, 48, 55, 70, 73, 107, 120, 138] One medium-quality article found slightly higher rurality for engaged Veterans (30 vs 24% of non-engaged).[137] In contrast, another medium-quality article reported lower rural residence in engaged Veterans (18% engaged vs 28% non-engaged), but was limited to Native Americans enrolled in VHA and Indian Health Service.[81] One high-quality article used VHA administrative data and showed lower rural residence for Veterans using VHA homeless services (15% engaged vs 21% non-engaged).[26]

We found insufficient evidence for the effects of rurality on differences in health behaviors, health services utilization, or health outcomes between engaged and non-engaged Veterans. No articles examined health behaviors, but two medium-quality articles addressed utilization[137, 138] (Table 2). Both of these articles defined engaged as self-reported VHA

utilization, with one finding that rurality was associated with lower rate of check-ups[137] and the other reporting significant interactions between rurality and Veteran/engaged status, as described above.[138] Two medium-quality articles investigated health outcomes, and found no association between rurality and general or mental health,[137] or with hospitalizations due to ambulatory care-sensitive conditions (21) (Table 2).

Trauma

We found low strength of evidence that there is a higher prevalence of trauma exposure among Veterans, as compared with non-Veterans. Articles comparing Veterans and non-Veterans used different measures to assess different trauma types (online Appendix Table 5). Six articles examined adverse childhood experiences[29, 60, 77, 100, 103, 118, 145] and the Adverse Childhood Experiences scale (ACEs) was the most commonly used measure.[29, 77, 100] All three articles using ACEs employed Behavioral Risk Factor Surveillance System (BRFSS) data, which included an ACEs module in multiple years. One article reported whether respondents had been "victimized" in the prior 12 months.[139] Four articles examined adult experience of sexual trauma or intimate partner violence (IPV),[34, 60, 103, 118] while two examined adult physical trauma.[89, 103] Only one article examined combat-related trauma.[103] Prevalence estimates were inconsistent across articles, with six finding higher prevalence among Veterans,[29, 41, 77, 103, 118, 139] three finding lower prevalence among Veterans,[34, 60, 89] and two finding no difference in prevalence between Veterans and non-Veterans.[100, 145] Inconsistencies were likely due to a broad range of historical periods and cohorts being studied (i.e., Vietnam era through wars in Iraq and Afghanistan), and differences in age, sex, race/ethnicity, and other key participant characteristics (online Appendix Table 5). One article included only homeless smokers.[60]

There was low strength of evidence that trauma exposure contributes to differences in prevalence of smoking between Veterans and non-Veterans, and insufficient evidence for the role of trauma in health services utilization and health outcomes. Four articles examined associations of trauma exposure with health behaviors, and most focused on smoking and heavy drinking, which were self-reported in BRFSS.[34, 41, 77, 100] Trauma exposure, whether IPV[34, 41] or ACEs,[77, 100] was associated with higher prevalence of current smoking (Table 2). Two of these articles also found a positive association between trauma exposure and heavy drinking.[34, 77] One article analyzed trauma exposure as moderating the association between Veteran status and health behaviors (i.e., smoking and heavy drinking), finding significant interaction effects between Veteran status and ACEs score for smoking, but no significant interaction for predicting heavy drinking.[77] One article showed that trauma exposure may mediate the association between Veteran status and smoking—higher odds of smoking for Veterans compared with non-Veterans (adjusted odds ratio [AOR] 1.84 [95% CI 1.18, 2.88]) were reduced after including ACEs scores (AOR 1.57 [95% CI 0.96, 2.58]).[100] Five articles[34, 41, 77, 89, 100] examined a range of health outcomes, with two finding that trauma was positively associated with more depression,[34, 41] and one showing associations with worse general health, more days of poor physical health, and more days of poor mental health[77] (Table 2). One article showed that trauma partially mediated associations between Veteran status and disability—accounting for ACEs scores reduced the higher odds of disability among Veterans compared with non-Veterans (AOR 1.83 [95% CI 1.08, 3.10] without ACEs, and AOR 1.57 [95% CI 0.90, 2.75] with ACEs included).[100] One article examined risk for all-cause mortality, cancer-specific mortality, and cardiovascular disease-related mortality, finding inconsistent associations between trauma and these outcomes, in models accounting for Veteran status.[89]

We found low strength of evidence that there is a higher prevalence of trauma exposure among engaged vs non-engaged Veterans. Articles on engaged and non-engaged Veterans also employed different measures and studied various trauma exposures (online Appendix Table 6). One article examined adverse childhood experiences and adult experience of sexual trauma or IPV,[88] three articles addressed combat-related trauma and sexual or non-combat-related physical trauma during military service,[88, 107, 115] one article examined history of military sexual assault,[59] and one article examined Vietnam war-zone service.[52] One article investigated military trauma related to sexual minority status.[120] Estimates of trauma prevalence were primarily unadjusted and mostly consistent across articles, with five articles finding higher prevalence among engaged Veterans,[52, 59, 88, 115, 120] and one showing mostly no difference.[107]

No articles examined the role of trauma in health behaviors, health services utilization, or health outcomes for engaged and non-engaged Veterans.

Sexual Orientation

We found insufficient evidence on sexual orientation for Veterans and non-Veterans, and no articles compared engaged and non-engaged Veterans (Table 2). The two articles examining sexual orientation for Veterans and non-Veterans both used nationally representative data, had only women participants, and were medium quality (online Appendix Table 5).[87, 89] One article used National Health and Nutrition Examination Survey data (1999–2010) and reported no significant difference in prevalence of non-heterosexual orientation (7% Veterans vs 5% non-Veterans); no health behaviors, health services utilization, or health outcomes were examined.[87] The other article used data from the Women's Health Initiative and found more Veterans identified as sexual minorities (i.e., non-heterosexual) compared to non-Veterans (4 vs 1%).[89] In adjusted analyses, sexual minority status and Veteran status were independently associated with increased risk for all-cause mortality.[89] Interaction effects were also examined for sexual minority status and

Veteran status, in predicting mortality risk but these were largely insignificant.[89] These two articles differed in study populations (e.g., mean age 40 years[87] vs 63 years[89]).

DISCUSSION

In this evidence review of social determinants impacting health behaviors, health services utilization, and health outcomes for Veterans, we found that most published articles examined classic sociodemographic characteristics. A smaller set of published articles addressed factors, such as rurality and trauma. Few or no studies addressed the remaining group of emerging social determinants, including sexual orientation and gender identity. Often, even when there was substantial published literature for certain social determinants, gaps remained due to lack of studies examining how social determinants actually affected health behaviors, healthcare utilization, and/or health outcomes.

We found little to no evidence on the roles of rurality and trauma exposure on health behaviors, health services utilization, and health outcomes, whether comparing Veterans vs non-Veterans or engaged vs non-engaged Veterans. Given this lack of evidence, existing literature on the impact of these factors in the general population can help guide policy for Veterans. Numerous challenges and health disparities affecting rural US communities have been demonstrated[151]; Veterans in rural settings likely face similar resource limitations, access barriers, and risk factors. Similarly, there are substantial health consequences of trauma exposures for the general adult population,[152] which should inform policy and planning for Veterans. For example, VHA could improve standardized assessment for exposures, develop strategies for providing trauma-sensitive care, and consider targeted efforts to prevent negative impacts associated with poor health behaviors (e.g., smoking). Since some types of trauma exposure precede military service, it may also be beneficial to develop assessment and strategies at the time of enlistment.

We found insufficient evidence for both sexual orientation and gender identity. Challenges to addressing these factors include cultural stigma and lack of standardized assessment in many current national datasets.

The VHA Blueprint for Excellence[153] outlines several essential strategies for improving services and enhancing Veteran health, including addressing the needs of vulnerable Veterans and delivering personalized, patient-centered care (e.g., considering relevant social determinants). Our review supports systematic assessment for socioeconomic factors which have a robust literature and contribute to health disparities.[1, 7] For social determinants with more limited evidence specifically for Veterans, such as rurality and trauma exposure, we suggest that current evidence gaps should not preclude the development of VHA policies to address probable challenges and health impacts of these factors for Veterans. For social determinants with little to no evidence, such as sexual orientation and gender identity, VHA should support development of consistent, accurate measures within VHA, and advocate for inclusion of these measures in ongoing large national surveys on health and behavior. Integration of VHA data with existing non-VHA data sources could also help us compare the impact of social determinants on Veterans engaged and not engaged in VHA services.

Our review highlights certain challenges in examining the role of social determinants in health. First, measures for rurality and trauma exposure often encompassed conceptually related but distinct aspects within these broader constructs. Rural communities are defined not just by distance and population density, but also by social connections, cultural norms, and attitudes.[154] To address health disparities for rural Veterans, we need direct measures of those aspects relevant to health. Similarly, although a variety of adverse circumstances and traumatic events could plausibly affect Veterans' health, failing to make conceptually important distinctions in types of trauma leads to challenges in defining those key relationships that could be targeted to improve health outcomes. Second, per our conceptual model (online Appendix Figure), relationships involving social determinants are likely bidirectional and dynamic over the lifespan. For example, education can affect selection into the military, and military service could in turn impact educational attainment (e.g., military training or as benefits for Veterans).[155] In the current era of service without conscription, social determinants may have even stronger effects on selection into the military and the nature of military experiences. One article highlighted this complexity by showing that for men in the current era, there was greater childhood adversity for Veterans compared with non-Veterans, but this was not true when comparing men who would have served during the draft era.[29] Future studies should address selection effects of social determinants and other mechanisms that predate military service.

Our evidence review has several limitations. We excluded articles if they did not compare our populations of interest; thus, our results do not imply that evidence did not exist for the general population. Publication bias may have affected our results if articles were less likely to be published when results showed no impact of social determinants on health. Finally, although we aimed to be broad and inclusive in conducting our review, our final search and selection focused on social determinants of high interest to our VHA partners.

In conclusion, we found limited to no evidence on certain emerging social determinants. We found no differences in rural residence between our groups of interest; trauma exposure was higher in Veterans (vs non-Veterans) and Veterans engaged in VHA care (vs non-engaged). We found insufficient

evidence on sexual orientation and gender identity. We recommend consistent measures for social determinants, clear conceptual frameworks, and analytic strategies that account for the complex relationships between social determinants, Veteran experiences, and health.

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Compliance with Ethical Standards:

Conflict of Interest: *The authors declare that they do not have a conflict of interest.*

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