LIVING WITH PTSD SYMPTOMS: A COMPREHENSIVE EXPLORATION OF
FUNCTIONING REPORTS AND SYMPTOM INTERPRETATION

by

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by

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DEDICATION

This dissertation is dedicated to my parents, who have inspired me to be the best version of myself in all aspects of life. This accomplishment is only possible because of your love, your sacrifices, and your unwavering support. I cannot repay you for all you've given me, but I can start paying my own credit card now.

ACKNOWLEDGEMENTS

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ABSTRACT

LIVING WITH PTSD SYMPTOMS: A COMPREHENSIVE EXPLORATION OF FUNCTIONING REPORTS AND SYMPTOM INTERPRETATION

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George Mason University, 2020

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PTSD has been negatively associated with numerous indices of functioning within veterans. However, most empirical evidence of this association has relied on the use of global self-report measures. In some areas, empirical study has revealed incongruencies between global reports of impairments and more time-specific reports, with greater symptoms sometimes linked to overreporting bias particularly on broader, global measures. Additionally, studies in this area typically have focused solely on individual functioning outcomes (e.g., life satisfaction), despite the possibility that interpersonal domains (e.g., marital satisfaction) might be differentially affected by the presence of PTSD symptoms. Also, different clusters of PTSD symptoms may have differing impacts on functioning, but most research findings focus on overall symptom severity. Finally, despite efforts to increase veterans' knowledge about PTSD, no research has yet examined the role that knowledge about PTSD itself plays in functioning. This

dissertation addressed these gaps in our understanding through two separate but related studies.

The first study was a 7-day, daily diary study of PTSD symptom severity, individual functioning, and interpersonal functioning. A sample of 31 U.S. military veterans provided online reports of their past-week PTSD symptom severity and past-week functioning at baseline, followed by 7 days of daily reports of both PTSD symptoms and functioning. Consistent with prior research, past-week PTSD symptoms and past-week functioning were negatively correlated. In addition, hierarchical linear modeling confirmed that daily reports of PTSD symptoms and functioning were negatively associated. Furthermore, past-week functioning was positively associated with daily reports of functioning; however, this association was moderated by baseline PTSD symptoms, with the association weaker in the context of more severe PTSD symptoms. These results are consistent with the notion that respondents might demonstrate greater reporting bias on self-report measures that stretch over longer periods of time.

In the second study, 96 U.S. military veterans provided online self-reports of PTSD symptoms, individual and interpersonal functional impairment, and PTSD knowledge. For individual functioning, contrary to hypotheses, no PTSD cluster exerted a significant association with functional impairment, and greater PTSD knowledge showed a significant association with *more* impairment. For interpersonal functioning, avoidance symptom severity was associated with less impairment, whereas severity of negative alterations in mood/cognition was associated with more impairment. Furthermore, for individual functioning, re-experiencing symptoms were nonsignificantly associated with

less impairment at higher levels of PTSD knowledge but significantly more impairment at lower levels of knowledge. On the other hand, avoidance symptoms were nonsignificantly associated with more impairment at higher levels of knowledge but significantly less impairment at lower levels of knowledge. Finally, for interpersonal functioning, re-experiencing symptoms were significantly associated with less impairment at higher levels of PTSD knowledge and nonsignificantly associated with more impairment at lower levels of knowledge. Also, avoidance symptoms were nonsignificantly associated with more impairment at higher levels of knowledge but significantly associated with less impairment at lower levels. Although complicated, these results suggest differences in the associations of PTSD symptoms and PTSD knowledge with individual vs. relationship functioning. Further research is needed to improve our understanding of how PTSD knowledge impacts psychosocial functioning, and to determine whether my results related to associations among PTSD clusters and impairment replicate.

INTRODUCTION

Research on combat veterans from recent conflicts indicates that between 7% and

20% of service members develop posttraumatic stress disorder (PTSD) following

deployment (Adler & Sipos, 2018; Hoge et al., 2004). The availability and quality of

treatment for PTSD has grown significantly in recent decades, particularly within military

populations (Cusack et al., 2016). Despite this development, studies indicate that only 13-

69% of service members actually seek treatment (Elbogen et al., 2013; Hoge et al., 2014),

and of those, only 49-70% of those in treatment experience significant reductions in

symptoms (e.g., Steenkamp, Litz, Hoge, & Marmar, 2015). Thus, there remains a

significant portion of service members who are left to function with symptoms of PTSD.

A substantial amount of literature documents the connection between PTSD

symptoms and various domains of functional impairment (Hoge et al., 2004; Pietrzak et

al., 2010; Bovin et al., 2018), including both interpersonal (e.g., Vasterling et al., 2016)

and individual domains of functioning (e.g., Sripada, Henry, Yosef, Levine, Bohnert,

Miller, & Zivin, 2018). Different theories implicate different processes linking PTSD

with individual vs. interpersonal functioning (e.g., Fredman, Monson, & Dekel, 2010),

but no research has yet evaluated interpersonal and individual functioning domains in a

single study to allow for clear comparisons of patterns detected. In addition, most prior

research in this area has relied on self-report instruments of symptoms and functioning

over a broad span of time (e.g., several weeks), but recent research has revealed a

possible tendency to overreport symptoms when reporting on broader spans of time, in

comparison to more time-limited data (e.g., daily reports of symptoms; Campbell et al., 2017; Naragon-Gainey et al., 2012). To date, no study has examined the correspondence of reports for functioning outcomes, which may be even more prone to bias than specific, stable constructs like PTSD. Finally, given the clear associations of PTSD symptoms with functional impairment, there is a need for additional information on potential moderators of these associations.

This dissertation contains two empirical studies that address the need for a more comprehensive understanding of the link between PTSD and functioning in veterans. In the first manuscript (Chapter 2), I aimed to address the issue of potential bias in reporting on broader time spans by (a) replicating prior findings regarding concordance between retrospective and daily PTSD symptom reporting and (b) investigating the concordance between retrospective and daily reports of psychosocial functioning. I also sought to determine whether severity of PTSD symptoms impacted the concordance of retrospective and daily reports of functioning. In the second manuscript (Chapter 3), I explored the unique associations of overall PTSD as well as PTSD clusters with both interpersonal and individual functioning. Moreover, I evaluated the potential impact of PTSD knowledge, a heretofore unstudied moderator, on these associations.

Both of these manuscripts use data from an online sample of 96 veterans recruited for a cross-sectional investigation of PTSD and functioning variables. All participants were then invited to participate in the study involving daily diary methodology, and about one-third (31 participants) completed nightly online surveys about their PTSD and functioning for the following 7 days. Overall, these papers provide a thorough empirical

investigation aimed at illuminating our understanding of the real-life picture of veterans who are left to function with PTSD symptoms, regardless of whether or not they receive treatment.

CORRESPONDENCE OF WEEKLY AND DAILY REPORTS OF PSYCHOSOCIAL FUNCTIONING: INFLUENCE OF PTSD SYMPTOM SEVERITY

Introduction

Posttraumatic stress disorder (PTSD) is the focus of much research and clinical attention for U.S. military veterans (Fulton et al., 2015; Magruder & Yeager, 2009). Characterized by symptoms of re-experiencing, avoidance, negative changes in cognitions and mood, and hyperarousal (American Psychiatric Association, 2013), PTSD can negatively impact the lives of service members for years after exposure to trauma. Treatment of PTSD has been a strong focus in the literature, but much research has also evaluated functioning in the context of PTSD symptoms. Not surprisingly, veterans with PTSD experience poorer psychosocial functioning compared to veterans without PTSD (Shea, Vujanovic, Mansfield, Sevin, & Liu 2010). PTSD has shown medium to large effect sizes in its association with functional impairment in general (e.g., Pietrzak, Goldstein, Malley, Rivers, & Southwick, 2010; Taft, Watkins, Stafford, Street, & Monson, 2011) and in regard to a number of specific domains, including romantic relationships (Birkley Birkley, Eckhardt, & Dykstra, 2016), family relationships (Vasterling et al., 2015), friendships and socializing (Pagotto et al., 2015), work (Kleykamp, 2013), education (Barry, Whiteman, & MacDermid Wadsworth, 2012), parenting (Vogt et al., 2017), and overall self-care (Khalili et al., 2017).

Most empirical evidence for the association between PTSD and functioning has relied on a range of well-validated measures, many of which rely on retrospective

reporting about symptoms that occurred over a broad period of several days or weeks

(Schneider & Stone, 2016). This type of retrospective recall forces respondents to

aggregate long intervals of time, which makes it difficult to know if reports at the time of

the assessment reflect persistent or intermittent experiences (Shiffman, Stone, & Hufford,

2008). Additionally, retrospective recall is vulnerable to different types of cognitive

biases. For example, the *mood-congruent memory effect* suggests that an individual's

affect at the time of an assessment may lead to greater recall of symptoms congruent with

that affective state (Ebner-Priemer & Trull, 2009; Schuler et al., 2019). Other heuristic

cognitive processes, like *peak-end rules,* create mental shortcuts and can lead to

assumptions based on the most intense or most recent experiences (Schneider & Stone,

2016; Schuler, 2019). Additionally, the *fading effect bias* has been identified as a

potentially protective mechanism, allowing negative events to be remembered with fewer

details in order to evoke less intense negative emotions (Konnert & Wong, 2015;

Williams et al., 2007).

Research in the past decade has investigated the influence of such biases on

retrospective reporting of PTSD symptoms by directly comparing global reports with

more time-limited reports like daily measures (e.g., Campbell, Krenek, & Simpson, 2017)

and measures taken via ecological momentary assessment (Shiffman et al., 2008). The

majority of these studies have found good consistency between global and more time-

specific reports (Carlson et al., 2016; Naragon-Gainey, Simpson, Moore, Varra, &

Kaysen, 2012). However, some studies have found evidence of either overreporting

(Campbell et al., 2017) or underreporting of symptoms on more global measures when

compared to more time-delimited measures (Priebe et al., 2013). Nahleen et al. (2019) found both over- and underestimation of retrospective PTSD symptoms, depending on current PTSD symptomatology, with higher PTSD symptoms linked to overestimation of past symptom severity and lower PTSD symptoms linked to underestimation of past symptom severity. Relatedly, Schuler et al. (2019) found that retrospective reports of PTSD symptoms were most aligned with the worst day of symptoms during the period of recall.

While the literature on retrospective PTSD symptom reporting remains mixed, no research has yet examined the phenomenon of potential retrospective reporting bias for psychosocial functioning. Psychosocial functioning is a broad construct that may be more prone to bias than specific constructs like PTSD symptom severity. This paper aims to address this critical gap in the literature, by exploring concordance between retrospective weekly and daily reports of both PTSD symptom severity and PTSD-related functional impairment. Specifically, I aimed to (1) replicate prior findings regarding concordance between retrospective and daily PTSD symptom reporting, (2) add to the literature by investigating the concordance between retrospective and daily reports of psychosocial functioning, and (3) determine whether severity of PTSD symptoms would impact the concordance of retrospective and daily reports of functioning. Based on the majority of prior research regarding the correspondence of global and time-limited reports, I hypothesized that weekly and daily reports (of PTSD and of psychosocial functioning) would be strongly associated. Furthermore, I hypothesized that PTSD symptom severity would moderate the association of weekly and daily reports of functioning, such that

there would be lower concordance between weekly and daily reports of functioning in the context of more severe symptoms of PTSD.

Method

Participants

A total of 31 participants were recruited from a larger sample of U.S. military veterans with appreciable levels of PTSD symptom severity who were participating in a larger study investigating psychosocial functioning. Participants had an average age of 38.87 (*SD* = 7.75) and were primarily male (74.2%), White (74.2%), and employed (58.1%). The entire sample reported at least one prior deployment. In line with the eligibility criterion of having significant symptoms of PTSD, 51.6% of participants reported currently being in treatment, with a total of 75% of the sample reporting having received psychological treatment at some point following deployment.

Measures

Weekly Functioning. At baseline, participants completed the Inventory of Psychosocial Functioning (IPF; Bovin et al., 2018), an 80-item, self-report measure of functional impairment related to PTSD that is usually completed in reference to the past month. For this study, instructions were modified to reference functional impairment over the past *week*, yielding a slightly more specific time frame. The IPF provides a total score and subscale scores for each of the following seven areas of functioning: romance, family, friendships, parenting, education, work, and self-care activities. Participants respond to items only on domains that are relevant. An example item from the romance domain is: "I had trouble sharing thoughts or feelings with my spouse or partner." Item

responses range from 0 (*Never*) to 6 (*Always*), and the total score is created by summing

scored items, dividing by the maximum possible score on completed items (thus

disregarding items that are irrelevant to the participant), and multiplying by 100. The

total score thus ranges from 0–100, with higher scores signifying greater impairment.

Bovin et al. (2018) suggested the following ranges of scores to describe differing levels

of impairment: 0–10 (*no impairment*), 11–30 (*mild impairment*), 31–50 (*moderate

impairment*), 51–80 (*severe impairment*), and 81–100 (*extreme impairment*). The IPF has

demonstrated excellent test-retest reliability, internal consistency, and convergent validity

(Bovin et al., 2018). In the present sample, the overall scale demonstrated strong internal

consistency ($\alpha = .92$).

Daily functioning. Daily functioning was assessed using a modified version of

the Brief Inventory of Psychosocial Functioning (B-IPF; Kleiman et al., 2018). The B-

IPF is a 7-item self-report measure that is based on the full 80-item version of the IPF. It

is comprised of 1 item per domain of functioning: self-care, romantic relationship,

family, work, socializing, parenting, and education. The responses are designed to assess

past-month functional impairment, with higher scores indicating worse functioning. For

the present study, the instructions were adapted to assess participants' even more specific

ratings of functional impairment for the past day. Similar to the full IPF, respondents only

answer items for domains that are relevant. An example item reflecting the romance

domain is: "I had trouble in my romantic relationship with my spouse or partner." Item

responses range from 0 (*Never*) to 6 (*Always*), and the total score is created by summing

scored items, dividing by the maximum possible score on all scored items, and

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multiplying by 100. Thus, total scores again range from 0–100. The B-IPF has demonstrated high internal consistency (α = .84) and adequate test-retest reliability (r = .65, $p < .001$; Kleiman et al., 2020). Kleiman et al. (2020) found that the B-IPF is strongly correlated with the IPF ($r = .71$, $p < .01$). It also demonstrated moderate to strong correlations with other measures of mental health impairment and quality of life, as well as strong criterion-related validity. In the present sample, the B-IPF demonstrated excellent internal consistency (α = .96).

Weekly PTSD. The PTSD Checklist for DSM-5 (PCL-5; Weathers et al., 2013) is a 20-item questionnaire reflecting the diagnostic criteria for PTSD in the DSM-5 (American Psychiatric Association, 2013) that assesses the degree to which respondents have been bothered by symptoms of PTSD within the last month. At baseline (i.e., in the larger study), the instructions were adapted to direct participants to respond regarding PTSD symptoms in the previous *week*. An example item is: "Repeated, disturbing dreams of the stressful experience?" Items are summed to provide a total score, with higher scores indicating greater weekly PTSD symptom severity. The PCL-5 has demonstrated strong psychometric properties, including internal consistency, test–retest reliability, convergent and discriminant validity, and diagnostic utility (Blevins et al., 2015).

Daily PTSD. The PTSD Checklist for DSM-5 (PCL-5; Weathers et al., 2013) was administered each day to measure daily PTSD symptoms. Instructions were modified to direct participants to respond regarding PTSD symptoms for the previous *day*. Items were summed to provide a total score, with higher scores indicating greater daily PTSD symptom severity.

Procedures

Participants for this study came from a larger study of PTSD and functioning. For this study, participants were recruited primarily through Amazon's Mechanical Turk (MTurk), as well as targeted advertisements distributed through various online sources, including social media platforms and military-related listservs. Inclusionary criteria for the larger study included veteran status (not active duty), over 21 years of age, fluent in English, currently residing in the United States, and endorsing scores at or above 33 on the PCL-5. All advertisements directed participants to the survey website (Qualtrics). This larger study included the baseline measures of past-week functioning and PTSD. Within 24 hours of completing the larger study, participants were re-contacted, through MTurk or via email, and invited to participate in the current study. Participants were provided with a description of the study, instructions for beginning the nightly surveys, and information about compensation.

The study consisted of seven separate Qualtrics surveys, with one survey for each night of the study. The initial study invitation included the link for the Day 1 survey. Participants who did not initiate the Day 1 survey within 24 hours were sent a follow-up email with this same information. To maximize potential concordance between weekly and daily assessments, participants who did not initiate the study within 48 hours were excluded from participation in the second study. Each night, participants were instructed to complete measures in regard to psychological symptoms and functioning from the time they awoke that day.

Time stamps were analyzed each day, and if a participant missed a day of the survey, they were contacted with a reminder to complete the survey. If a participant completed a survey more than 24 hours after a particular day (e.g., completed the Day 4 survey on Day 5), their responses were coded as missing for the day(s) missed, and their responses were counted for the next appropriate day. At the end of each nightly survey, participants were given a code randomly generated by Qualtrics. MTurk participants were instructed to input the code into MTurk for compensation nightly ($0.50 for the first three nights, $0.75 for the final four nights, and an additional $1 for completing all seven nights). Participants from other online sources were instructed to email the code to the study coordinator nightly, and they received compensation at the end of their total study participation ($5 for each night completed and an additional $10 for completing all seven nights).

Of the 96 participants invited to participate in the present study, 28 did not access the survey, and another 17 participants accessed the first survey but did not complete it. An additional 18 participants completed only the first nightly survey. Lastly, two participants were removed from the final analyses due to invalid data. The final sample consisted of 31 participants (see Table 1 for demographic information). T-tests confirmed no significant differences between participants who were included in the study and those who were not ($n = 65$) on any demographic variables (all ps > .05) or past-week PTSD symptom severity ($p = .664$). There was a significant difference in reports of past-week functional impairment ($t[94] = -2.35$, $p = .021$), with participants included in the present

study reporting greater impairment ($M = 49.49$, $SD = 11.29$) than those who were not ($M = 43.09$, $SD = 13.01$.

Data Analysis

With 31 participants and 7 days of surveys, there were 217 total days of data possible. Data were missing from 41 of these days (18.89%). Little's Test of Missing Data indicated that the data were missing completely at random ($p = .520$). Therefore, I imputed data for variables with missing data using multiple imputation procedures in Blimp 2.2 (Enders, Du, & Keller, 2019). Multiple imputation estimated missing scores by evaluating the relationships among all observed variables from baseline and daily surveys. I set the initial burn-in iterations at 5000 and the number of iterations between datasets at 500, and I requested 10 imputed datasets. I then ran analyses with each of the 10 datasets, and I present the mean estimates across the 10 imputed datasets as results.

The basic association between weekly PTSD symptom severity and weekly functional impairment was evaluated via correlation. The basic association among mean daily reports of PTSD and mean daily reports of functioning was evaluated via a simple multilevel model (MLM) using HLM8. MLMs account for nonindependence among the data by nesting structure days (Level 1) within individuals (Level 2). To investigate the association of daily reports of PTSD symptom severity with daily reports of functioning, daily functioning was entered as the outcome, with daily PTSD was entered as a Level-1 predictor ($dlyBIPF_{ti} = \beta_{00} + \beta_{01}dlyPCL_i + r_{0i}$, where $dlyBIPF_{ti}$ is the mean daily report of functioning and $dlyPCL_i$ is the mean daily report of PTSD symptom severity). Subsequently, we also evaluated the links between (a) weekly and daily reports of PTSD

and (b) weekly and daily reports of functioning impairment, to examine the basic level of concurrence among weekly and daily reports. In these models, the daily variable was entered as the outcome, with the corresponding weekly measure entered as a Level-2 predictor.

Finally, to test the primary research question of whether the association of weekly reports of functioning with more specific, daily reports of functioning was moderated by PTSD symptom severity, we tested a MLM with daily functioning as the Level-1 outcome and the following Level-2 predictors: (1) weekly report of PTSD symptom severity, (2) weekly report of functioning, and (3) the interaction of these two variables (created by multiplying centered versions of these variables in SPSS). The formula for the mixed model was as follows: $\text{dlyBIPF}_{ti} = \beta_{00} + \beta_{01}\text{PCL}_i + \beta_{02}\text{IPF}_i + \beta_{03}\text{PCLxIPF}_i + r_{0i}$, where dlyBIPF_{ti} is the daily report of functioning, PCL_i is weekly PTSD symptom severity, IPF_i is weekly report of functioning, and PCLxIPF_i is the interaction between weekly PTSD and weekly functioning. A significant result for the interaction in this model would indicate that weekly PTSD symptom severity moderated the association between daily and weekly functioning reports. A significant interaction would be probed following recommendations of Aiken & West (1991) to investigate conditional effects.

Results

Table 2 displays the descriptives for all variables. Overall, past-week PTSD symptom severity was higher than the mean of daily reports of PTSD symptom severity. Similarly, past-week functional impairment was higher than the mean of daily reports of functional impairment. The correlation between past-week PTSD symptom severity and

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past-week IPF was $r = .31$, $p = .088$. Although not quite significant in this small sample of 31 participants, the effect was medium in size. The association of daily PTSD symptom severity with daily reports of functional impairment, as detected by the MLM of daily B-IPF on daily PCL-5, was significantly positive and strong ($B = 0.80$, $SE = 0.12$, $t = 6.44$, $p = < 0.001$). Subsequent MLMs also confirmed a strong association of past-week PTSD symptom severity with daily PTSD symptom severity ($B = 0.91$, $SE = 0.15$, $t = 5.87$, $p = < 0.001$), but not of past-week functional impairment with daily reports of functional impairment ($B = 0.64$, $SE = 0.48$, $t = 1.33$, $p = .195$).

The results of the MLM testing the primary research question are displayed in Table 3. Past-week PTSD symptom severity was significantly associated with daily reports of functional impairment, but past-week report of functional impairment was not. However, the significant interaction term indicated that past-week PTSD symptom severity moderated the association between past-week and daily functional impairment. Probing this interaction revealed that the association between past-week and daily reports of functional impairment was nonsignificant and negative at high levels (+1 SD) of PTSD, $B = -1.05$, $SE = 0.57$, $t = -1.83$, $p = .078$. In contrast, at low levels (+1 SD) of PTSD, this association was significantly positive, $B = 1.75$, $SE = 0.56$, $t = 3.07$, $p = .005$.

Discussion

The present study used daily diary methodology to compare daily and weekly reports of PTSD, daily and weekly reports of psychosocial functioning, and PTSD symptom severity as a potential moderator of daily and weekly psychosocial functioning reports. The association of past-week PTSD symptom severity with past-week functional

impairment was medium in size. Although the correlation was nonsignificant due to the small sample size, the size of this effect was consistent with that in prior samples (Pietrzak et al., 2010; Taft et al., 2011). Notably, the association of daily reports of PTSD symptoms with daily reports of functional impairment was strong and significant, extending prior findings that have been based on reports over longer time frames. This pattern of stronger association among daily reports compared to retrospective reports of a longer time frame is consistent with prior literature (Kleiman et al., 2018).

In this sample, I also replicated prior findings of strong agreement between past-week and daily PTSD symptom severity (Naragon-Gainey et al., 2012), supporting the potential use of retrospective measures of symptoms across differing time periods. Furthermore, and consistent with finding by Campbell et al. (2017), the overall mean for reports of past-week PTSD symptom severity was higher in terms of raw scores than the mean of daily reports of PTSD symptom severity.

Somewhat surprisingly, and in contrast to my hypotheses, I did not find a similar significant association between reports of past-week functional impairment and reports of daily functional impairment. It should be noted that two different measures were used to assess past-week (IPF) and daily (B-IPF) reports of psychosocial functioning, which may have contributed to the lack of association. However, the briefer measure was developed based on the longer measure, both measures are scored on the same scale, and the measures have been found to be highly associated in prior research ($r = .71$, Kleiman et al., 2018). Thus, the lack of association was surprising and suggests that veterans might experience more fluctuation in their psychosocial functioning over shorter periods of time

than they do in their PTSD symptoms. In line with this possibility, PTSD symptoms in the context of an official diagnosis must be *persistent* (i.e., have a notable level of stability) for 1 month or more (American Psychiatric Association, 2013). PTSD-related functional impairment, on the other hand, can wax and wane. For example, an argument with a loved one may be more sporadic and have greater influence on perceptions of functioning than more consistent trauma-related nightmares have on perceptions of PTSD symptom severity. Because of the possibility that functional impairment fluctuates more than PTSD symptoms, we may be better able to understand the association between PTSD and impairment when assessing more specific time periods.

Interestingly, and in line with my hypothesis, PTSD symptom severity moderated the association between past-week and daily reports of functional impairment. Specifically, at higher levels of PTSD, past-week reports of functioning were not associated with daily reports of functioning, but at lower levels of PTSD, this association was significant and positive. In other words, veterans experiencing more severe symptoms of PTSD were more likely to report higher levels of past-week functional impairment, regardless of their daily levels of impairment the following week, whereas veterans with relatively lower levels of symptom severity had a clear link between their past-week reports and their subsequent daily reports of functioning. This pattern is consistent with the notion that veterans with more severe PTSD symptoms may be more susceptible to bias when reporting on past-week symptoms, which aligns with findings that link higher retrospective reports of PTSD symptom severity with overestimation of symptoms (Nahleen et al., 2019). It is also consistent with bias specifically due to the

mood-congruency effect (Ebner-Priemer & Trull, 2009; Schuler et al., 2019). For instance, veterans who had a particularly difficult day at baseline may have been likely to report higher levels of past-week symptoms and impairment, but this overestimation did not carry into more time-specific reports on the days that followed. This bias may be more pronounced for the report of functional impairment, relative to the report of PTSD symptom severity, as functional impairment is comprised of several domains that impact overall quality of life and may be more vulnerable to subjectivity.

There are several limitations to note for the present study. First, although we had multiple days of data from each participant, the small size of our sample hampered our power in statistical analyses. Similarly, our study focused on associations of reports of the prior week with subsequent daily reports. Ideally, future studies could investigate reports over longer periods of time that are matched (e.g., daily reports for 2 weeks, followed by a retrospective report of the past 2 weeks), to gain a fuller picture of associations among these variables. Lastly, our study relied on self-report measures of daily symptoms and functioning, which are still vulnerable to the response bias that motivated the development of this study. We also used parallel, but not identical, measures for past-week and daily reports of functioning. Incorporating objective measures in future research (e.g., number of hospital visits, collateral reports), as well as using one measure for broader vs. more specific time reports, would bolster confidence in the detection of potential biases.

Despite these limitations, our study successfully extended prior research on reporting bias for self-report measures over longer periods of time, finding that PTSD

symptoms may influence self-reports of functional impairment. Because much of the literature on PTSD and functional impairment utilizes global reports, we may be misestimating how much PTSD symptoms and functioning overlap. It is important to note that these findings certainly do not signify that PTSD symptoms have no impact on veterans with PTSD. Rather, they point to the possibility that there are veterans who are able to function decently, in spite of appreciable levels of PTSD symptom severity. Moreover, increased variability in functioning may lead to greater difficulties in reporting on functioning over long periods of time. Additional research on bias in self-report measures is needed to improve the validity of this assessment method and improve our understanding of the lives of veterans with PTSD.

INDIVIDUAL AND INTERPERSONAL FUNCTIONING IN THE CONTEXT OF PTSD SYMPTOMS: ASSOCIATIONS WITH SYMPTOM CLUSTERS AND KNOWLEDGE ABOUT PTSD INTRODUCTION

Recent studies suggest that between 7 and 20% of service members have developed posttraumatic stress disorder (PTSD) following recent deployments (Adler & Sipos, 2018; Hoge et al., 2004), with additional numbers experiencing subclinical symptoms. The availability and quality of treatment has grown significantly in recent decades (e.g., Cusack et al., 2016). Despite this development, only 13-69% of service members seek treatment (Elbogen et al., 2013; Hoge et al., 2014), and of those, only 49-70% experience significant reductions in symptoms (e.g., Steenkamp, Litz, Hoge, & Marmar, 2015). Thus, a sizeable number of veterans have PTSD symptoms that persist for years or even a lifetime (Marmar et al., 2015; Vasterling et al., 2016) and must figure out how to function with those symptoms in their everyday life.

In psychological literature, *functioning* is a broad term that encompasses a number of domains (Bryant et al., 2016; Schnurr & Lunney, 2016). Much of the literature in military samples has focused on domains of interpersonal functioning, such as romantic relationships, family relationships, friendships and socializing, and parenting. Conceptual models, such as the cognitive-behavioral interpersonal theory of PTSD, have noted that PTSD influences dynamics between the individual and loved ones, which can even create a bidirectional effect between the individual's symptoms and their interpersonal functioning (e.g., Campbell & Renshaw, 2018; Monson, Fredman, & Dekel, 2010). Some

symptoms, such as detachment from others or persistent irritability, are even defined by their interpersonal effects.

Consistent with this, empirical findings have broadly identified negative associations of PTSD with several interpersonal functioning outcomes (e.g., Birkley, Eckhardt, & Dykstra, 2016; Pagotto et al., 2015; Vasterling et al., 2016; Vogt et al., 2017). When PTSD symptoms are present following deployment, service members cite lower satisfaction with their intimate relationships, greater impairments in intimate relationship functioning, and higher divorce rates (Birkley, Eckhardt, & Dykstra, 2016); Taft, Watkins, Stafford, Street, & Monson, 2011). A diagnosis of PTSD, or even the presence of PTSD symptoms, is also strongly tied to greater family relationship problems, worse family adjustment, and lower family cohesion (Monson, Taft, & Fredman, 2009; Tsai, Harpaz-Rotem, Pietrzak, & Southwick, 2012; Vasterling et al., 2015). Furthermore, social isolation and difficulty maintaining friendships – especially with non-veterans – are among the top reported reintegration difficulties for returning veterans (e.g., Sayers, Farrow, Ross, & Oslin, 2009), and research has consistently found negative association between PTSD and social functioning (Brewin, Andrews, & Valentine, 2000; Fang et al., 2015; Pagotto et al., 2015). Similar patterns have been found for parenting practices, with a PTSD diagnosis associated with lower satisfaction with parenting experiences and greater impairments in parenting functioning (Galovski & Lyons, 2004; Vogt et al., 2017).

In addition to poor overall interpersonal functioning, research strongly supports negative associations between PTSD symptoms and individual domains of functioning,

such as work and self-care. The interactions among cognitive, emotional, and behavioral symptoms of PTSD, which include phenomena such as decreased interest in activities and difficulty concentrating, have clear potential to impact their engagement with areas of their life (e.g., Ahmadian, Neylan, Metzler, & Cohen, 2019). One area of particular importance to veterans is the ability to work (Sripada, Henry, Yosef, Levine, Bohnert, Miller, & Zivin, 2018), and several studies have supported links between PTSD symptom severity and poorer occupational functioning (e.g., Erbes, Kaler, Schult, Polusny, & Arbisi, 2011; Fang et al., 2015). Among veterans, a PTSD diagnosis is associated with higher rates of unemployment, worse job performance, lower job satisfaction, and poorer job security (Horton et al., 2013; Kleykamp, 2013; Smith, Schnurr, & Rosenheck, 2005; Sripada et al., 2018). PTSD also generally shows a negative association with varying indicators of self-care in veterans (e.g., Bovin et al., 2018; Khalili, Nir, Khoshknab, Mahmoudi, & Ebadi, 2017), including difficulties with regular exercise (Whitworth & Ciccolo, 2016), caring for physical health (e.g., Buckley, Mozley, Bedard, Dewulf, & Greif, 2004), attending medical screenings (Buckley et al., 2004), seeking emergency care (Possemato et al., 2010), and adhering to prescribed medication (Rheingold, Acierno, & Resnick, 2004; Zen, Whooley, Zhao, & Cohen, 2012). Somewhat in contrast, research on the association between PTSD symptoms and academic success has been more mixed, with some studies finding a negative association (e.g., Barry, Whiteman, & MacDermid Wadsworth, 2012), others finding no association (e.g., Ness & Vroman, 2014), and one study even revealing a positive association (Campbell & Riggs, 2015).

To date, no research has evaluated interpersonal and individual functioning together in the context of PTSD, to understand whether there are differences in the ways in which symptoms impact these domains. Some PTSD symptoms are experienced by the individual alone (e.g., intrusive memories), while others are defined in terms of interactions with others (e.g., difficulty experiencing love). Therefore, it is possible that PTSD impacts functioning in individual domains differently than functioning in interpersonal domains. Accordingly, one primary aim of the present study was to evaluate the nature of associations of PTSD with both individual and interpersonal functioning.

In addition to treating functioning in a global manner, much of the research in this area has similarly treated PTSD as a unitary construct. In reality, PTSD consists of separate clusters of symptoms that may have differing impacts: re-experiencing (e.g., recurrent intrusive thoughts, nightmares, physiological reactivity to reminders of the trauma), avoidance (e.g., avoidance of internal or external reminders of the trauma), alterations in cognition and mood (e.g., loss of interest in previously-enjoyed activities, difficulty experiencing positive emotions), and changes in arousal and reactivity (e.g., irritability, sleep difficulties; American Psychiatric Association, 2013). Research that has examined PTSD at the level of symptom clusters has revealed definitive differences in relative associations of symptom clusters with functioning. While re-experiencing symptoms have not demonstrated a strong unique association with interpersonal outcomes compared to other clusters, in two separate samples, partners who perceived more re-experiencing symptoms in service members reported *less* relationship distress (Renshaw & Caska, 2012). In an interpersonal context, these hallmark PTSD symptoms

may provide a basis for partners to understand other symptoms as part of a broader trauma response, which might then engender additional sympathy from others. Regarding individual functioning, however, re-experiencing symptoms have demonstrated negative associations with outcomes such as physical functioning (Asnaani, Reddy, & Shea, 2014) and home management (Ross, Murphy, & Armour, 2018), and these symptoms could highly interfere with someone's ability to accomplish individual goals.

The avoidance cluster has been identified as a key prognostic factor for the development and course of PTSD over time (e.g., Bistricky et al., 2019; Foa, Hembree, & Rothbaum, 2007; Pineles et al., 2011), yet research on the short-term impact of avoidance points to a potentially *positive* association with individual functioning (e.g., Blais & Geiser, 2019; Hall et al., 2014) but a *negative* association with interpersonal functioning (e.g., Renshaw & Campbell, 2011). It is possible that avoidance could foster a short-term ability for an individual to accomplish individual tasks, while simultaneously having a negative impact on the ability to engage in relationships (due to withdrawal).

Both alterations in cognition and mood (sometimes examined as emotional numbing in studies prior to DSM-5) and changes in arousal have displayed unique negative associations with relationship functioning, with emotional numbing consistently demonstrating a stronger negative link with relationship distress than other clusters (see review by Campbell & Renshaw, 2018). However, only a few studies have begun to gather a complete picture of the relative association of alterations in cognition and mood symptoms with individual functioning domains (e.g., Kuhn, Blanchard, & Hickling, 2003; Meyer et al., 2018; Miller, Wolf, Martin, Kaloupek, & Keane, 2008). Similarly,

changes in arousal have been associated with greater intimate relationship difficulties

(Meis, Erbes, Polunsy, & Compton, 2010; Monson, Taft, & Fredman, 2009; Taft,

Watkins, Stafford, Street, & Monson, 2011), yet literature on the relative contributions of

this cluster to individual functioning is limited and mixed (e.g., Campbell & Renshaw,

2018; Maguen, Stalnaker, McCaslin, & Litz, 2009; Shea et al., 2010). In sum, there

remains a need for examination of the clusters in relation to both interpersonal and

individual functioning outcomes, which represents the second aim of the present study.

Finally, identifying factors that moderate the association of PTSD symptoms with

functional impairment has the potential to inform us about possible risk and protective

factors. To date, a number of protective factors in relation to domains of functioning

following exposure to trauma have been identified. These include extraversion (e.g.,

Mattson, James, & Engdahl, 2018), optimism (e.g., Jakšić, Brajković, Ivezić, Topić, &

Jakovljević, 2012), hardiness (e.g., Bartone, Hystad, Eid, & Brevik, 2012), psychological

flexibility (e.g., Bryan, Ray-Sannerud, & Heron, 2015) and approach or acceptance-based

coping styles (e.g., Grosso et al., 2014; Thompson, Arnkoff, & Glass, 2011). Greater

perceived social support and stronger relationship quality with romantic partners (e.g.,

Freedman, Gilad, Ankri, Roziner, & Shalev, 2015), family (e.g., Wagner, Monson, &

Hart, 2016), and peers (e.g., Caddick, Phoenix, & Smith, 2015), have also been

associated with better functional outcomes in the face of PTSD symptoms. Lastly, a wide

range of demographic and historical variables have been tied to resilience, including

older age, male sex, non-minority race, higher socioeconomic status, higher level of

education, and prior history of trauma (e.g., Bonanno, Galea, Bucciarelli, & Vlahov,

2007; Delahanty & Nugent, 2006). Military-specific demographics like officer rank (e.g., Xue et al., 2015) and nondeployed duty status (e.g., Vasterling et al., 2010) have also been explored.

Many of these protective factors are somewhat static or difficult to influence. In contrast, cognitions represent a more malleable factor. Cognitions have been theorized and empirically shown to affect behavior (e.g., Ajzen, 1991; Armitage & Conner, 2001; Becker, 1974; Floyd, Prentice-Dunn, & Rogers, 2000; Jones, Smith, & Llewellyn, 2014; Rogers, 1983). Furthermore, cognitions like attitudes and intentions are even stronger predictors of future behavior when an individual has more knowledge about the condition or issue related to that behavior (Davidson, Yantis, Norwood, & Montano, 1985; Fabrigar, Petty, Smith, & Crites Jr., 2006; Kallgren & Wood, 1986). Thus, it is possible that knowledge about PTSD might impact functioning in the context of PTSD symptoms. *Mental health literacy* is a concept that refers to not only recognizing signs and symptoms of a particular disorder, but also understanding its causes, treatments, and available resources for treatment (Kutcher, Wei, & Coniglio, 2016). Researchers have evaluated mental health literacy in relation to stigma and access to treatment (e.g., Bonabi et al., 2016; Corrigan, Druss, & Perlick, 2014; Jorm et al., 2003; Rüsch, Evans-Lacko, Henderson, Flach, & Thornicroft, 2011), but few studies have examined the impact of mental health literacy on functioning in the face of symptoms.

With the push of the military (e.g., Mulligan et al., 2012), community centers (e.g., Oflaz, Hatipoğlu, & Aydin, 2008), and impactful organizations such as the National Center for PTSD (e.g., U.S. Department of Affairs, 2020) to disseminate and implement

programs aimed at providing education about PTSD, the assumption appears to be that more knowledge about PTSD is beneficial. While there is widespread agreement that psychoeducation about PTSD symptoms is an important component of any effective treatment (e.g., Friedman, 2015), literature regarding psychoeducation about PTSD as a standalone intervention is scarce and mixed (e.g., McHugo & Fallot, 2011; Mulligan et al., 2012; Niles et al., 2012; Oflaz et al., 2008; Whitworth, 2016). Additionally, to our knowledge, there is no empirical literature on the impact of PTSD knowledge on functional impairment in veterans. Thus, the third aim of this study is to evaluate the impact of PTSD knowledge on veterans' psychosocial functioning in the context of PTSD symptoms.

In sum, the aims of the present study were to (1) examine relative associations of PTSD with both interpersonal and individual functioning, (2) explore the unique associations of PTSD clusters with interpersonal and individual functioning, and (3) evaluate the impact of PTSD knowledge on these associations. We hypothesized that total PTSD and the individual PTSD clusters would be associated with lower indices of interpersonal and individual functioning. We also hypothesized that changes in cognition and mood would be particularly associated with impairments in interpersonal functioning, with no accompanying a priori hypotheses about specific associations of clusters with individual functioning. Finally, we hypothesized that greater accuracy in knowledge about PTSD would be associated with better functioning (main effect) and would also weaken (moderate) the negative associations of PTSD symptom severity with interpersonal and individual functioning outcomes.

Method

Participants

Participants were 96 U.S. military veterans with symptoms consistent with possible presence of PTSD. Table 4 shows the full sample demographics. The sample consisted primarily of male, White veterans. A plurality were Army veterans, and slightly more than half were unemployed. Roughly half of participants (52%) reported receiving current psychological treatment at the time of the study. T-tests revealed no significant differences between those currently receiving treatment and not receiving treatment on any major demographic variables (all ps > .10).

Measures

Demographics. Survey participants provided basic information on gender, racial and ethnic background, employment status, and current and prior psychiatric history (i.e., diagnoses, psychiatric treatment). Additionally, information about participants' military history was gathered through select military-specific demographic questions (i.e., branch of service, prior deployment).

PTSD. Participants provided self-reports of PTSD symptom severity using the PTSD Checklist for DSM-5 (PCL-5; Weathers et al., 2013), a 20-item questionnaire that assesses the degree to which respondents have been bothered by symptoms of PTSD within the last month. Each item corresponds to a DSM-5 PTSD symptom, with a total sum score representing overall PTSD severity. An example item is: "Repeated, disturbing dreams of the stressful experience?" The PCL-5 can also quantify severity within each of the four individual DSM-5 clusters, allowing subscale scores to be created for each

cluster. Because of different numbers of items in clusters, subscale scores are typically reported as a mean response, rather than a sum. The PCL-5 has demonstrated strong psychometric properties, including internal consistency, test–retest reliability, convergent and discriminant validity, and diagnostic utility (Blevins, Weathers, Davis, Witte, & Domino, 2015). In the present sample, the total PCL-5 ($\alpha = .89$) and the subscales (re-experiencing, $\alpha = .83$; avoidance, $\alpha = .77$; negative alterations in cognition and mood, $\alpha = .73$; alterations in arousal and reactivity, $\alpha = .76$) all demonstrated acceptable internal consistency.

PTSD Knowledge. The PTSD Knowledge Scale (PKS; Renshaw & Allen, 2013) is a measure of how well participants recognize and understand symptoms of PTSD. The PKS is comprised of 10 questions about PTSD symptomatology with *Yes* and *No* answers. An example item is: "The person feels unable to get emotionally close to others." Correct items are summed to create a total score, with higher scores indicating greater knowledge of PTSD symptoms. The measure was originally developed from items that were generated and refined by experts in PTSD and then evaluated in a pilot study with approximately 200 respondents. Rasch curve analyses were used to identify items that provided maximum levels of information, with the final scale successfully discriminating between undergraduates who had and had not taken a course related to psychological disorders. The measure demonstrated adequate internal consistency ($\alpha = .75$) in the current sample. Independent samples *t*-tests indicated that the measure successfully discriminated between veterans who had ($M = 7.85$, $SD = 1.14$) and had not ($M = 6.92$, $SD = 1.35$) received PTSD treatment at any time following deployment

(t[104] = -3.44, p = .001), but not between those who were or were not currently

receiving PTSD treatment at the time of their participation (t[104] = -1.24, p = .217).

Functional Impairment. Global functional impairment was assessed using the

Inventory of Psychosocial Functioning (IPF; Bovin et al., 2018), an 80-item self-reported

measure created to assess functional impairment related to PTSD. The IPF is comprised

of seven subscales that encompass the following areas of functioning: romance, family,

friendships, parenting, education, work, and self-care activities. Participants respond to

items only on domains that are relevant. An example item from the self-care domain is: "I

had trouble keeping up with household chores (for example, cleaning, cooking, yard

work, etc.)." Item responses range from 0 (*Never*) to 6 (*Always*), and both subscale and

total scores are generated by summing scored items, dividing by the maximum possible

score, and multiplying by 100. Grand and subscales means thus fall between 0–100, with

higher scores indicating greater impairment. The overall IPF has demonstrated excellent

test-retest reliability, internal consistency, and convergent validity, and the IPF subscales

have also demonstrated good internal consistency (Bovin et al., 2018). In the present

sample, the overall scale demonstrated strong internal consistency (α = .92). Internal

consistencies of the individual subscales were more variable, with the "family" subscale

demonstrating poor internal consistency (α = .61), and the rest of the subscales ranging

from fair (α = .74) to strong (α = .90). To address the primary research questions, we

grouped the items into two broader subscales: the "interpersonal" (items from romance,

family, friendships, parenting) and "individual" (items education, work, self-care)

subscales. Items for each of these groupings demonstrated strong internal consistency (α = .89 and α = .87, respectively).

Procedures

Participants were primarily recruited through an online survey posted on Amazon's Mechanical Turk (MTurk), an online platform that provides a workforce for the completion of tasks that require human intelligence. Research has supported that MTurk is a viable source of high-quality data (Chandler & Shapiro, 2016; Kilpatrick et al., 2013), with samples that are comparable to the general population in terms of demographics (Mishra & Carleton, 2017) and prevalence of mental health problems (Shapiro, Chandler, & Mueller,, 2013), including PTSD (Engle, Talbot, & Samuelson, 2020; van Stolk-Cooke et al., 2018). In addition to MTurk, targeted advertisements were distributed on various online sources (e.g., social media platforms and military-related listservs) to direct participants to the survey platform.

MTurk and all advertisements directed participants to the survey website, where they were provided with a description of the study and pre-screening questions about gender, age, English fluency, current active military service, and previous U.S. military service. Participants were also administered veteran screening questions, consisting of five items assessing both generic and specific military knowledge (e.g., acronyms, order of officer rank), developed and validated for use in accurately identifying veterans (Lynn & Morgan, 2016). Per Lynn and Morgan's (2016) suggestion, participants were also presented with a statement after the initial consent that indicated that the person understand the legal repercussions of impersonating a veteran for monetary gain.

For eligibility, participants were required to be military veterans (not active duty), over 21 years of age, fluent in English, currently residing in the United States, and endorse appreciable PTSD symptoms (i.e., scores at or above 33 on the PTSD measure). After screening, MTurk participants who were not eligible were directed back to the MTurk website and compensated $0.01 for completing the screening task, and non-MTurk participants who were not eligible were directed to a page thanking them for their participation and informing them that they were not eligible. All eligible participants were directed to the informed consent, an informed consent comprehension task, and then the survey measures. Upon completion of all the survey measures, MTurk participants were compensated $2.50 (above the median MTurk worker hourly wage), and participants recruited from general Internet sources were compensated with a $10 gift card.

A total of 907 participants accessed the survey. Of these participants, 274 were removed due to reporting active duty status, 155 did not pass the veteran screening, 128 did not meet the cutoff criteria for PTSD, 110 did not pass the language/comprehension screening, 16 declined consent to the study, and 14 did not complete the entire functional impairment measure. Of the remaining participants, 114 participants were removed during *ex post* screening procedures due to false IP addresses and/or GPS coordinates located outside of the United States. The final sample consisted of a total of 96 participants (82 recruited via MTurk and 14 recruited from Internet advertisements; see Figure 1 for flow chart).

Data Analysis

Preliminary analyses confirmed normal distribution of all variables. T-tests
confirmed no significant differences between participants recruited from MTurk and
those recruited from other Internet sources on any demographic variables (all ps > .25) or
any of the variables of interest (all ps > .10). Bivariate correlations were used to examine
associations among all variables of interest, to provide bivariate tests of hypothesized
associations.

Subsequently, we ran a series of hierarchical linear regressions. The first set of
regressions investigated *total* PTSD and *total* functional impairment scores, and then total
PTSD and the two separate domains of functional impairment (interpersonal and
individual). The next set of regressions were identical to the first, but substituting
separate PTSD clusters for total PTSD. In all regressions, Block 1 of each hierarchical
model regressed functional impairment (total IPF or IPF subscales) on PTSD symptom
severity (total PCL or PCL clusters) and PKS, and Block 2 added the interactions of
PTSD symptom severity (total PCL or PCL clusters) and PKS. In this manner, Block 1
provided multivariate tests of hypothesized associations, and Block 2 provided a test of
the moderation hypothesis. Using recommendations of Aiken and West (1991),
significant interactions were probed to investigate conditional effects. Regressions were
inspected for multicollinearity problems (using variance inflation factor) and normality of
residuals, with no problems identified.

<center>**Results**</center>

Descriptives and Bivariate Correlations

Means, standard deviations, and bivariate associations of all variables of interest are shown in Table 5. Total PTSD symptom severity and total functional impairment demonstrated a small positive correlation with each other. Individual PTSD clusters demonstrated moderate correlations with each other and with total PTSD score. Only the cognitions/mood and the arousal clusters were significantly positive correlated with total functional impairment.

The re-experiencing cluster was significantly positively correlated with individual functional impairment, the cognitions/mood cluster was significantly positively correlated with interpersonal functional impairment, and the arousal cluster was significantly positively correlated with both interpersonal and individual functional impairment. Notably, of all the PTSD and impairment variables, PTSD knowledge was only significantly correlated with the cognitions/mood cluster, in a positive direction.

Overall Functioning

Results for all hierarchical linear regressions involving total PTSD symptom severity are shown in Table 6. Step 1 of the regression of total functional impairment on total PTSD and PTSD knowledge was significant, $F(2, 91) = 3.99$, $p = .022$, $R^2 = .08$. Adding the interaction term in Step 2 minimally increased the variance explained ($\Delta R^2 = .02$), and there was minimal change in the significance of the full model, $F(3, 90) = 3.33$, $p = .023$, $R^2 = .10$. In the full model, total PTSD and PTSD knowledge were both

<center>43</center>

significantly positively associated with functional impairment, but the interaction was nonsignificant.

Results for hierarchical linear regressions involving separate PTSD clusters are shown in Table 7. Step 1 of the regression of total functional impairment onto PTSD clusters and PTSD knowledge was significant, $F(5, 88) = 2.41$, $p = .043$, $R^2 = .12$. Adding the interaction term in Step 2 increased the variance explained ($\Delta R^2 = .11$), as well as the significance of the full model, $F(9, 84) = 2.74$, $p = .007$, $R^2 = .23$. Greater avoidance symptoms were associated with less functional impairment, but greater cognitions/mood symptoms were associated with more functional impairment. PTSD knowledge was associated with greater functional impairment. PTSD knowledge significantly moderated the association of the avoidance cluster with functional impairment and trended toward moderating the association of re-experiencing with functional impairment.

Probing these interactions revealed that the avoidance cluster was significantly associated with less functional impairment at lower levels (-1 *SD*) of PTSD knowledge (partial $r = -.30$, $p = .005$) but nonsignificantly associated with more impairment (partial $r = .02$, $p = .841$) at higher levels (+1 *SD*) of PTSD knowledge. In contrast, the re-experiencing cluster was significantly associated with more functional impairment at lower levels (-1 *SD*) of PTSD knowledge (partial $r = .22$, $p = .045$) but nonsignificantly associated with less functional impairment (partial $r = -.12$, $p = .279$) at higher levels (+1 *SD*) of PTSD knowledge.

Interpersonal Functioning

Step 1 of the regression onto total PTSD and PTSD knowledge was significant, $F(2, 85) = 3.61$, $p = .031$, $R^2 = .08$. Adding the interaction term in Step 2 did not increase the variance explained ($\Delta R^2 = .00$), and both the interaction term and the full model were nonsignificant, $F(3, 84) = 2.38$, $p = .075$, $R^2 = .08$. In Block 1, total PTSD was significantly associated with more functional impairment, while PTSD knowledge was nonsignificant.

In the model with the four PTSD clusters and PTSD knowledge, Step 1 was significant, $F(5, 82) = 3.01$, $p = .015$, $R^2 = .16$. Adding the interaction terms in Step 2 increased the variance explained ($\Delta R^2 = .07$ and resulted in a significant full model, $F(9, 78) = 2.61$, $p = .011$, $R^2 = .23$. Greater avoidance symptoms predicted less interpersonal functional impairment, whereas greater cognitions/mood symptoms predicted more interpersonal functional impairment. There was no main effect of PTSD knowledge, but PTSD knowledge moderated the association of the re-experiencing and avoidance clusters with functional impairment (with a trending interaction of PTSD knowledge with the arousal cluster).

Probing these interactions revealed that the re-experiencing cluster was nonsignificantly associated with more functional impairment at lower levels (–1 *SD*) of PTSD knowledge (partial $r = .16$, $p = .169$) but trending toward a significant association with less functional impairment (partial $r = -.20$, $p = .074$) at higher levels (+1 *SD*) of PTSD knowledge. In contrast, the avoidance cluster was significantly associated with less functional impairment at lower levels (-1 *SD*) of PTSD knowledge (partial $r = -.25$, $p = $

.027) but this association became nonsignificant (partial $r = -.01$, $p = .952$) at higher

levels (+1 *SD*) of PTSD knowledge. Of note, probing the trending interaction with the

arousal cluster yielded a generally similar pattern as the re-experiencing cluster, with a

nonsignificant association with less functional impairment (partial $r = -.10$, $p = .360$) at

lower levels (-1 *SD*) of PTSD knowledge but a nearly-significant association with more

impairment (partial $r = .22$, $p = .053$) at higher levels (+1 *SD*) of PTSD knowledge.

Individual Functioning

Step 1 of the regression of individual functional impairment on total PTSD and

PTSD knowledge was nonsignificant ($F[2, 91] = 2.47$, $p = .09$, $R^2 = .05$). Adding the

interaction terms in Step 2 increased the variance explained ($\Delta R^2 = .02$), but the full

model was only trending toward significance Step 2 ($F[3, 90] = 2.37$, $p = .08$, $R^2 = .07$).

In Block 1, total PTSD was significantly associated with more functional impairment,

while PTSD knowledge was not. These results held in Block 2, and the interaction in this

step was nonsignificant.

In the model substituting the four clusters for total PTSD, Step 1 was

nonsignificant, $F(5, 88) = 1.70$, $p = .143$, $R^2 = .09$. Adding the interaction terms in Step 2

increased the variance explained ($\Delta R^2 = .09$) and resulted in a significant full model, $F(9,$

$84) = 2.081$, $p = .040$, $R^2 = .18$. In the full model, there were no main effects of any PTSD

cluster, but greater PTSD knowledge significantly predicted greater functional

impairment. PTSD knowledge also trended toward moderating the association of the re-

experiencing and avoidance clusters with PTSD knowledge.

Although these interactions did not reach significance, they were probed to evaluate whether the general directions were similar to those for interpersonal functioning. Probing these trending interactions revealed that the re-experiencing cluster was significantly associated with more functional impairment at lower levels (−1 *SD*) of PTSD knowledge (partial *r* = .22, *p* = .043) but nonsignificantly associated with less functional impairment (partial *r* = −.08, *p* = .461) at higher levels (+1 *SD*) of PTSD knowledge. For the avoidance cluster, the association with functional impairment was nearly significantly associated with less functional impairment at lower levels (-1 *SD*) of PTSD knowledge (partial *r* = −.21, *p* = .052), but nonsignificantly associated with more impairment (partial *r* = .05, *p* = .675) at higher levels (+1 *SD*) of PTSD knowledge.

Discussion

In this study of veterans with notable levels of PTSD symptoms, we evaluated total, individual, and interpersonal functioning in relation to overall symptom severity, specific symptom clusters, and general level of knowledge about PTSD. Consistent with prior literature, overall PTSD symptom severity was positively correlated with functional impairment overall, as well as impairment in specific domains of individual and interpersonal functioning (Meyer et al., 2018; Pietrzak, Goldstein, Malley, Rivers, & Southwick, 2010; Taft et al., 2011).

When we examined bivariate links of PTSD clusters with functioning, the arousal cluster was the only cluster significantly correlated with total, interpersonal, and individual functioning. However, it was also the only cluster that subsequently demonstrated no significant association with indices of functioning in any of the

multivariate analyses. The arousal cluster contains some of the hallmark symptoms of PTSD that are less trauma-specific (e.g., hypervigilance, irritability), many of which serve as precursors for an array of difficulties across functioning domains. For example, hypervigilance capitalizes on cognitive resources, which may make it difficult to fully engage in work or educational activities. Similarly, irritability can damage the ability to maintain close relationships, particularly if loved ones feel like they are constantly "walking on eggshells." Nevertheless, when all PTSD symptoms are considered simultaneously, these symptoms may not be primary drivers of impairment. That said, additional research is needed to determine whether these findings are replicable and, if so, to further clarify mechanisms that link this cluster with veteran functioning.

The cognitions/mood cluster was positively associated with total and interpersonal functional impairment, but not with individual functional impairment. These associations held in both bivariate and multivariate analyses. The link between this cluster and total functional impairment is consistent with prior literature (Kuhn et al., 2003; Meyer et al., 2018), but the absence of an association with individual functional impairment suggests that the link of cognitions/mood with overall impairment may be driven primarily by the link with difficulties in interpersonal functioning. Research has consistently found emotional numbing symptoms (now captured in the cognitions/mood cluster) to be distinctly associated with interpersonal functioning outcomes (see Campbell & Renshaw, 2018). Some research implicates lack of engagement and less intimate connections with others in this association (Renshaw, Campbell, Meis, & Erbes, 2014), and other research has pointed to the possibility that others view these symptoms as

stable, internal characteristics of the veteran, rather than as part of a reaction to an external trauma (e.g., Renshaw, Allen, Carter, Markman, & Stanley, 2014).

Our findings suggest that these negative cognitions/mood symptoms may not necessarily compromise veterans' ability to engage in individual tasks like work or school. In fact, it is possible that, when veterans become somewhat alienated, some turn to individual tasks to occupy themselves. A core component of military training involves teaching service members to persevere in the face of adversity. Such perseverance may help offset the negative impact of maladaptive thoughts and negative mood states on individually driven tasks. Given the importance of social support for reintegrating veterans (Tsai et al., 2012) and for veterans with chronic PTSD symptoms (Laffaye, Cavella, Drescher, & Rosen, 2008), targeting cognitions/mood symptoms early in treatment could boost veterans' interpersonal functioning, thus helping to facilitate recovery (Charuvastra & Cloitre, 2008). Further, helping veterans and loved ones understand that PTSD symptoms are a part of a broader response to trauma, rather than permanent traits, might help loved ones take these symptoms less personally and mitigate damage to relationships.

The avoidance cluster demonstrated no bivariate correlations with any of the functional impairment outcomes. In multivariate analyses, however, avoidance was significantly associated with better overall functioning. This finding held specifically for the interpersonal domain but not for the individual domain. When other symptoms that could be impairing to relationships (e.g., physiological reactivity, irritability) arise, veterans may find that avoidance actually helps to blunt the impact of those symptoms on

their relationships. Some veterans may even view their avoidance of trauma-related stimuli – and in some cases, close others – as an attempt to "protect" others from things like explosive anger. Indeed, decreased avoidance (i.e., more social interaction) in the context of high symptoms may be met with more interpersonal problems, thus reinforcing the idea that avoiding others is the "best" way to avoid losing these relationships.

Notably, avoidance is a key target in PTSD treatment. Our findings reinforce the likely importance of discussing with clients the potential for initial reductions in avoidance to be met with increases in distress and functional impairment while other symptoms persist (e.g., Foa et al., 2007). It is important to ensure clients are properly prepared for this possibility, which can include discussing possible symptom trajectories with close others in their lives. Indeed, PTSD treatments are most effective for individuals with stronger interpersonal supports (Meis et al., 2019; Price, Gros, Strachan, Ruggiero, & Acierno, 2013).

Lastly, the re-experiencing cluster demonstrated a bivariate correlation with individual functional impairment, but it showed no other bivariate correlations or any multivariate main effect associations with functioning outcomes. This cluster has been associated with specific individual outcomes, such as problematic alcohol use (e.g., Walton et al., 2017), with speculation that individuals are typically left to cope with re-experiencing symptoms on their own, and in doing so they are more likely to turn to avoidance strategies such as alcohol use. However, in line with prior research that lacks distinct associations of this cluster with interpersonal outcomes (see review by Campbell

& Renshaw, 2018), our findings suggest that the association of these symptoms with functional impairment is overshadowed in the presence of other clusters.

Of note, we did find a modest moderating role of PTSD knowledge with regard to the avoidance cluster and re-experiencing cluster, in somewhat opposite directions. With regard to avoidance, we found that associations with total and interpersonal functional impairment were stronger in the context of less PTSD knowledge. It may be that having greater awareness of the long-term negative effects of avoidance reduces the effectiveness of avoidance as even a short-term strategy, thus weakening the positive association with functioning that has been detected in our sample and in prior research (Blais & Geiser, 2019; Hall et al., 2015). In contrast, the general trend for re-experiencing symptoms was that they were associated with worse total and interpersonal functioning in the context of lower PTSD knowledge. It may be that veterans who understand re-experiencing symptoms are better equipped both individually and interpersonally. For instance, when these symptoms specifically impact areas that involve others (e.g., waking a significant other because of a nightmare), having more PTSD knowledge may increase veterans' ability to maintain their social relationships, perhaps by facilitating communication about these symptoms. Due to inconsistent findings regarding this cluster, continued research is needed to understand how this construct interacts with veterans' ability to function across varied domains.

In a broader sense, our hypothesis that higher PTSD knowledge might serve as a protective factor with regard to functioning in the context of PTSD symptoms was not well supported. Bivariate associations revealed that PTSD knowledge was not associated

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with functional impairment, whether assessed as total functioning, interpersonal functioning, or individual functioning. Additionally, in multivariate models for total PTSD symptom severity, PTSD knowledge was either unassociated with functional impairment or associated with *greater* impairment in total or individual functional impairment. This finding is in contrast with literature on mental health literacy, which has consistently linked greater mental health literacy with positive outcomes such as increased help-seeking behaviors and decreased mental health stigma (Jorm, 2000; Jung, von Sternberg, & Davis, 2017). It is important to note that our sample is comprised of veterans, whereas prior studies on mental health literacy have been conducted with overwhelmingly civilian samples. It is entirely possible that knowledge about mental health symptoms functions differently in veteran populations. A common coping mechanism in this population is to persevere or "push through" difficult symptoms, without necessarily paying attention to symptoms or seeking additional knowledge. Such an approach may allow a veteran to maintain at least the self-perception that they are functioning adequately.

Also, much of the prior research on mental health literacy has focused on samples with depression, generalized anxiety, and schizophrenia. It is possible that knowledge about PTSD operates differently. Indeed, some research has suggested that PTSD knowledge might increase perceptions of trauma-related cues (Niles et al., 2012), and such awareness might actually lead to some greater impairments in functioning. Clearly, further research is needed before drawing strong conclusions. The different patterns in our findings as compared to prior literature suggests such research is warranted.

Several limitations in the present study must be noted. First, the cross-sectional nature of the study does not allow for any causal inferences. It is possible that worse functional impairment can aggravate PTSD symptom severity, and vice versa, over time. In that same vein, the cross-sectional design does not allow for directional inferences regarding PTSD knowledge. Individuals who experience specific types of problems may seek out more knowledge about PTSD over time, or individuals who gain such knowledge may experience changes in their attentiveness to PTSD symptoms and functional impairments. Another limitation regarding the construct of PTSD knowledge is the use of a self-report instrument that has yet to be validated in a published study. Although it demonstrated strong psychometric properties in its development (Renshaw & Allen, 2013), additional research is needed to evaluate its validity and reliability across different clinical and non-clinical populations. Lastly, our measures were all self-report, leaving vulnerability to reporting bias. In particular, there is evidence to suggest that reports of PTSD symptoms and functional impairment might be influenced by PTSD knowledge, or severity of symptoms or impairment (e.g., Nahleen, Nixon, & Takarangi, 2019).

Despite these limitations, this study represents a first step in integrating several parts of the literature to strengthen our understanding of how veterans function in the context of considerable PTSD symptoms. This was the first study to separately investigate multiple domains of functioning in relation to PTSD symptom clusters and knowledge about PTSD. The results support the importance of considering the multifactorial nature of both functioning and PTSD, as clusters evidenced different

associations with functional impairment in different domains. Similarly, veterans may thrive in one domain of functioning while suffering in another. Moreover, our results raise the possibility that increasing knowledge about PTSD through psychoeducational interventions may have the potential to aggravate certain PTSD symptoms and functional impairment, thus increasing risk of poor treatment response and/or treatment dropout. Future studies of functioning may continue to inform more efficacious interventions for PTSD, with the goal of encouraging recovery from PTSD and improvements in overall psychosocial functioning.

Table 1

Sample Demographics

Variable	M (SD) / n (%)
Age	38.87 (7.75)
Gender	
Male	23 (74.2%)
Female	8 (25.8%)
Race	
White	23 (74.2%)
Black	4 (12.9%)
Hispanic/Latino	4 (12.9%)
Branch	
Army	15 (48.4%)
Air Force	8 (25.8%)
Navy	4 (12.9%)
Marines	2 (6.5%)
Coast Guard	2 (6.5%)

Table 2

Variable Descriptives

Variable	*Mean*	*SD*
PCL-5		
Past-Week	50.68	14.77
Daily	35.53	18.76
IPF		
Past-Week	49.49	11.29
Daily IPF	43.24	21.92

Note. PCL-5 = PTSD Checklist for DSM-5.

Table 3

Coefficients from Multilevel Model of Daily Functioning

Model	*B*	*SE*	*t*-ratio	*p*-value
Past-Week PTSD	0.77	0.22	3.47	0.002
Past-Week Functioning	0.35	0.29	1.21	0.237
PTSD x Functioning	-0.09	0.03	-2.84	0.008

Note. PTSD = Posttraumatic stress disorder.

Table 4

Sample Demographics

	M (*SD*) / *n* (%)
Age	38.41 (10.36)
Gender	
Male	72 (66.7%)
Female	36 (33.3%)
Race	
White	76 (70.4%)
Hispanic/Latino	10 (9.3%)
Black	8 (7.4%)
Asian American/Asian	6 (5.6%)
Bi-racial/Other	6 (5.6%)
Branch	
Army	52 (48.1%)
Navy	21 (19.4%)
Air Force	18 (16.7%)
Marines	13 (12.0%)
Employment Status	
Employed	56 (51.9%)
Retired	22 (20.4%)
Student	10 (9.3%)
Disabled	10 (9.3%)
Unemployed/Other	10 (9.3%)

Table 5

Means, Standard Deviations, and Bivariate Correlations

	Mean (*SD*)	1	2	3	4	5	6	7	8
1. Total PTSD	51.06 (12.30)								
2. Re-experiencing	2.33 (0.79)	.86**							
3. Avoidance	2.82 (0.77)	.61**	.57**						
4. Cognitions/Mood	2.66 (0.69)	.83**	.53**	.45**					
5. Arousal	2.53 (0.77)	.86**	.69**	.33**	.57**				
6. PKS	7.55 (1.45)	.09	.05	-.11	.20*	.02			
7. Total IPF	44.44 (11.91)	.22*	.16	-.02	.24*	.23*	.18		
8. Interpersonal IPF	44.11 (11.97)	.24*	.09	-.02	.30**	.26**	.15	.88**	
9. Individual IPF	43.81 (15.91)	.21*	.20*	-.00	.15	.23*	.10	.88**	.57**

Note. PTSD = Posttraumatic Stress Disorder. PKS = PTSD Knowledge Scale. IPF = Inventory of Psychosocial Functioning.
**$p < .01$. *$p < .05$.

Table 6

Results of Hierarchical Linear Regressions of Impairment onto Total PTSD

	Model Predictors	partial-*r*		
		Total Impairment	Interpersonal Impairment	Individual Impairment
Step 1	Total PTSD	.22	.24*	.20*
	PKS	.18	.15	.10
Step 2	Total PTSD	.24*	.24*	.22*
	PKS	.23*	.13	.16
	PTSD x PKS	.15	.01	.15

Note. PTSD: Posttraumatic Stress Disorder.
*p ≤ .05. ^ p < .10.

Table 7

*Results of Hierarchical Linear Regressions of Impairment onto PTSD Clusters*

	Predictors	partial-*r*		
		Total Impairment	Interpersonal Impairment	Individual Impairment
Step 1	Cluster B	.07	-.08	.12
	Cluster C	-.17	-.12	-.14
	Cluster D	.14	.23*	.02
	Cluster E	.08	.15	.10
	PKS	.14	.09	.10
Step 2	Cluster B	.07	-.04	.10
	Cluster C	-.26*	-.22*	-.17
	Cluster D	.22*	.31*	.03
	Cluster E	.07	.06	.15
	PKS	.26*	.13	.23
	PKS x Cluster B	-.21	-.23*	-.19
	PKS x Cluster C	.27*	.22*	.20
	PKS x Cluster D	.02	-.12	.16
	PKS x Cluster E	.16	.21	.05

Note. Cluster B = Re-experiencing; Cluster C = Avoidance; Cluster D = Alterations in cognitions/mood; Cluster E = Changes in arousal. PKS = PTSD Knowledge Scale. ** *p* < .01. * *p* < .05.

Figure 1

Recruitment Flow Chart
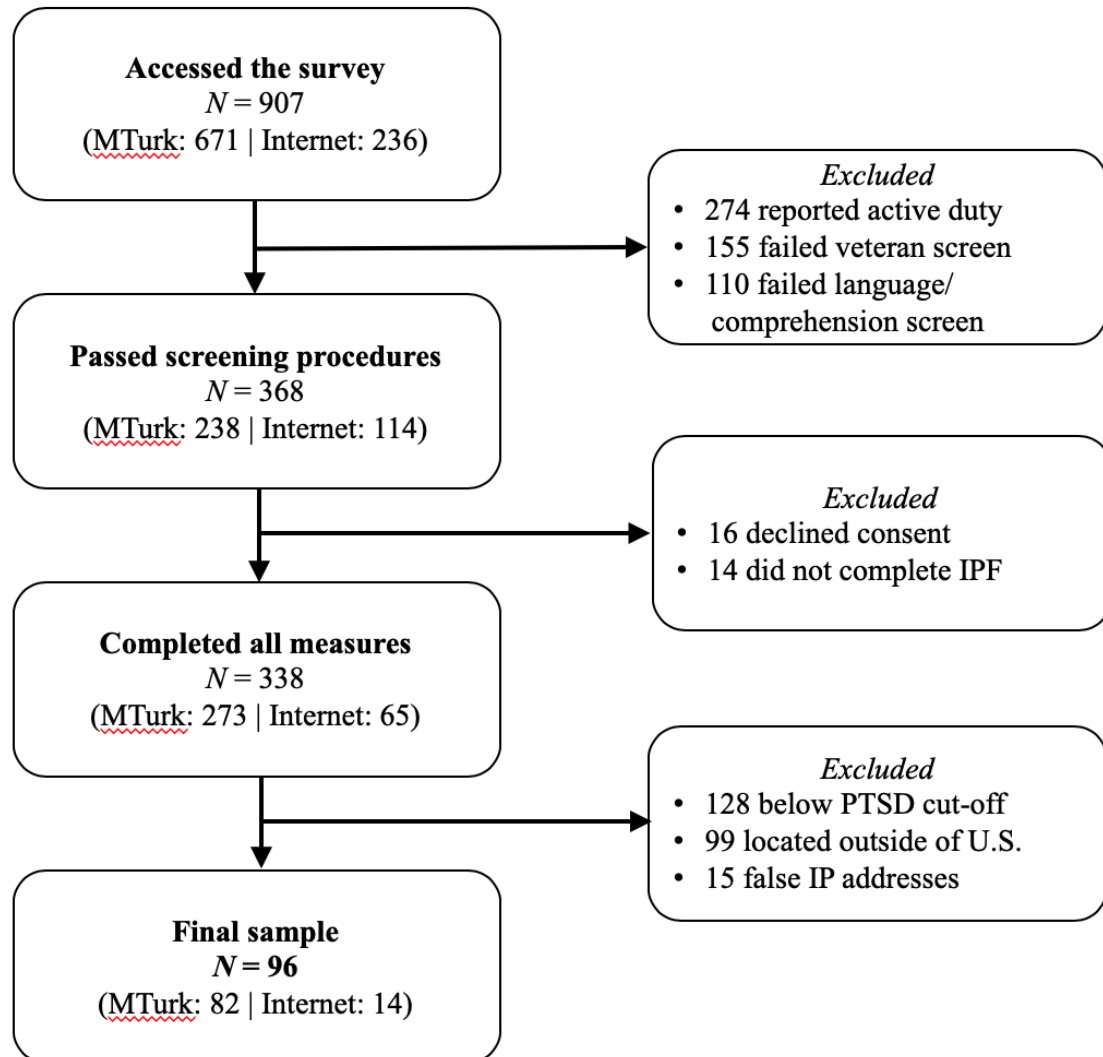
Note. IPF = Inventory of Psychosocial Functioning. PTSD = Posttraumatic Stress Disorder.

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