PSYCHIATRIC SERVICE DOGS FOR VETERANS WITH MILITARY SEXUAL TRAUMA

by

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We respectfully acknowledge the University of Arizona is on the land and territories of Indigenous peoples. Today, Arizona is home to 22 federally recognized tribes, with Tucson being home to the O'odham and the Yaqui. Committed to diversity and inclusion, the University strives to build sustainable relationships with sovereign Native Nations and Indigenous communities through education offerings, partnerships, and community service.

Dedication

Dedicated to veteran and service dog teams; past, present, and future.

May *hope* find you in your darkest moments, and may you find love for yourself and life again, through the unconditional love of a dog.

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ABSTRACT

Military sexual trauma (MST) is a traumatic experience caused by physical assault or harassment of a sexual nature that occurred during active duty or training. MST is pervasive, being reported by more than 30% of post-9/11 women veterans. MST is impactful and associated with more severe posttraumatic stress disorder (PTSD). Recent findings show partnership with a trained service dog is associated with lower anxiety and depression for veterans with PTSD. However, the effects of service dog partnerships specifically for veterans with MST remain unclear.

This study involved 142 post-9/11 veterans (19% women, M_{age}=39 years [SD=8.2], age range=22-67 years) with a clinical diagnosis of PTSD. They were recruited from the waitlist of an accredited service dog organization and participated in an NIH-funded nonrandomized, pre-registered clinical trial (R21HD091896, NCT03245814). Of the total sample, 40 veterans (28%) disclosed a history of MST. Among women, there was a 96% rate of reporting MST (26 of 27 total women in the study). Participants completed standardized surveys at baseline and 3-month follow-up. Half of the participants (n=80, including n=21 disclosing MST) were paired with a service dog immediately after baseline assessment. Standardized survey measures assessed depression, anxiety, companionship, suicidal ideation intensity, and PTSD severity.

Veterans who disclosed a history of MST had significantly higher baseline PTSD symptom severity compared to those who did not report MST. Baseline PTSD symptom severity within the MST group did not vary by gender, with no significant differences between men and women. While service dog partnership was associated with marginally lower PTSD severity for MST survivors, it was not associated with depression, anxiety, companionship, or suicidality in our sample. Future research should explore whether human-animal bond strength may mediate the efficacy of partnership with a trained service dog among veterans with a history of MST.

Psychiatric Service Dogs for Veterans with Military Sexual Trauma

Nearly 4 million veterans served the United States of America in the post-9/11 era, making up nearly 20% of the total veteran population (JEC, 2016). Unfortunately, posttraumatic stress disorder (PTSD) is common among these veterans, with roughly one-quarter receiving a clinical diagnosis (Fulton et al., 2015). Posttraumatic stress disorder (PTSD) is a mental condition that can occur in individuals who have experienced an extremely stressful or terrifying event (NIMH, 2024). At one time called "battle fatigue syndrome", this severe mental condition has been used to describe military members' experiences and symptoms following combat engagement since World War II (Chekroud, Loho, Paulus, & Krystal, 2018). While PTSD is a mental condition that can develop in any individual who has experienced trauma, it is especially common among military members who have experienced combat-zone engagement, military-related sexual trauma, or even training trauma, with higher rates of clinical diagnoses of PTSD for veterans than civilians (National Center for PTSD, 2024).

PTSD is a persistent and sometimes lifelong mental condition that can cause an array of often severe symptoms, including disturbed biopsychosocial functioning (e.g., pain, compromised mental health, isolation) and occupational functioning for many patients. Comorbid conditions are prevalent and can include major mental health conditions (e.g., depression/anxiety, sleep, substance use), as well as other physical ailments (e.g., chronic pain, cardiovascular and digestive system issues; Qassem, Aly-El Gabry, Alzarouni, Abdel-Aziz, & Arnone, 2021).

Military sexual trauma and PTSD

Military sexual trauma (MST) is a psychological trauma resulting from physical assault, battery, or harassment of a sexual nature that occurred during active or inactive duty (U.S.

Government, 2014, Title 38 U.S. Code 1720D). MST is an unfortunately common experience among service members with PTSD. For example, one study examined prevalence of comorbid conditions in a sample of over 70,000 older women veterans (Gibson et al., 2020). Women who disclosed a history of MST had a 7.25 times greater likelihood of having PTSD compared to women who did not. Given that the prevalence of MST in veterans can range as high as 10% for male service members (0.7-10%) and over 30% for women service members (15-32%) during their time in service (Kimerling et al., 2010; Klingensmith, Tsai, Mota, Southwick, & Pietrzak, 2014; VA, 2021), there is critical need to better understand the relationship between MST and PTSD for veterans.

MST is a complex traumatic experience that is associated with a wide range of symptoms that impact survivors in different ways, most notably by negatively affecting their mental health. Veterans who served in the Iraq/Afghanistan war and report MST were more likely to be diagnosed with a mental health condition (Kimerling et al., 2010) and reported more psychological distress (Rowe, Gradus, Pineles, Batten, & Davison, 2009). In addition, MST presents with many comorbid symptoms that contribute to PTSD severity and which can be chronic, including lower relationship satisfaction and perceived social support, more loneliness and depression, as well as greater risk of self-inflicted injury, substance use disorder (SUD) and eating disorders (Galovski, Street, Creech, Lehavot, Kelly, & Yano, 2022; Goldberg et al., 2019; Livingston, Tannahill, Meter, Fargo, & Blais, 2022; Yalch, Hebenstreit, & Maguen, 2018). Physical health is also a concern among survivors of MST. Women veterans who experienced MST were twice as likely to report infertility and being childless by choice (Nillni, Fox, Cox, Paul, Vogt, & Galovski, 2021; Ryan, Mengeling, Booth, Torner, Syrop, & Sadler, 2014). Researchers have also explored how specific traumas, such as MST, may predict more severe PTSD symptoms and higher PTSD ratings on clinician-

conducted interviews (Jakob, Lamp, Rauch, Smith, & Buchholz, 2017). Finally, veterans that identified MST as the source of their PTSD showed higher levels of active suicidal ideation (Blais & Monteith, 2019).

Thus, MST is a prevalent and complex traumatic experience among veterans significantly contributing to PTSD and other mental health issues, including depression, anxiety, decreased social support, and suicidal ideation. Given the high rates of MST among veterans and its negative impact on both mental and physical health, further investigation into its interaction with PTSD is crucial.

Negative impact of MST on veteran health

Increased risk of suicide in military sexual trauma survivors. In 2021, the US Department of Veteran's Affairs deemed veteran suicide a 'public health and national security crisis', making it an increasingly salient concern in the eyes of practitioners, researchers, and policy makers (US Department of Veteran's Affairs, 2021). Overall, veterans who report MST are three times more likely to have attempted suicide in their lifetime and twice as likely to report active suicidal ideation (Klingensmith et al., 2014). Women veterans who experience MST are at even higher risk for death by suicide compared to women veterans who have not experienced MST (Blais & Monteith, 2019). Additionally, veterans with MST report relatively higher rates of intentional self-harm, with one study finding 27% of participants reported a history of non-suicidal self-injury (Cawood et al., 2022; Kimerling, Gima, Smith, Street, & Frayne, 2007). In addition, feelings of institutional betrayal and isolation resulting from MST are related to increased reports of deaths by suicide (Galovski, et al., 2022). Current literature supports the notion that social support may mitigate the increased risk of death by suicide (Kleiman & Liu, 2013). Considering diminished

social support and increases in self-harm, suicidal ideation, and deaths by suicide, timely answers are needed to improve quality of life and long-term outcomes for veterans with MST.

Deployment-related military sexual trauma. As defined by the U.S. Government, MST includes instances of sexual harassment or assault that occur on inactive as well as active duty. Deployment-related MST rates are high, reported by 12% of women veterans from Operation Enduring Freedom/Operation Iraqi Freedom (Maguen Cohen, Ren, Bosch, Kimerling, & Seal., 2012). In another study examining deployment-related MST and heavy drinking, over 17% of male veterans disclosed a history of MST during a recent deployment (Fillo, Heavy, Homish, & Homish, 2017). While research on deployment-related MST is sparse, one study suggests that the absence of accountability for offenders, military culture, and deployment structure may be important factors (Burns, Grindlay, Holt, Manski, & Grossman, 2014). Thus, given the limited literature on deployment-related MST and adverse impacts on biopsychosocial functioning, clinicians are searching for ways to provide comprehensive intervention and expedited prevention routes for survivors.

Trauma-focused treatments for post-traumatic stress disorder and military sexual trauma

Evidence-based psychotherapies. In recent years, concerns are rising about public health and national security given the rate of veteran suicides resulting from the challenges of living with PTSD. More than 65,000 veterans have died by suicide since 2010, which more is more than the total number of combat-related deaths from the Vietnam War and operations in Iraq and Afghanistan combined (U.S. Department of Veteran's Affairs, 2021). The Veterans Health Administration (VA) and other organizations have worked diligently for over two decades to end this public health crisis by developing treatment guidance, including evidence-based psychotherapies to reduce symptoms associated with PTSD (Maguen et al., 2023).

Evidence-based psychotherapies take different approaches to addressing trauma and most trauma-focused interventions are effective. For example, an intensive outpatient program (IOP) at the VA focusing on Prolonged Exposure Therapy (PE) reported more than 70% of participants had a clinically significant reduction in PTSD symptoms at post-treatment and 30% no longer met criteria for PTSD as per the Clinician-Administered PTSD Scale (CAPS-IV; Ragsdale, Watkins, Sherril, Zwiebach, & Rothbaum, 2020). Despite strong efficacy, evidence-based trauma-focused psychotherapies such as Prolonged Exposure Therapy (PE) and Cognitive Processing Therapy (CPT) have dropout rates as high as 49% (Doran & DeViva, 2018). Both require the individual to directly recall memories, thoughts, or emotions related to their index trauma, which may limit treatment palatability and retention (Watkins, Sprang, & Rothbaum, 2018).

In addition to substantial rates of dropout, treatment-seeking among military-connected members is significantly lower than for individuals in the general population suffering from similar mental health conditions. This can be due to a variety of reasons including stigma, practical barriers, perceived concerns about reporting mental health problems, and preconceived notions about treatment (Zinzow, Britt, McFadden, & Gillispie, 2012). Indeed, veterans and service members with MST and PTSD have higher rates of self-stigma regarding seeking treatment for psychological symptoms, such as suicidal ideation (Blais & Monteith, 2023). Furthermore, high levels of emotional avoidance in this population, a core symptom of PTSD, may also contribute to the high dropout rates seen for trauma-focused interventions (Weiss, Schick, Contractor, Goncharenko, Raudales, & Forkus, 2022).

Complementary, integrative, and alternative interventions for post-traumatic stress disorder. As a result, more veterans are turning to complementary and integrative healthcare interventions in search of reprieve from symptoms associated with PTSD. Complementary and

integrative healthcare comprises health care systems, practices, and treatments that may not be considered a part of conventional medicine (NIH Center for Complementary and Integrative Healthcare, 2025). These therapies include those used as an adjunct to (complement) or in parallel with (integrative) conventional care. Examples of these interventions include wellness modalities such as yoga, acupuncture, and meditation (Park, Finkelstein-Fox, Barnes, Mazure, & Hoff, 2016). Complementary and integrative healthcare interventions have also been accepted by the VA as a means for treatment and are offered nationwide. While these options have been increasingly sought after by members of the military community with PTSD, many lack empirical support for their efficacy (Wahbeh, Senders, Neuendorf, & Cayton, 2014).

Psychiatric service dogs for veterans with posttraumatic stress disorder

In recent years, psychiatric service dogs have become increasingly popular as a complementary intervention (O'Haire & Rodriguez, 2018) and are specially trained to perform tasks for an individual with mental or physical disabilities (Americans with Disabilities Act, 2010). Because service dogs can help their handlers perform tasks that they may not be able to otherwise do, they have the potential to promote their handlers' independence (Rodriguez, K. E., Bibbo, J., & O'Haire, M. E. (2019). In 2019, Assistance Dogs International reported 19% of assistance animal partnerships worldwide being comprised of psychiatric service dogs for PTSD. According to a recent meta-analysis by Leighton, Nieforth, & O'Haire (2022), being partnered with a service dog had a positive impact on PTSD symptoms, with veterans showing a significant reduction in PTSD symptom severity (1.14 SD decline in PCL-5 scores; posttraumatic stress disorder checklist for DSM-5). In a clinical trial looking at veterans paired with psychiatric service dogs in tandem with usual care, service dog partnership was associated with 66% lower odds of having a PTSD

diagnosis on the Clinician Administered PTSD Scale (CAPS 5) at follow-up, as well as lower anxiety and depression (Leighton et al., 2024).

While such findings suggest that psychiatric service dog partnerships are associated with positive, measurable, and clinically significant improvements for veterans with PTSD, previous research is limited in scope and more rigorous clinical trials are required to explore the impact that psychiatric service dogs may have on veterans with PTSD and associated traumas such as military sexual trauma.

The present study

To explore the prevalence of MST in a service dog seeking population, as well as whether PTSD and MST symptoms are impacted by being partnered with a trained psychiatric service dog, we conducted a secondary analysis on data from an NIH-funded pre-registered, non-randomized clinical trial (R21HD091896; NCT03245814) designed to quantify the efficacy and role of service dogs for military veterans with PTSD. Few studies exist examining the associations between psychiatric service dogs and veterans, and even fewer have explored these questions for veterans with military sexual trauma, despite this population's greater symptom severity and risk of dying by suicide. To fill this gap the present study sought first to replicate previous findings (Jakob et al., 2017) suggesting that veterans disclosing MST experience more severe PTSD symptomology compared to veterans who do not report MST (RQ1). We accomplished this by comparing baseline PTSD symptom severity for veterans in our sample who did and did not report MST. Our remaining questions focused on the subset of veterans who disclosed a history of MST, to explore whether baseline PTSD symptom severity among MST survivors may vary by gender (RQ2). Given that rates of MST are especially high among women veterans, it is important to establish whether gender differences in MST symptomology are evident for this subpopulation. Finally, and

again focusing just on the MST reporting subset of our sample, we explored whether service dog partnership mitigates conditions that are comorbid with specific MST constructs and experiences (RQ3), including depression, anxiety, companionship, suicidality, and PTSD symptom severity.

By answering these questions, we hope to (a) shed light on the nature of symptomology for veterans suffering from PTSD who also report MST and (b) determine whether service dog partnership might be an effective complementary intervention for PTSD and the other comorbid conditions (e.g., anxiety, depression) among veterans reporting MST.

METHODS

Participants

Data were collected from 142 United States military members and veterans (19% women, mean age = 39 years (SD=8.2; range=22–67) who participated in a pre-registered, non-randomized clinical trial (ClinicalTrials.gov ID: NCT03245814) exploring the efficacy of trained psychiatric service dogs for mitigating PTSD symptomology in veterans. Secondary analyses are reported here regarding MST-focused research questions.

Participants were recruited from the acceptance list of nationwide service dog provider – K9s For Warriors (K9FW). K9FW is a not-for-profit organization who partners trained psychiatric service dogs with veterans living with PTSD at no charge. All participants applied and were accepted into the K9FW program, were currently on the waitlist to receive a dog, and met the following inclusion criteria: military service following September 11, 2001; an honorable discharge or currently serving honorably; current PTSD diagnosis confirmed by independent, blinded clinicians on the Clinician-Administered PTSD Scale (CAPS-5); no history of animal abuse convictions; and were 18 years of age or older. Self-reported demographic questions

included gender, age, BIPOC-belonging (Black, Indigenous, and People of Color), pet dog ownership, relationship status, concurrent evidence-based treatment participation, levels of exposure to combat, history of traumatic brain injury (TBI), and disclosure of history of military sexual assault or harassment before, during, or following a deployment. Demographics are reported in Table 1 for the full sample, as well as the MST-disclosing and non-disclosing subsamples.

Participants disclosing a history of Military Sexual Trauma. Out of 142 participants, 40 (28%) self-reported a history of military sexual trauma in the form of sexual assault or sexual harassment during or following a combat or non-combat deployment. Of this MST-disclosing subsample, 65% (26) were women and 35% (14) were men. Importantly, rates of MST-reporting in our sample varied substantially by gender. For men, 12% (14/115) disclosed a history of MST; in contrast, 96% of the women in our sample (26/27) disclosed a history of MST.

Procedure

Following recruitment from the K9s For Warriors waitlist, both intervention and control groups completed standardized surveys and demographics questions at baseline. Participants in the intervention group attended the service dog provider in-person training with 5-12 other veterans. After 3 months, at follow-up, participants completed the same set of standardized online survey measures in Research Electronic Data Capture (REDCap) and Qualtrics (Harris et al., 2009). Participants had unrestricted access to usual care during the study, meaning that they had no restrictions on the types of care they could seek while participating in the study.

Measures

Measures were curated to capture a broad set of symptoms that are associated with MST allowing us to better characterize the many challenges faced by MST survivors. All measures are standard in the field and validated for the present purposes.

Disclosure of *Military sexual trauma history* was captured by two self-report questions that were asked of any participant that reported ever being deployed: 1) "While you were in the military, did someone ever use force or threat of force to have sexual contact with you against your will?", and 2) "While you were in the military, did you receive uninvited and unwanted sexual attention, such as touching, cornering, pressure for sexual favors, or verbal remarks?" (Afari et al., 2015). If the participant answered "yes" to either option, they were considered to have disclosed a history of MST.

PTSD severity was assessed via both self-report and clinician assessment. The PTSD Checklist for the DSM-5 (PCL-5) is a self-report measure comprised of 20 items to assess symptom severity (range 0–80, where a higher score indicates greater severity; Weathers, Blake, Schnurr, Kaloupek, Marx, & Keane, 2013). This is based on the four DSM-5 symptom clusters of re-experiencing (subscale B), avoidance (subscale C), negative alterations in cognition and mood (subscale D), and alterations in arousal and reactivity (subscale e; Weathers, Litz, Herman, Huska, & Keane, 1993). A total score above 50 on a scale of 17 to 80 indicates a positive screening for PTSD among all individuals completing the instrument with a higher score indicating greater overall symptom severity (Forbes, Creamer, & Biddle, 2001). A change of 10 points is considered clinically meaningful (National Center for PTSD, 2025).

Trained, blinded clinicians administered the Clinician-Administered PTSD Scale for the DSM-5 (CAPS 5). It consists of 30 items, each corresponding to specific PTSD symptoms. For each domain, the clinician evaluates frequency and intensity and combines them to derive a single

severity score. The total CAPS-5 severity score is calculated by summing the severity scores of the 20 DSM-5 PTSD symptoms, yielding a range from 0 to 80. Higher total scores reflect more severe PTSD symptoms (Weathers et al., 2013, 2018).

Depression is often a comorbid condition that coincides with MST and PTSD. Measured by the 8-item PROMIS Emotional Distress – Depression – Short Form, scores range between 8-40, with a higher score indicating greater levels of depression (Pilkonis, Choi, Reise, Stover, Riley, & Cella, 2011).

Anxiety is a common symptom amongst survivors of MST and PTSD. The PROMIS short form v1.0 – Anxiety 7a was used, scores range between 4-20, with higher scores indicating greater anxiety (Pilkonis, et al., 2011).

Companionship. The PROMIS Short Form v2.0 - Companionship 6a was used to explore the effects of loss of companionship and loneliness that often coincides with experiencing MST. This form is a 6-item scale with a range of scores between 6-30, higher scores indicating a greater perceived level of companionship (Hahn et al., 2014).

Suicidality is among the more salient symptoms of MST. To gather current suicidality, the Columbia Suicide Severity Rating Scale (CSSRS) was used, specifically the ideation severity subscale. The CSSRS asks questions based off different subscales including ideation severity (highest level endorsed 1-5), intensity of ideation (scores range 2-25), suicidal behavior (y/n), and behavior lethality (scores range 0-2). Higher scores indicate more severe endorsement of each item within the subscales (Posner et al., 2011).

Combat exposure was assessed using the Combat Exposure Scale (CES), a 7-item self-report measure designed to quantify wartime stressors experienced by military personnel (Keane

et al., 1989). The CES evaluates the frequency and intensity of combat-related experiences, such as being under enemy fire, going on dangerous duty, or witnessing injury or death. Responses are weighted and summed to yield a total score ranging from 0 to 41, with higher scores indicating greater exposure to combat. A sample item includes, “Did you ever go on combat patrols or have other dangerous duty?” with response options ranging from “Never” (0 points) to “More than 50 times” (5 points), depending on the question. The scale is divided into five categories of exposure: *light* (0–8), *light-moderate* (9–16), *moderate* (17–24), *moderate-heavy* (25–32), and *heavy* (33–41), allowing researchers to classify participants based on combat intensity (Keane et al., 1989). The CES has demonstrated good reliability and validity in veteran populations and is commonly used in both clinical and research settings to assess the impact of war-zone experiences.

Intervention

Psychiatric Service Dogs were provided by a nationwide service dog provider - K9s For Warriors. The canines went through extensive training, completing 60+ hours with certified professional dog-trainers. Dogs were trained with five PTSD-specific tasks including: (a) creating space between the veteran and other individuals (block), (b) watching the veteran’s back (cover), (c) interrupting anxiety, (d) comforting the veteran following anxiety (e.g., panic attacks), and (e) fostering positive social greetings (make a friend). All potential service dogs were selected after undergoing a comprehensive set of behavioral, personality, and aptitude assessments, as well as meeting very strict breed, height, weight, health & trainability criteria. Potential service dogs were sourced by K9s For Warriors as puppies or young adults from local shelters and owner surrenders.

About half of the participants in this study were partnered with a psychiatric service dog after the baseline assessments, whilst the other half of the participants remained on the waitlist and received unrestricted access to usual care. Service dog placement classes consisted of 3 weeks of

in-person training at the K9s For Warriors campus in Ponte Vedra, Florida. Veterans were then partnered with a psychiatric service dog that best fit their needs (based on the service dog organization's own matching process). During the 3-week course, veteran-service dog teams underwent training to ensure they bonded and could develop a successful partnership. To be eligible for graduation and certification, partnered teams were required to pass the Assistance Dogs International (ADI) public access test. This test is intended to be predictive of the team's success in public settings and is followed by a final obedience and specialized skill proficiency assessment to test the service dog's ability to perform PTSD specific tasks.

RESULTS

Sample demographic data appears in Table 1 providing mean values for all variables including participants' mean age (in years), BIPOC belonging (y/n), pet dog ownership (y/n), current evidence-based treatment participation (Cognitive Processing Therapy, EMDR therapy, Prolonged Exposure Therapy) (y/n), relationship status (single/not single), TBI status (y/n), and combat exposure (total score), for the full sample and the MST-reporting sample, separately.

Table 1

Participant demographic characteristics including mean age (in years), BIPOC (Black, Indigenous, and People of Color) belonging (y/n), pet dog ownership (y/n), current evidence-based treatment (y/n), relationship status (single/not single), TBI status (y/n), and combat exposure (total score), for the full sample and the MST-disclosing sample, separately. Note there was only one women veteran who did not report MST; we excluded their data from the table to ensure their confidentiality.

	MST REPORTED			NO MST REPORTED			FULL SAMPLE
	Men	*Women*	*Total*	*Men*	*Women*	*Total*	*Total*
TOTAL N	14	26	40	101	1	102	142
MEAN AGE IN YEARS (SD)	39.79 (9.75)	34.81 (6.38)	36.55 (7.97)	39.29 (7.99)	--	39.47 (8.16)	38.65 (8.19)
BIPOC (YES/TOTAL)	57% 8/14	35% 9/26	43% 17/40	36% 34/95	--	36% 34/95	38% 51/136
RELATIONSHIP STATUS (SINGLE, YES/TOTAL)	21% 3/14	65% 17/26	50% 20/40	23% 23/101	--	23% 23/101	31% 44/142
PET DOG (YES/TOTAL)	50% 7/14	38% 10/26	43% 17/40	43% 43/101	--	43% 43/101	42% 60/142
EVIDENCE BASED TREATMENT AT BASELINE (YES/TOTAL)	54% 7/13	30% 7/23	39% 14/36	41% 36/87	--	41% 36/87	40% 50/124
TRAUMATIC BRAIN INJURY (YES/TOTAL)	57% 8/14	35% 9/26	43% 17/40	59% 60/101	--	59% 60/101	55% 78/142
MEAN COMBAT EXPOSURE SCORE (SD)	20.36 (10.75)	10.77 (9.21)	14.13 (10.69)	22.21 (9.75)	--	22.03 (9.87)	19.80 (9.48)

PTSD severity and MST

To examine whether veterans who disclosed a history of MST have greater PTSD symptom severity compared to veterans who did not disclose a history of MST (RQ1), we conducted a hierarchical linear regression predicting veterans' baseline CAPS scores (dependent variable) as a function of disclosing MST history (y/n), our main predictor of interest, in Step 1. In Step 2, we added demographic covariates: veteran age (in years), BIPOC (Black, Indigenous, and People of Color) belonging (y/n), pet dog ownership (y/n), current evidence-based treatment (y/n), relationship status (single/not single), TBI status (y/n), and combat exposure (total score). Gender was excluded to avoid collinearity. Preliminary analyses indicated it was moderately to strongly

correlated with several covariates (i.e., age, combat exposure, TBI, and relationship status) and very strongly correlated to disclosure of MST history (r=.73, p<.001) our main predictor of interest. In addition, we explore gender among our MST-reporting subsample in the next set of analyses.

MST history reliably predicted PTSD symptom severity at baseline (β=5.38, p=.002) in Step 1 and remained the only significant predictor (β=6.29, p<.001) in Step 2 with covariates included. No other factors were significant (all βs < |2.30|, all ps > .05). See Table 2 for full results. We also conducted a post-hoc independent samples t-test to examine whether the significant effect of MST history disclosure group indicated a genuine group difference at baseline. The test was significant, t(140)=-3.42, p<.001, two-tailed, confirming that veterans in our sample who reported MST started our study with higher average PTSD symptom severity (n=40, M=44.78, SD=6.87), than veterans who did not disclose a history of MST (n=102, M=40.12, SD=7.45).

Table 2

Results of hierarchical linear regression model predicting PTSD symptom severity (CAPS baseline score) with MST-reporting status (yes/no) as main predictor.

	STEP 1			STEP 2 - FULL MODEL		
	β	***t*(1,122)**	***p***	**β**	***t*(8,115)**	***p***
INTERCEPT	38.61	43.27	**<.001**	39.47	8.16	**<.001**
MST HISTORY DISCLOSURE (YES/NO)	5.37	3.20	**.002**	6.29	3.39	**<.001**
AGE IN YEARS	--	--	--	-0.05	-0.51	.614
BIPOC (YES/NO)	--	--	--	-2.16	-1.30	.197

PET DOG (YES/NO)	--	--	--	2.30	1.40	.164
EVIDENCED BASE TREATMENT (AT BASELINE, YES/NO)	--	--	--	-1.97	-0.11	.221
RELATIONSHIP STATUS (SINGLE, YES/NO)	--	--	--	-0.84	-0.05	.640
TRAUMATIC BRAIN INJURY (YES/TOTAL)	--	--	--	0.13	0.07	.944
COMBAT EXPOSURE SCORE	--	--	--	0.09	1.00	.317

Note. Covariates (age, BIPOC, pet dog ownership, evidence-based treatment, relationship status, traumatic brain injury, and combat exposure) were entered in step 2. MST-reporting status was a significant predictor both without ($\beta = 5.37$, $p = .002$) and with covariates included ($\beta = 6.29$, $p < .001$); veterans reporting MST began the study with higher PTSD symptom severity than veterans who did not disclose MST.

Relationship between gender and PTSD symptom severity for veterans disclosing MST

Remaining analyses were conducted on just the subset of veterans who reported experiencing MST. Rates of MST-reporting were high in our sample with 28% of veterans overall reporting MST (40/142). Reported incidence rates differed by gender with 18% (14/115) of men in our sample reporting MST, while a significantly higher percentage of women - 96% (26/27) - disclosed a history of MST. A chi-square analysis confirmed this was a reliable difference ($\chi^2(1) = 76.47$, $p < .001$, two-tailed).

To examine whether PTSD symptom severity for MST survivors differed by veteran gender (RQ2), we conducted a hierarchical linear regression predicting veterans' baseline CAPS scores (dependent variable) as a function of gender (m/w), our main predictor of interest, entered alone in Step 1. In Step 2, veteran age (in years), BIPOC status (y/n), pet dog ownership (y/n), current

evidence-based treatment (y/n), relationship status (single/not single), TBI status (y/n), and combat exposure (total score) were all entered simultaneously as covariates. Gender did not predict PTSD symptom severity at baseline when modeled alone (β=2.51, p>.05) or with covariates (β=.69, p>.05); nor were any reliable effects observed for any covariates (all βs<|2.60|, all ps>.05). See Table 3 for full regression results. An independent samples t-test confirmed no group difference between men (n=14, M=43.14, SD=8.93) and women (n=26, M=45.65, SD=5.47) for PTSD symptom severity at baseline, (t(38)=-1.05, p>.05, two-tailed). Thus, men and women in our sample who disclosed MST started the study with equivalent baseline PTSD symptom severity.

Table 3

Results of hierarchical linear regression model predicting PTSD symptom severity at study start (CAPS baseline score) with Gender (men/women) as the main predictor of interest.

	STEP 1			**STEP 2 - FULL MODEL**		
	β	***t*(1,34)**	***p***	**β**	***t*(8,27)**	***p***
INTERCEPT	43.14	22.30	**<.001**	43.04	6.00	**<.001**
GENDER (MEN/WOMEN)	2.51	1.05	.303	.690	.219	.829
AGE IN YEARS	--	--	--	-.124	.753	.458
BIPOC (YES/NO)	--	--	--	-1.33	-.489	.629
PET DOG (YES/NO)	--	--	--	2.23	.828	.415
EVIDENCE BASED TREATMENT (AT BASELINE, YES/NO)	--	--	--	-3.68	-1.38	.178
RELATIONSHIP STATUS (SINGLE, YES/NO)	--	--	--	2.15	.707	.485
TRAUMATIC BRAIN INJURY (YES/NO)	--	--	--	-1.77	-.528	.602

COMBAT EXPOSURE SCORE	--	--	--	.110	.644	.525

Note. Covariates (age, BIPOC, pet dog ownership, evidence-based treatment, relationship status, traumatic brain injury, and combat exposure) were entered in Step 2. Gender was not a significant predictor either alone (Step 1: β=2.51, *p*=.303) or with covariates included (Step 2: β=.690, *p*=.829), with veterans beginning the study with equivalent PTSD symptom severity regardless of veteran gender.

In a final set of analyses, we investigated whether service dogs mitigate symptoms often associated with MST in veterans (RQ3). Because MST is multifaceted, we conducted five separate hierarchical linear regressions focusing on survey data from the subset of participants reporting MST (n=40) to explore whether partnership with a service dog is related to veterans' follow up scores for depression, anxiety, companionship, suicidality, and PTSD symptom severity. For each analysis, we entered the follow-up (T2) score for the dependent variable of interest (depression, anxiety, companionship, suicidality, or PTSD severity) and Group (service dog or waitlist), the main predictor of interest, as well as the baseline (T1) score for that dependent variable, in Step 1. The same set of covariates were entered simultaneously in Step 2 for all five regression analyses and included: veteran gender (man/woman), veteran age (in years), BIPOC status (y/n), pet dog ownership (y/n), current evidence-based treatment (y/n), relationship status (single/not single), TBI status (y/n), and combat exposure (total score).

Regression models revealed few significant predictors for any of the five MST constructs, indicating in general that service dog partnership (versus staying on the waitlist) was not systematically related to change in depression, anxiety, companionship, or suicidality in this MST subsample (see Table 4 for full regression results). However, service dog partnership did reliably

predict PTSD severity at follow-up when entered only with the PTSD severity baseline score (β=-10.89, *p*=.042, Step 1) but was no longer significant with the inclusion of all covariates (β=-10.49, *p*=.119, Step 2). See Table 4 for full model results.

Table 4

Results of five hierarchical linear regression models, predicting the follow-up (T2) score for the dependent variable of interest: depression, anxiety, companionship, suicidal ideation, and PTSD symptom severity.

DEPENDENT MEASURE	DEPRESSION			ANXIETY			COMPANIONSHIP			SUICIDAL IDEATION			PTSD SYMPTOM SEVERITY		
	β	*t (df)* (2,30) (10,22)	*p*	β	*t (df)* (2,30) (10,22)	*p*	β	*t (df)* (2,30) (10,22)	*p*	β	*t (df)* (2,30) (10,22)	*p*	β	*t (df)* (2,30) (10,22)	*p*
INTERCEPT															
STEP 1	24.40	1.73	**.093**	36.28	2.40	**.023**	8.99	.988	.332	.232	.835	.410	-8.56	-.544	.590
STEP 2	24.90	1.18	.253	35.72	1.84	.079	9.10	.691	**.497**	.418	.34	.737	-20.48	-.793	.436
GROUP (SERVICE DOG/WAITLIST)															
STEP 1	-4.26	-1.35	.187	-3.43	-1.29	.206	1.57	.515	.611	**.129**	.399	.692	-10.89	-2.12	**.042**
STEP 2	-3.41	-.746	.464	-3.09	-.890	.384	-.800	-.296	.770	.379	.912	.371	-10.49	-1.61	.119
DV BASELINE SCORE															
STEP 1	.60	2.74	**.010**	.45	2.01	**.054**	.82	4.00	**<.001**	.339	3.33	**.002**	1.03	4.01	**<.001**
STEP 2	.58	2.02	**.057**	.40	1.60	**.124**	.849	4.51	**<.001**	.363	2.85	**.009**	.938	3.18	**.004**
AGE	.095	.40	.694	.10	.57	.574	-.273	-1.71	.101	.002	.08	.931	.311	.83	.413
GENDER (MEN/WOMEN)	-.882	-.191	.851	2.09	.60	.553	9.26	3.03	.007	-.237	-.515	.611	7.98	1.13	.296
BIPOC (YES/NO)	.882	.22	.827	.417	.14	.889	-1.53	-.605	.552	-.062	-.156	.877	-2.93	-.48	.634
PET DOG (YES/NO)	-1.83	-.45	.655	-.998	-.33	.746	2.99	1.16	.257	-.017	-.043	.966	6.11	.97	.342
EVIDENCE BASED TREATMENT (AT BASELINE, YES/NO)	-3.80	-.95	.356	-4.89	-1.63	.117	8.67	3.34	**.003**	-.417	-1.05	.303	-7.29	-1.16	.257
RELATIONSHIP STATUS (SINGLE, YES/NO)	-.225	-.05	.959	-.053	-.016	.988	-3.32	-1.03	.312	-.466	-.99	.328	2.08	.301	.766
TRAUMATIC BRAIN INJURY (YES/NO)	2.40	.51	.615	-.552	-.15	.881	-3.53	-1.12	.275	-.438	.886	.384	-4.84	-.651	.521
COMBAT EXPOSURE SCORE	-.133	-.534	.599	.038	.196	.846	.216	1.31	.204	-.003	-.103	.919	.230	.59	.521

DEPENDENT MEASURE	DEPRESSION			ANXIETY			COMPANIONSHIP			SUICIDAL IDEATION			PTSD SYMPTOM SEVERITY		
	β	*t*(32)	*p*	β	*t*(32)	*p*	β	*t*(32)	*p*	β	*t*(32)	*p*	β	*t*(32)	*p*
INTERCEPT															
STEP 1	32.82	2.97	**.006**	37.52	3.16	**.004**	14.40	2.03	*.051	.39	1.13	.268	5.27	.36	.718
STEP 2	26.30	1.61	.121	31.75	2.02	*.056	27.89	2.28	**.033**	.71	.49	.627	-5.84	-.25	.804
GROUP (SERVICE DOG/WAITLIST)															
STEP 1	-3.62	-1.33	.195	-3.38	-1.55	.131	2.98	1.17	.250	-.01	-.03	.977	-10.57	-2.12	**.042**
STEP 2	-3.90	-1.28	.215	-3.24	-1.32	.200	3.53	1.49	.151	.01	.03	.979	-10.41	-1.90	*.071
DV BASELINE SCORE															
STEP 1	.48	2.82	**.008**	.43	2.43	**.021**	.67	4.31	**<.001**	.34	2.83	**.008**	.82	3.41	**.002**
STEP 2	.56	2.82	**.010**	.44	2.10	**.048**	.55	3.17	**.004**	.41	2.71	**.013**	.77	2.91	**.008**
AGE	.10	.59	.623	.12	.76	.455	-.23	-1.46	.160	-.01	-.32	.755	.30	.85	.403
GENDER (MEN/WOMEN)	.22	.06	.951	2.25	.78	.442	2.15	.74	.466	.16	.30	.768	6.06	.90	.376
BIPOC (YES/NO)	1.45	.41	.689	1.59	.58	.566	-2.57	-.94	.357	-.18	-.36	.723	.24	.04	.971
PET DOG (YES/NO)	-3.15	-.95	.351	-.57	-.22	.827	2.44	.93	.363	-.30	-.60	.553	1.12	.19	.855
EVIDENCED BASE TREATMENT (AT BASELINE, YES/NO)	-2.67	-.88	.386	-2.43	-1.02	.317	3.76	1.53	.139	-.20	-.44	.666	-6.96	-1.24	.227
RELATIONSHIP STATUS (SINGLE, YES/NO)	1.17	.33	.745	-.14	-.05	.960	-6.39	-2.20	**.038**	-.51	-.97	.341	.57	.09	.930
TRAUMATIC BRAIN INJURY (YES/NO)	-2.84	-.63	.537	-1.88	-.53	.604	.51	.14	.891	-.19	-.29	.778	-5.53	-.68	.507
COMBAT EXPOSURE SCORE	.05	.25	.805	.07	.40	.694	-.08	-.50	.625	.03	.93	.362	.16	.43	.669

Note. All analyses entered the predictor of interest, Group (service dog or waitlist) in Step 1 along with the baseline (T1) score for the dependent variable. The same set of covariates (age, gender, BIPOC, pet dog ownership, evidence-based treatment, relationship status, traumatic brain injury, and combat exposure) were entered in Step 2 for all models. Partnership with a service dog was associated with lower PTSD symptom severity (β=-10.89, *p*=.042), but was no longer significant with covariates included (β=-10.50, *p* = .119). No significant effects were observed for Group in any other model. Except for baseline scores for the modeled dependent measure, the only significant covariates across all five analyses were gender (β=9.26, *p*=.007) and evidenced-based treatment (β=8.67, *p*=.003), both which reliably predicted companionship scores (but no other outcome variables). Beta coefficients, t-values, and p-values for each of the five models are presented with Step 1 and Step 2 estimates for all modeled variables.

To directly explore differences between the service dog and waitlist groups among our MST-reporting subsample, we also conducted 5 separate independent samples t-tests (one for each MST construct: depression, anxiety, companionship, suicidality, and PTSD severity) on average change scores (follow-up minus baseline) for a given outcome variable. Mean change T-scores for all five constructs broken down by MST-reporting status, intervention group, and gender are provided in Table 5.

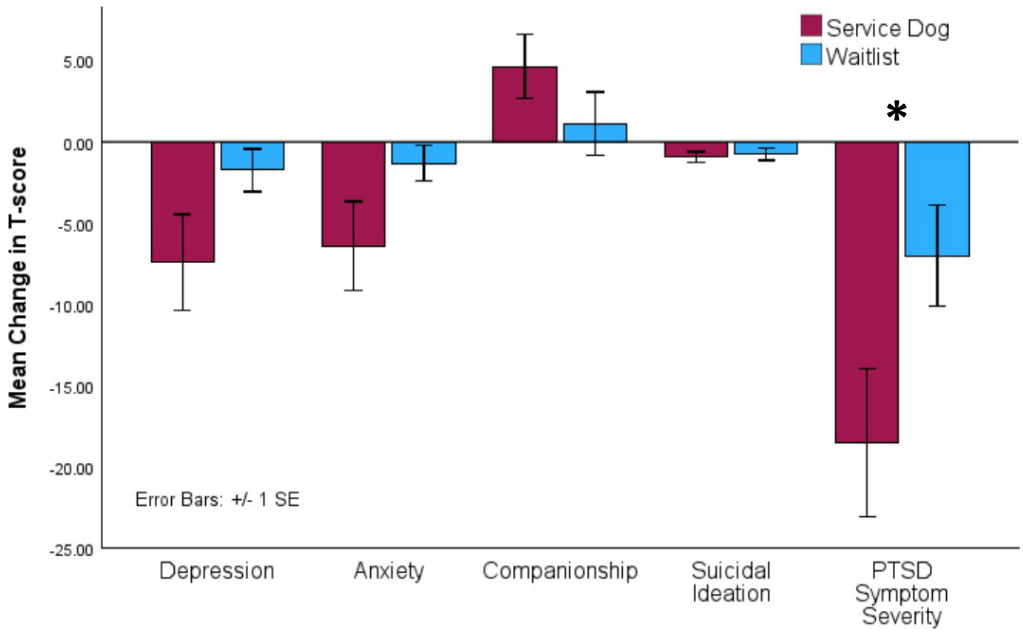
Table 5

*Mean change T-scores (T2-T1), standard deviations, and sample mean sizes for the five measured MST constructs as a function of intervention group (service dog or waitlist), gender (women or men), and separately for veterans who did and did not disclose MST. Values in Green indicate clinically significant change, defined here as 3.0 or more change in T-score points (Terwee et al., 2021). Note that only one woman in our sample did not disclose MST, hence we redacted that participants' scores to maintain their confidentiality. Negative scores denote a decline in symptoms associated with that construct, e.g., -6.3 for depression indicates a clinically meaningful reduction in depressive symptoms for that group at follow up compared to baseline. Therefore, negative scores indicate improvement for all measures except companionship, for which positive scores indicate improvement (i.e., relatively more self-reported companionship at follow up). Asterisks indicate a significant gender difference between the mean scores for that construct, *p<.05, two-tailed independent samples t-test.*

	YES MST REPORTED				NO MST REPORTED				FULL SAMPLE			
MEASURE	Service Dog		Wait List		Service Dog		Wait List		Service Dog		Wait List	
	Women	*Men*	*Women*	*Men*	*Women*	*Men*	*Women*	*Men*	*Women*	*Men*	*Women*	*Men*
DEPRESSION	-6.6	-10.4	0.1	-3.8		-4.7	--	-1.9	-6.2	-4.8	-0.9	-2.1
N	11	3	10	9	--	51	1	35	14	60	21	46
(SD)	(11.3)	(12.0)	(6.5)	(4.3)		(8.5)	--	(5.6)	(10.4)	(8.9)	(5.9)	(5.3)
ANXIETY	-6.3	-6.8	0.7	-3.5		-5.1	--	0.5	-6.1	-4.9	-0.7	-0.1
N	11	3	**10** *	**9**	--	51	1	35	14	60	21	46
(SD)	(9.4)	(15.6)	**(4.7)**	**(3.7)**		(7.8)	--	(5.0)	(8.4)	(8.1)	(4.5)	(5.0)
COMPANIONSHIP	4.5	5.3	4.9	-3.0		3.0	--	-2.5	4.8	2.8	2.2	-2.3
N	11	3	10 *	9	--	51	1	35	14	60	21 *	46
(SD)	(8.2)	(4.7)	(5.3)	(9.7)		(9.3)	--	(6.3)	(7.4)	(9.3)	(5.3)	(7.0)
SUICIDAL IDEATION	-0.6	-0.6	-1.2	-0.2		-0.5	--	-0.2	-0.6	-0.5	-0.9	-0.2
N	14	5	10	9	--	53	1	36	17	65	22	48
(SD)	(1.3)	(0.9)	(1.9)	(1.2)		(1.3)	--	(1.4)	(1.3)	(1.3)	(1.8)	(1.3)
PTSD SEVERITY	-14.7	-26.0	-4.4	-9.9		-13.8	--	-2.8	-14.9	-14.8	-3.8	-3.8
N	14	5	10	9	--	55	1	36	17	67	22	48
(SD)	(16.5)	(12.7)	(10.8)	(16.4)		(15.6)	--	(12.5)	(15.4)	(15.6)	(10.5)	(13.2)

Figure 1 depicts mean change in scores for the five measured constructs. The only reliable group difference detected was for PTSD severity, with the service dog group showing an average decline of 17.68 points (SD=16.08) in their PCL-5 score from baseline to follow up compared to an average decline of 7.0 points (SD=13.61) for veterans on the waitlist, $t(36)=2.21$, $p=.034$, two tailed. No other comparisons reached significance, all t's < 2.00, all ps > .05, two tailed.

Figure 1. Mean change scores (follow-up minus baseline) for five MST constructs as a function of Group (service dog or waitlist). *$p < .05$, *two-tailed.*



Note. Independent samples t-tests revealed only one significant group difference. Veterans partnered with service dogs showed a significantly greater reduction in PTSD symptom severity compared to veterans on the waitlist ($t(36)=2.21$, $p=.034$, two-tailed).

DISCUSSION

Veterans in our sample that disclosed a history of having experienced MST reported significantly higher PTSD symptom severity scores at baseline than veterans who did not, consistent with current literature (Jakob et al., 2017). Among veterans with a history of MST in our sample, PTSD symptom severity was equivalent regardless of gender, although 96% of women reported experiencing MST in the full sample (26/27), compared to 12% of men. However, significant underreporting of MST by men has been documented. Often, servicemen underreport sexual assault and harassment incidents due to lack of awareness, marginalization of men as victims, lack of confidence in leadership, and greater perception of stigma (Sadler, Cheney, Mengeling, Booth, Torner, & Young, 2018). However, we do not know if these institutional

challenges are experienced the same or are equally challenging across gender identities. For example, servicewomen face relatively more barriers to entry and stigma once in a combat role, which may further increase risk for experiencing MST. Moreover, previous research suggests that there are generational differences among veterans that can also impact their willingness to report MST, such as self-stigma, self-reliance, and self-efficacy (Smith, Workneh, & Yaya, 2020). Further research is needed to better gauge actual rates of MST across genders and generations. Doing so will help us better understand veteran experiences of MST to provide more targeted services, reduce barriers to treatment, and support survivors to promote healthy recovery and mitigation of MST symptomology.

One factor that may impact severity for MST and PTSD is the relationship between deployments and combat exposure. Historically, combat exposure tends to be more prevalent for servicemen, and it is possible that deployment and amount of combat exposure might interact with gender in predicting risk for MST and PTSD (Kelber et al., 2021). Furthermore, combat exposure coupled with cultural and hierarchal structures within military culture during deployment pose a salient risk for experiencing MST (Monteith, Bahraini, Matarazzo, Soberay, & Smith, 2019). While combat exposure and deployments were not the main focus of this study, we plan to investigate these factors and how they interact in a future study.

While previous research suggests that partnership with a trained psychiatric service dog can mitigate symptoms like depression and anxiety for veterans living with PTSD, we observed a significant benefit of partnership amongst MST survivors only for PTSD symptom severity. While we did not observe any statistically reliable changes for the other MST symptoms, we note in this small sample that mean group differences all favored the service dog group over the waitlist group (relatively lower depression, anxiety, and suicidal ideation, and relatively higher companionship).

Because the original study was not designed to examine MST and service dog partnership, our data suggests the need for more research using a well-powered design to replicate these findings in a larger sample of MST survivors. This type of targeted study focusing on MST-survivors is necessary to enable genuine comparisons to be made between subpopulations by gender, for example, who may show differing mental health effects as the result of MST. Given the high prevalence of MST overall, and stark gender difference in rates of occurrence, there is a critical need for further research.

Additionally, current literature supports the idea that MST is a more resistant type of trauma to treat with recurrence of symptoms often following treatment completion (Holliday et al., 2020). Thus, a spectrum of complementary and integrative health interventions are needed, which may include service dogs, to address the complex symptoms that require multiple approaches.

Limitations

This study had several limitations that should be considered when evaluating the conclusions. First, data was collected in a nonrandomized clinical trial, limiting our ability to assess causality. In addition, although the trial employed a longitudinal design, its duration was relatively short, just three months; longer clinical trials can better capture changes in outcomes that occur over longer periods of time. We are currently conducting a nationwide study of veterans with PTSD in a year-long randomized clinical trial which will allow us to draw causal conclusions and better describe the time course of the service dog intervention. We will examine MST in this sample as well to replicate current findings and ask new questions about mechanisms by exploring the role played by the human-animal bond in the service dog-veteran partnership and how the quality of that bond may impact treatment outcomes for veterans who have survived MST.

A final limitation is due to how disclosures of MST were queried in the original trial, with the MST question only appearing to participants who had reported a deployment. This limitation restricted the sample to deployment-related (during/post deployment) MST history, potentially excluding other cases among veterans who were never deployed. Similarly, because the original trial was not designed to examine MST, we were somewhat limited with the measures we had available to investigate MST-related symptoms. For example, many symptoms associated with MST (e.g., dissociation, sexual dysfunction disorder, infertility, perinatal depression, sexual pain, and reporting low sexual satisfaction; Galovski et al., 2022) were not assessed here. Instead, MST symptom assessment consisted of measures that largely overlap with PTSD, making it potentially challenging to disentangle the effects of MST from those of PTSD.

Future Directions

Continued research on veterans affected by military sexual trauma (MST) is essential, given the high prevalence of MST across military branches. This pervasive issue has significant implications for force preservation and may hinder recruitment efforts if not adequately addressed. Future investigations into service dog interventions for veterans with MST should comprehensively assess the full range of MST-related symptoms that may be influenced by this unique therapeutic approach, as well as the long-term effects of service dog partnership. Furthermore, research on the caretaker role within veteran-service dog dyads could provide insight into how this dynamic supports veterans—particularly those who are infertile or childless by choice due to MST (Nillni et al., 2021)— in their family conceptualization, satisfaction, and planning, potentially influencing family-planning considerations.

Ultimately, PTSD and MST symptoms overlap substantially due to the complex nature of MST as a form of trauma. While the efficacy of service dogs as a complementary intervention for

PTSD has been initially demonstrated, this study is the first, to our knowledge, that has explored the relationship between service dogs and PTSD among veterans with a history of MST. Although only suggestive, our findings highlight the critical need for more research to allow for the development of better targeted and more effective interventions for veterans with a history of MST.

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