


Subjective cognitive difficulties and posttraumatic stress disorder interact to increase suicide risk among middle-aged and older US military veterans

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ABSTRACT

Objectives To examine the role of subjective cognitive difficulties (SCD), posttraumatic stress disorder (PTSD), and their interaction in predicting suicidal ideation and current suicidal intent in middle-aged and older United States (US) military veterans.

Design Population-based cross-sectional study.

Setting and participants Data were analyzed from the 2019 to 2020 National Health and Resilience in Veterans Study, which surveyed a nationally representative sample of 3602 US veterans aged 50 years and older (mean age = 69.0).

Measurements Questionnaires including the Medical Outcomes Study Cognitive Functioning Scale (SCD), PTSD Checklist for DSM-5 (PTSD), Patient Health Questionnaire-9 (suicidal ideation in the previous two weeks), and the Suicide Behaviors Questionnaire-Revised (current suicidal intent).

Results A total of 154 (4.4%) veterans screened positive for current PTSD, 239 (6.7%) reported past two-week suicidal ideation, and 37 (1.0%) reported current suicidal intent. The probability of suicidal ideation among veterans with both SCD and PTSD was more than six times higher than that observed in the full sample (44.5% vs. 6.7%) and more than 2.5 times higher than that observed in veterans with SCD and no PTSD (44.5% vs. 17.5%). Veterans with both subjective memory and concentration difficulties were more likely to report suicidal intent, though the interaction between SCD and PTSD was not significantly associated with suicidal intent.

Conclusion Middle-aged and older U.S. veterans with subjective cognitive impairment and PTSD report higher rates of suicidal ideation than those with SCD alone. Interventions targeting SCD and PTSD may mitigate suicide risk among middle-aged and older veterans.

Key words posttraumatic stress disorder, cognitive impairment, suicide

Introduction

Middle-aged and older adults are at high risk for death by suicide, recording the highest age-specific suicide rate of any age group in most countries (World Health Organization, 2019). In the United States (US), the age-adjusted suicide rate among men aged 75 and older (39.9/100,000) is nearly three times that observed in the general population

(13.9/100,000, Centers for Disease Control and Prevention, 2019). Although older people are less likely to report suicidal ideation (SI) than their younger counterparts, those who do report SI are more likely to eventually die by suicide relative to younger individuals (Miret *et al.*, 2010). Identifying middle-aged and older adults most at risk for SI and intent is therefore a public health priority.

Subjective cognitive difficulties (SCD), characterized by an individual's perceived difficulties in cognitive abilities relative to their prior performance, are reported by up to 60% of older persons (Rabin, *et al.*, 2017). SCD can predict the onset of neurocognitive disorders including dementia

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(Singh-Manoux *et al.*, 2014) and can be highly distressing for an individual (Liew, 2020). SCD have been linked to anxiety (Liew, 2020), depression (Molinuevo *et al.*, 2017), and reduced quality of life (Hill *et al.*, 2017; Rabin, *et al.*, 2017). In addition, SCD can be indicative of objective impairments that are risk factors for suicide including cognitive inhibition (Conejero *et al.*, 2018). Indeed, prior research has found that older adults diagnosed with mild cognitive impairment or dementia are at increased risk for suicidal behavior (Cipriani *et al.*, 2013; Lai *et al.*, 2018) and suicide mortality (Günak *et al.*, 2021) in the months following their diagnosis.

Emerging evidence suggests that middle-aged and older adults who have experienced psychological trauma may find the onset of SCD particularly distressing. Up to 70% of older adults have experienced one or more traumatic event in their lifetime (Reynolds *et al.*, 2016), with 6–8% meeting lifetime or current criteria for posttraumatic stress disorder (PTSD) (12). The interplay between traumatic stress and cognitive impairment is complex; while traumatic stress is a putative risk factor for dementia, dementia can also trigger the re-emergence or exacerbation of traumatic stress (Desmarais *et al.*, 2019; Pless Kaiser *et al.*, 2019). Individuals who have experienced childhood trauma report a profound fear of developing cognitive impairments and associated loss of independence in later life (Browne-Yung *et al.*, 2021; Fernandez *et al.*, 2016). In these studies, cognitive impairments were perceived as potentially signaling the progressive loss of control and agency that they consider essential to their trauma recovery (Browne-Yung *et al.*, 2021). This is consistent with prior evidence that trauma survivors frequently experience acute distress in situations that trigger feelings of powerlessness (Fang, *et al.*, 2020). In addition, exposure to traumatic stress can be associated with cognitive changes such as impaired executive function and increased impulsivity (Netto *et al.*, 2016), which have been linked to increased risk for suicide and self-harm behavior (Bredemeier and Miller, 2015; Erlangsen *et al.*, 2021; Pless Kaiser *et al.*, 2019).

To our knowledge, no known study has examined the relationship between SCD, PTSD, and suicide risk in middle-aged and older adults. The risk for SI and suicidal intent associated with traumatic stress is supported by strong evidence (Gradus, 2018; Nichter, Stein, *et al.*, 2021), with some studies suggesting an increased risk for SI among older adults with SCD (Jeong *et al.*, 2021). Clarifying the relationship between these factors can help guide suicide prevention efforts to intervene at times of high risk for middle-aged and older trauma survivors (i.e. at the onset or initial diagnosis of SCD (Beristianos *et al.*, 2016)).

Toward this end, the aim of this study was to examine the role of SCD, PTSD, and their interaction in relation to SI and current suicidal intent in a nationally representative cohort of middle-aged and older US military veterans. We hypothesized that middle-aged and older veterans who reported greater SCD would be more likely to report SI and current suicidal intent and that this association would be strongest among those with current PTSD.

Method

Data were analyzed from middle-aged and older adults (aged ≥ 50 ; $n = 3,602$ [88.5%]) who participated in the 2019–2020 National Health and Resilience in Veterans Study (NHRVS), a nationally representative study of 4,069 US veterans. The sampling methodology of the NHRVS has been described in detail previously (Tsai *et al.*, 2020). Briefly, veterans completed an anonymous, web-based survey. The NHRVS sample was drawn from KnowledgePanel®, a survey panel of more than 50,000 US households maintained by Ipsos, a research firm. KnowledgePanel® is a probability-based survey panel of a representative sample of US adults that covers approximately 98% of US households. Panel members were recruited through national random samples, originally by telephone and now almost entirely by postal mail. To permit generalizability of study results to the entire population of US veterans, Ipsos statisticians computed post-stratification weights following benchmark distributions of US military veterans from the most recent (August 2019) Current Veteran Population Supplemental Survey of the US Census Bureau's American Community Survey: age, gender, race/ethnicity, Census Region, metropolitan status, education, household income, branch of service, and years in service.

Additional details regarding the Ipsos post-stratification weighting procedure can be found elsewhere (Nichter, Maguen, *et al.*, 2021). Missing data (<3%), which were missing completely at random as per Little's MCAR test, were imputed using chained equations. The NHRVS protocol was approved by the Human Subjects Subcommittee of the VA Connecticut Healthcare System, and all participants provided informed consent.

Assessments

Subjective Cognitive difficulties. SCD were assessed using the Medical Outcomes Study Cognitive Functioning Scale (MOS-CFS) (Stewart *et al.*, 1992), a six-item self-report measure that assesses past-month difficulties in six cognitive domains:

reasoning, concentration and thinking, confusion, memory, attention, and psychomotor speed; sample item used to assess subjective memory difficulties: “During the past month, how much of the time did you forget (e.g. things that happened recently, where you put things, appointments)?” Prior studies have found that MOS-CFS have a small-to-moderate correlation with objective assessments of memory, attention, psychomotor speed, and graphomotor speed (i.e. r 's = 0.23–0.34; (Klein *et al.*, 2002). Scores range from 0 to 100, with higher scores indicative of better cognitive functioning; in the current study, scores were inverted so that higher scores indicate greater cognitive dysfunction. Cronbach's α on MOS-CFS items in the current sample was 0.91. SCD was operationalized as ≥ 1 SD reduction in total MOS-CFS scores relative to the mean MOS-CFS score for the full sample, as this would constitute a clinically significant difference between the groups.

Lifetime Trauma Burden. The Life Events Checklist for DSM-5 (Gray *et al.*, 2004) was used to assess direct (i.e. happened to me) and indirect (i.e. witnessed, learned about, part of job) exposures to potentially traumatic events (PTEs), as well as the index PTE used to assess PTSD symptoms. A count of PTEs was used to compute lifetime trauma burden.

Posttraumatic Stress Disorder. The PTSD Checklist for DSM-5 (PCL-5, Weathers *et al.*, 2013) was used to assess PTSD symptoms in relation to veterans' self-reported “worst” Criterion A traumatic event (a common approach to the assessment of PTSD symptoms (Breslau *et al.*, 2004)), as assessed using the Life Events Checklist for DSM-5 (LEC-5, Gray *et al.*, 2004). The PCL-5 is a 20-item measure of past-month DSM-5 PTSD symptoms, with responses ranging from 0 (*not at all*) to 4 (*extremely*). Higher scores indicate more severe symptoms and a score ≥ 33 is indicative of a positive screen for PTSD (Bovin *et al.*, 2016). In the present sample, Cronbach's α on PCL-5 items was 0.95.

Suicidal Ideation. SI within the past two weeks was assessed using item 9 on the Patient Health Questionnaire-9 (Kroenke, *et al.*, 2003). This item was broken down into two separate questions to assess passive and active SI. Specifically, participants were asked how often over the past two weeks they had been (1) bothered by thoughts that they were better off dead (passive SI); and (2) thoughts of hurting themselves in some way (active SI). Response options ranged from (0) *not at all* to (3) *nearly every day*. To increase statistical power, these items were combined and recoded in the current study into the absence (0) or presence (1) of passive and/or active SI in the past two weeks (i.e. endorsement of “Several days,” “More than half the days,” or “Nearly every day”).

Current Suicidal Intent. Item 4 of the Suicide Behaviors Questionnaire-Revised (SBQ-R, Osman *et al.*, 2001) was used to assess current suicidal intent. Participants responded to the item by asking: “How likely is it that you will attempt suicide someday?” with response options ranging from “Never” to “Very Likely.” Endorsement of “Likely,” “Rather Likely,” or “Very Likely” was considered a positive screen for suicidal intent. The SBQ-R has been validated with adequate internal consistency in older adults samples (e.g. Cronbach's α = 0.70 in Bamonti, *et al.*, 2014, McDonald's ω = 0.76 in McLaren *et al.*, 2022) and in veterans samples (e.g. Cronbach's α = 0.84, Rudd, *et al.*, 2011).

Psychiatric Comorbidities. Modified self-report modules from the Mini Neuropsychiatric Interview for DSM-5 (Hergueta and Weiller, 2013) were used to assess major depressive, alcohol, and drug use disorders.

Physical Health Problems. Participants were asked: “Has a doctor or healthcare professional ever told you that you have any of the following medical conditions?” A total of 23 conditions were assessed (e.g. arthritis, pulmonary conditions, heart disease). A count of these conditions was computed.

Data analysis

We first computed descriptive statistics to summarize sample characteristics and estimate the prevalence of past two-week SI and current suicidal intent. Second, we conducted two multiple logistic regression analyses to examine the relation between PTSD, SCD, and SI and current suicidal intent. Main effects of PTSD and SCD were entered in Step 1, and an interaction of PTSD \times SCD was added in Step 2, adjusted for age, sex, race/ethnicity, education, marital/partnered status, household income, combat veteran status, cumulative lifetime trauma burden, major depressive, alcohol use, and drug use disorders, and number of medical conditions. Third, we computed probabilities of SI and current suicidal intent from fully adjusted models to quantify how PTSD and SCD related to these outcomes. Fourth, we ran a second set of adjusted multiple regression analyses to examine which specific aspects of SCD—alone and interactively with PTSD—were associated with SI and current suicidal intent.

Results

Sample characteristics

The mean age of participants was 69.0 years (SD = 10.4; range = 50–99). The majority were male (93.5%) and White, non-Hispanic (81.2%),

with 10.5% self-identifying as non-Hispanic Black, 4.3% Hispanic, and 4.0% bi/multi-racial. Approximately a third (32.3%) completed a college degree or higher education, more than half (56.6%) were retired, and three-quarters (73.3%) were married/partnered. A total of 47.4% served in the Army, 20.9% Navy, 19.9% Air Force, 4.7% Marines, and 7.1% National Guard, Reserves, or Coast Guard, with a third serving 10 or more years (35.0%). Thirty percent were combat veterans, the majority of whom reported serving in the Vietnam (60.7%), Persian Gulf (12.5%), and Iraq/Afghanistan (10.8%) conflicts. On average, the sample endorsed 8.3 PTEs ($SD = 7.9$, range = 0–60), with the most prevalent index traumas being motor vehicle accident (15.7%), natural disaster (13.2%), life-threatening illness or injury (12.5%), combat or war-zone exposure (11.0%), and witnessing a sudden death (7.6%).

Prevalence of PTSD, SI, and current suicidal intent

A total of 154 (weighted 4.4%) veterans screened positive for current PTSD and 239 (6.7%) reported past two-week SI. This included 230 (6.4%) endorsing passive SI, 88 (2.7%) active SI, 79 (2.4%) both passive and active SI, and 52 (1.4%) endorsing both PTSD and SI. A total of 37 veterans (1.0%) screened positive for current suicidal intent. SCD was reported by 432 veterans (12.0%), and 95 veterans reported both PTSD and SCD (2.6%).

PTSD, SCD, and SI and current suicidal intent

As shown in Table 1, results of a hierarchical multivariable logistic regression analysis revealed significant main effects of SCD and PTSD in predicting SI and current suicidal intent. Incorporation of an $SCD \times PTSD$ interaction term in second steps of these models revealed a significant association with SI but not current suicidal intent.

Figure 1 shows the mean probability of reporting SI as a function of SCD and PTSD from the fully adjusted regression model. The probability of SI among veterans with SCD and PTSD was more than six times higher than that observed in the full sample (44.5% vs. 6.7%), and more than 2.5 times higher than that observed in veterans with SCD and no PTSD (44.5% vs. 17.5%).

Secondary regression analyses revealed that greater SCD in executive function ($OR = 1.02$, 95%CI = 1.01–1.04, Wald $\chi^2 = 17.85$, $df = 1$, $p < 0.001$) and concentration/thinking ($OR = 1.02$, 95%CI = 1.01–1.03; Wald $\chi^2 = 7.39$, $df = 1$, $p = 0.002$) were independently associated with SI. Further, a significant SCD in executive dysfunction \times PTSD interaction was observed ($OR = 1.02$, 95%CI = 1.01–1.04; Wald $\chi^2 = 3.79$, $df = 1$, $p = 0.035$),

Table 1. Results of multiple logistic regression analyses of the relation between SCD, PTSD, and suicidal ideation and current suicidal intent

	Wald χ^2 ^a	<i>p</i>	OR (95% CI) ^b
Suicidal ideation			
Step 1			
SCD	90.78	<0.001	1.04 (1.03–1.05)
PTSD	5.22	<0.001	1.78 (1.09–2.92)
Step 2			
SCD \times PTSD	6.92	0.009	1.02 (1.01–1.03)
Current suicidal intent			
Step 1			
SCD	18.06	<0.001	1.05 (1.02–1.07)
PTSD	0.08	0.78	1.17 (0.39–3.51)
Step 2			
SCD \times PTSD	2.41	0.12	1.03 (0.99–1.07)

Abbreviations: SCD = subjective cognitive difficulties; PTSD = posttraumatic stress disorder; OR = odds ratio; 95%CI = 95% confidence interval.

^a $df = 1$.

^b ORs are adjusted for age, sex, race/ethnicity, education, marital/partnered status, household income, combat veteran status, cumulative lifetime trauma burden, major depressive, alcohol use, and drug use disorders, and number of medical conditions.

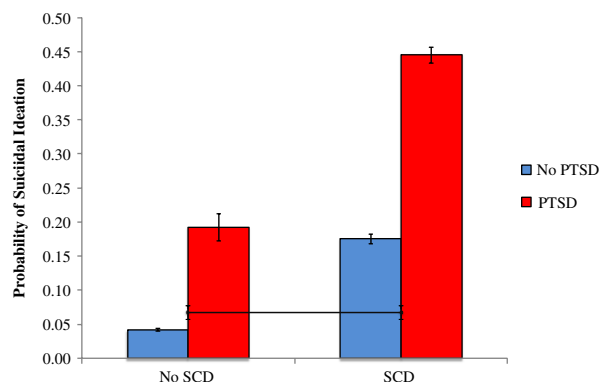


Figure 1. Probability of suicidal ideation as a function of SCD and PTSD. *Note.* Abbreviations: SCD = subjective cognitive difficulties; PTSD = posttraumatic stress disorder. Horizontal black bar represents mean probability of suicidal ideation in the full sample (.067). Error bars represent 95% confidence intervals. SCD operationalized as a score ≥ 1 SD in the full sample (mean = 63.3, $SD = 15.3$ vs. 95.0, $SD = 5.9$). Probabilities are adjusted for age, sex, race/ethnicity, education, marital/partnered status, household income, combat veteran status, cumulative lifetime trauma burden, major depressive, alcohol use, and drug use disorders, and number of medical conditions.

with greater SCD in executive dysfunction and PTSD associated with increased likelihood of SI.

Greater SCD in memory ($OR = 1.03$, 95%CI = 1.01–1.05; $p = 0.009$) and concentration/thinking ($OR = 1.02$, 95%CI = 1.01–1.04; $p = 0.022$) were

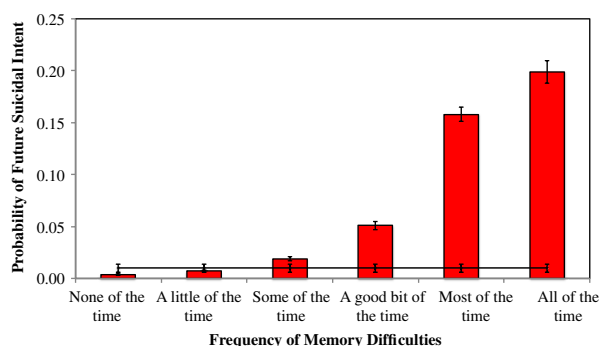


Figure 2. Probability of current suicidal intent as a function of frequency of SCD in memory. *Note.* Abbreviations: SCD = subjective cognitive difficulties. Horizontal black bar represents mean probability of current suicidal intent in the full sample (0.01). Error bars represent 95% confidence intervals. Probabilities are adjusted for age, sex, race/ethnicity, education, marital/partnered status, household income, combat veteran status, cumulative lifetime trauma burden, major depressive, alcohol use, and drug use disorders, and number of medical conditions.

also independently associated with current suicidal intent. Figure 2 shows the mean probability of current suicidal intent as a function of frequency of SCD in memory. The probability of current suicidal intent increased as a function of greater memory difficulties, diverging from the mean probability of intent in the full sample, as indicated by non-overlapping 95% confidence intervals, among middle-aged and older veterans who reported memory difficulties at least some of the time.

Discussion

Consistent with previous studies of both military (Nichter *et al.*, 2019; Pompili *et al.*, 2013) and civilian populations (Krysinska and Lester, 2010), middle-aged and older veterans with current PTSD in this study were more likely to report SI and suicidal intent than those without PTSD. In addition, cognitive difficulties were more strongly associated with SI for those with PTSD (Browne-Yung *et al.*, 2021; Putney *et al.*, 2018). In prior qualitative research, older trauma survivors identify a feared loss of independent functioning, risk of institutionalization, and potential difficulty engaging in valued coping strategies as key contributors to distress when experiencing SCD (Browne-Yung *et al.*, 2021).

To our knowledge, the mechanisms by which psychological trauma and SCD may interact to give rise to SI in middle-aged and older adults have not been explored widely in previous research. Results of this study corroborate themes identified from qualitative research among older survivors

that the onset of cognitive impairment and dementia can be highly distressing as these symptoms may trigger a fear of progressive loss of independence and functioning (Browne-Yung *et al.*, 2021; Putney *et al.*, 2018). Dementia is among the most feared illnesses for older adults (Lee and Jung, 2020) and older adults perceiving elevated SCD often report psychological distress and fear for the future even where such subjective impairments are not confirmed in objective testing (Mendonça, *et al.*, 2016). Regaining and retaining a sense of personal autonomy and independence is known to promote recovery from traumatic stress (Maercker and Hecker, 2016; Reeves, 2015). In prior qualitative research, older trauma survivors identify a feared loss of independent functioning, risk of institutionalization, and potential difficulty engaging in valued coping strategies as key contributors to distress when experiencing SCD (Browne-Yung *et al.*, 2021).

It is also plausible that the relationship occurs in the reverse direction, with SCD triggering a worsening of PTSD symptoms and leading to heightened risk of psychiatric distress and suicidal thinking. Indeed, the re-emergence or exacerbation of PTSD symptoms after the onset of dementia has been documented in previous research (Desmarais *et al.*, 2019), possibly related to progressive impairments in inhibitory control and other aspects of executive functioning (Lachmann and Hu, 2018; Mittal *et al.*, 2001; van Achterberg and Southwick, 2001). That subjective executive dysfunction, but not other specific cognitive difficulties, was associated with SI to a greater extent for those with PTSD in this study supports this hypothesis. Dementia-related neurodegeneration of limbic structures associated with emotion regulation may also increase risk of PTSD re-emergence (Ruzich, *et al.*, 2005; van Achterberg and Southwick, 2001). As such, those reporting SCD may also be experiencing an increase in severity or frequency of intrusive memories, hypervigilance, and hyperarousal that are known to have a dose-dependent relationship with psychological distress and SI (Glenn *et al.*, 2020; Surís, *et al.*, 2011).

A third possibility is that SCD reported by individuals in this study were posttraumatic symptoms themselves and that the presence of cognitive difficulties within PTSD represents an important moderating factor for SI among middle-aged and older veterans. Features of the SCD may include or induce problem-solving deficits, loss of perceived control, and hopelessness, and these factors may moderate the relationship with SCD and SI. In addition, some previous research has identified concentration difficulties as a significant contributor to reduced quality of life and SI among US veterans

(Kachadourian *et al.*, 2019), though research with civilian populations has not replicated this finding (Davis, *et al.*, 2014; Forbes *et al.*, 2019). Further research is needed to tease apart the mechanisms by which PTSD and SCD combine to influence SI, as well as how these may differ between veteran and civilian populations.

Although the interaction of PTSD and SCD was associated with SI, we did not find the same pattern of results with suicidal intent. While SCD, particularly memory and concentration difficulties, were independently associated with increased risk for suicidal intent, this effect did not differ between those with and without PTSD. There are several possible explanations for this discrepancy in findings. First, given the low prevalence of suicidal intent among veterans in our sample (1.0%), it is most likely that this analysis was underpowered to detect a significant interaction effect. It is also conceivable that SCD and PTSD may have differential effects on SI and intent, and that the impact of SCD for those with PTSD is less pronounced as a person progresses along the suicidality spectrum (i.e. from SI to suicidal behavior). Prior work has found that most individuals who report a lifetime history of SI do not report a history of suicidal intent or suicide attempts (Bryan *et al.*, 2015; Nichter, Monteith, *et al.*, 2021). Moreover, previous research has demonstrated that risk factors for different forms of suicidal behavior (e.g. ideation, intent, planning) differ (Klonsky, *et al.*, 2018; Nichter, Stein, *et al.*, 2021), and vulnerability factors for SI do not necessarily predict suicidal behavior (Nock *et al.*, 2018; Tucker *et al.*, 2015). Further research using samples with higher rates of suicidal intent is needed to determine whether SCD is a particular risk factor for suicidal intent among middle-aged and older veterans with PTSD, or whether this relationship is limited to SI.

Limitations of this study include that our sample size may have had limited statistical power to detect meaningful effects, particularly as suicidal intent was uncommon among our participants (1.0%). It is notable, however, that many effects persist after adjustment for covariates. The cross-sectional study design limits our ability to examine the direction of the observed associations or how SCD and PTSD interact with each other and SI over time. In addition, the NHRVS cohort is comprised predominantly of middle-aged and older Caucasian male non-combat veterans, thus limiting the potential generalizability of the results to more demographically diverse samples. Our sample size also did not facilitate comparison of middle-aged and older veterans, and the relationships between PTSD, SCD, and suicidality may differ with age. Recent research has identified that middle-aged people with

depression are more likely to report SCD than older adults (Schüssler-Fiorenza Rose *et al.*, 2021) and aged-based comparisons of those with PTSD are warranted. Self-report measures of PTSD may be vulnerable to bias and possible under- or over-identification of those with probable PTSD, especially with an atypical presentation (e.g. not engaging in avoidance of trauma reminders, as is more common among older adults; Rutherford *et al.*, 2021). Similarly, using items from the PHQ-9 to identify SI relies on the person being able and willing to disclose their ideation, which is not always possible (Louzon *et al.*, 2016). The NHRVS also did not include an objective neuropsychological assessment to corroborate self-reported SCD. Although previous research has found that measures of SCD are correlated with objective cognitive measures (Klein *et al.*, 2002) it is also possible that some of the variance captured by the SCD measure was accounted for by other variables. SCD may also be a proxy measure of other constructs such as a subjective assessment of general functioning. Subjective and objective cognitive difficulties are likely separate constructs, and they likely have differential impacts on suicidality.

Despite these limitations, results of this study highlight the importance of routine assessment of SCD among middle-aged and older adults and comprehensive risk assessment for veterans with trauma histories who endorse cognitive complaints. Future research can help to elucidate mechanisms and temporal pathways underlying the relationship between SCD and PTSD, and guide intervention development and delivery for middle-aged and older trauma survivors.

Conflicts of interest

None of the authors have any relevant conflicts of interest.

Author contributions

MC conceptualized this study and drafted and edited the manuscript. JC contributed to study development and manuscript editing. RHP is the principal investigator of the National Health and Resilience in Veterans Study and was responsible for funding acquisition, data collection and analysis, and drafting and revising the manuscript.

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Data statement

The data have not been previously presented orally or by poster at scientific meetings.

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