



Published in final edited form as:

Complement Ther Clin Pract. 2022 August ; 48: 101590. doi:10.1016/j.ctcp.2022.101590.

Quantifying the Emotional Experiences of Partners of Veterans with PTSD Service Dogs using Ecological Momentary Assessment

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Abstract

The objective of this study was to investigate the day-to-day experiences of positive and negative emotions among partners of veterans assigned service dogs for posttraumatic stress disorder (PTSD). As part of a larger clinical trial, a total of N=86 partners of post-9/11 veterans with PTSD were recruited from a nonprofit service dog provider and participated in an ecological momentary assessment (EMA) protocol. The sample included partners of veterans who received a PTSD service dog after baseline (n = 47, treatment group) and partners of veterans on the waitlist for a service dog (n = 39, control group). Data were collected twice daily for two weeks at baseline and again at follow-up three months later, for approximately 56 assessments per participant. A total of 3,780 EMA surveys were collected among partners for this analysis. Data were analyzed using a linear mixed effects regression model. Three months following baseline, partners of veterans with service dogs reported statistically significantly higher levels of positive emotions than the control partners ($p=0.01$, $d=0.39$) with small-to-medium effect sizes for each individual positive emotion. No statistically significant differences were reported for negative emotions ($p=0.77$, $d=0.21$). This study quantitatively identifies specific areas of positive change and areas of no change in partners who cohabitate with veterans who are assigned PTSD service dogs. Given the influence that positive emotions have on well-being and coping, findings suggest that the influence of service dogs may go beyond veterans to influence their cohabitating partners.

Despite a growing body of research regarding psychiatric service dogs and veterans, little is understood about the implications of service dogs for veterans’ families. Qualitative studies focused on the influence of service dogs for veterans suggest that psychiatric service dogs may improve family relationships (Crowe et al., 2018; Krause-Parello & Morales, 2018) and enable veterans to be present for more family functions and activities outside the home

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Declaration of Interests: none.

(Lessard et al., 2018). On the other hand, qualitative data have also shown that psychiatric service dogs can interfere with family interactions, leading to jealousy and increased burden for the partner (Krause-Parello & Morales, 2018; Yarborough et al., 2018). Additional research is necessary to quantify the complexity and balance of these benefits and challenges to refine service dog interventions to promote the best outcomes for veterans and their families. The focus of this study is to examine how partners of veterans are influenced by the addition of a service dog to their family with respect to their emotional experiences.

With more than 23% of the veterans returning from Iraq and Afghanistan having a PTSD diagnoses (Fulton et al., 2015) and the known effects that PTSD can have on individuals and families, it is crucial that the effect of new intervention options (e.g. PTSD service dogs) on families be investigated. Given the destructive effects of PTSD diagnoses on family relationships, recent studies suggest involving military/veteran families in interventions for PTSD (Blow et al., 2013; Goff et al., 2007; Knobloch-Fedders et al., 2017). Of particular interest is the couple relationship, as partners can both positively and negatively affect veterans' PTSD symptomology and treatment success (Albright et al., 2011; Balderrama-Durbin et al., 2013). The addition of a service dog has been inferred to be associated with improved psychosocial outcomes among veterans (O'Haire & Rodriguez, 2018) and may therefore affect veterans' relationships with others in their lives, including their partners and children. The mechanism of these changes is unknown but it is hypothesized that animals in family homes can provide social and emotional support through the bonds that the animals share with their human counterparts (Meehan et al., 2017).

Veterans and Posttraumatic Stress Disorder (PTSD) Service Dogs

Recent studies suggest that pairing service dogs with veterans with PTSD may be associated with lower PTSD symptomology, improved ability to reintegrate into the community, and improved ability to overcome anxiety with reduced hypervigilance (McLaughlin & Hamilton, 2019; O'Haire & Rodriguez, 2018; Vincent et al., 2019; Yarborough et al., 2018). These consequences may not only improve veterans' quality of life but may also have impacts beyond veterans themselves as they reverberate to interpersonal interactions. PTSD service dogs are trained to do certain tasks for veterans that mitigate the specific symptoms associated with PTSD, thus influencing veterans themselves and indirectly influencing those who are affected by veterans' PTSD. Examples of these tasks include "block" (the service dog stands in front of the veteran to create a boundary), "cover" (the service dog stands behind the veteran to watch behind), and "alert to anxiety" (the service dog responds to a veteran's anxiety) (Rodriguez et al., 2020).

Partners of Veterans with PTSD

Partners can be affected by unhealthy coping mechanisms and behavioral changes associated with PTSD. These unhealthy coping strategies and behavior changes may lead to negative mental health outcomes for some partners including increased depression and anxiety, and decreased marital satisfaction (E. Allen et al., 2018; Bjornestad et al., 2014; Herzog et al., 2011; Manguno-Mire et al., 2007). Additionally, some partners may experience increased caregiver burden (Caska & Renshaw, 2011). Considering the interplay of veteran PTSD on

partner wellbeing, recent literature has focused on both evidence-based couple therapies for PTSD as well as complementary interventions that may simultaneously influence both veterans and their partners. Evidence-based couple therapies include, but are not limited to cognitive behavioral conjoint therapy and structured approach therapy (Liebman et al., 2020; Sautter et al., 2015). Additionally, multiple studies have focused on complementary interventions (e.g., computer games, informational trainings) that empower families to learn more about PTSD. Families are taught to support and encourage veterans as they navigate PTSD intervention options (Albright et al., 2011; Roy et al., 2012; Zwanziger et al., 2017). Family involvement is inevitable with the pairing of a veteran and service dog. The service dog becomes a part of the household and interacts with all members of the family whether intentionally or simply because they live under the same roof. Therefore, families are indirectly or directly involved in the PTSD service dog intervention based on their everyday interactions with the dog.

A limited number of studies explore the effects of a PTSD service dog on veteran families or partners (McCall et al., 2020; Nieforth, Craig, et al., 2021; Whitworth et al., 2020). In one cross-sectional study of 60 veteran-partner dyads (n = 37 service dog group, n = 23 waitlist group) the self-reported experiences of partners were assessed with both quantitative and qualitative measures (McCall et al., 2020). Results suggested that there were no statistically significant differences across groups, but effect sizes in the small sample suggested that partners of veterans with service dogs may have had moderately higher levels of resilience and companionship, with lower levels of anger, social isolation, and work impairment. Qualitative results from the same study were mixed, with partners reporting both benefits and challenges, but mentioning benefits more often. Partners also reported improvements in veteran functioning, relationships, and quality of life. Another cross-sectional study of 15 partners of veterans participating in a service dog training program explored the perceptions of partners regarding the program (Whitworth et al., 2020). Results suggested veterans' participation created a relational bridge that helped improve relationships, lower PTSD symptomology and increase resilience (Whitworth et al., 2020). A third cross-sectional qualitative study, using data from participants enrolled in the same clinical trial as the current manuscript, used the Theory of Resilience and Relational Load (Afifi et al., 2016) to suggest that service dogs may be a mechanism for cultivating resilience among veterans and their partners (Nieforth, Craig, et al., 2021).

Findings regarding families of veterans with PTSD service dogs also have emerged from studies focused on veterans. These studies suggest that psychiatric service dogs may improve family relationships (Crowe et al., 2018; Krause-Parello & Morales, 2018) by enabling veterans to be more present for family events (Lessard et al., 2018), but can also interfere with family relationships by increasing caregiver burden and creating feelings of jealousy for the partner (Krause-Parello & Morales, 2018; Yarborough et al., 2018). Overall, though foundational studies exist, there is a significant gap in terms of quantifying and describing the daily emotional experience of partners of veterans with PTSD service dogs.

Affect and Psychological Wellbeing

Affect can be defined as conscious and accessible feelings that can be either positive or negative, and are often objectless in that they are not associated with a personally meaningful circumstance (Fredrickson, 2001). Research is ongoing as to how affect and emotion are connected, though it is commonly recognized that emotions are a subset of affect (Heilman, 1997). Multiple studies have found that affect is longer lasting than emotion and unlike emotion does not fit into specific categories but rather lies along two spectrums of emotional experience known as pleasantness and activation (e.g. Russell & Barrett, 1999).

A focus on affect is important as recent research has shown that positive affect and its resulting positive emotions may optimize overall health and wellbeing through the Broaden and Build theory (Fredrickson, 2004). This theory posits that positive emotions encourage cognition and behaviors that help to gather resources needed to encourage psychological wellbeing and growth over time. Previous studies have explored this theory in military/veteran partners, finding that partner depression and positive affect impacted coping skills and overall wellbeing (Wang et al., 2018). For partners of veterans with PTSD, a focus on psychological wellbeing is important as several studies have demonstrated a multitude of negative psychological effects related to having a partner with PTSD (Bjornestad et al., 2014; Herzog et al., 2011; Manguno-Mire et al., 2007). This study will examine the positive and negative affect of partners of veterans with PTSD in the context of having a PTSD service dog.

Literature suggests that affect should be operationalized and measured with ecological momentary assessment (EMA) in order to capture the dynamic nature of affect over time (Trull et al., 2015). EMA has been said to be one of the most accurate reflections of “real life” experiences (Robbins & Kubiak, 2014), as it has the potential to eliminate active recall bias. Previous research has demonstrated that recall bias is not random and may distort responses in systematic ways (Clark & Teasdale, 1982). EMA allows researchers to bypass this phenomenon thus promoting a more accurate reflection of experiences. Using data from daily surveys obtained through EMA, this study aims to compare affect and emotions of partners of veterans with or without a service dog.

Methods

Participants

As part of a larger clinical trial of veterans, a total of 86 partners participated in an ecological momentary assessment portion of the study. Participants were recruited from K9s For Warriors, a national, non-profit service dog provider. Service dogs are provided to the veteran free of charge. The following inclusion criteria were necessary to be met for a veteran to receive a service dog from K9s For Warriors: a) military service on or after Sept. 11, 2001, b) honorable discharge, c) a diagnosis of PTSD from a medical professional, and d) no conviction of any crimes against animals. In addition to these service dog provider criteria, to participate in the study veterans needed to have a PTSD diagnosis verified by an independent clinician through the Clinician Administered PTSD Scale (CAPS, Weathers et al., 2013). Once veterans were accepted into the study, an invitation was extended for their

partner to participate as well. Partner inclusion criteria included living in the same home as the veteran. Cohabitation, not legal marriage, was a prerequisite to participate.

Procedure

The clinical trial of veterans was pre-registered (clinicaltrials.gov ID NCT03245814) and approved by the University Human Research Protection Program Institutional Review board (IRB Protocol 1702018766) and the University Institutional Animal Care and Use Committee (IACUC Protocol 1702001541). This clinical trial was not randomized because of the long waitlists for service dogs (average 2 years) and provider concerns about the dilemma of changing allocation order when applicants had already waited so long for the service. Veterans and partners were allocated to one of two groups: (1) unrestricted usual care on the waitlist for a service dog (control group) or (2) unrestricted usual care with a service dog (intervention group). An independent data and safety monitoring board (DSMB) supervised the study.

Self-report, objective physiology, and masked clinician assessment took place at baseline (without the service dog) and three months later. The service dog was obtained by the intervention group at the beginning of the three-month period. Three months was selected as the separation between baseline and follow up as an initial examination of short-term efficacy. Self-report assessments included an online survey and EMA. The online survey contained standardized clinical assessments. This manuscript will focus on the partner ecological momentary assessment data which were collected via the RealLife Exp (LifeData Corporation, 2020) mobile phone application. One participant did not have access to a smartphone to download the application and was mailed an iPod touch to complete the study.

Ecological Momentary Assessment Data

Participants downloaded the LifeData RealLifeEXP mobile phone application (LifeData Corporation, 2020) and then downloaded a customized study package in order to access individualized surveys. The study included a two-week baseline study period followed by a two-week follow up study period three months later. Each study period had 28 surveys totaling 56 possible surveys per participant over the entire study. Participants received a notification upon waking, two random notifications during the day, and one notification before bed each day during their two-week study period. Morning surveys focused on questions regarding sleep, daily surveys focused on social interactions and affect, and evening surveys focused on capturing total interactions for the day. This manuscript focuses on questions from two daily notifications that were randomized starting two hours after wakeup and ending two hours before bedtime with a 30-minute response window and two reminders at 10-minute intervals.

Emotion and affect ratings.—State affect and emotions were measured using a modified version of the Discrete Emotions Questionnaire (DEQ, Harmon-Jones et al., 2016) and Positive and Negative Affect Scale (PANAS, Watson et al., 1988). A modified set of 10 items were selected based on a synthesis of the most prevalent themes across qualitative and quantitative pilot study data of veterans (Nieforth, Rodriguez, et al., 2021; O’Haire &

Rodriguez, 2018; Rodriguez et al., 2018). Half of the items were positive (calm, confident, happy, loving, excited) and the other half were negative (angry, anxious, depressed, lonely, on guard). The order of items was randomized at each presentation of the survey. The prompt read, “For the following questions, rate how much you feel each emotion right now.” The DEQ 7-point rating scale was used, ranging from 1 (Not at All) to 7 (An Extreme Amount).

Social partner proximity.—To determine how often partners were together, each survey also included the question, “Who are you with?” The option for “spouse or significant other” was analyzed as a binary outcome, with “1” indicating that they were with their partner (the veteran) and “0” indicating that they were not with their partner. The rationale behind including this variable was to describe how often veterans and spouses were with each other to provide context for the role of the service dog in terms of potentially taking the caregiving role or creating more independence for the veteran away from the spouse.

Data Analysis

Demographic variables were compared with t-tests (continuous variables) or Fisher’s exact tests (categorical variables) to determine if demographic information was balanced across the two treatment groups (Table 1). Positive and negative affect outcome data were analyzed with a linear mixed effects regression model that utilized an autoregressive AR(1) structure to account for correlations between repeated measures (Faraway, 2014; Stroup, 2012). A second model was focused on the binary outcome data (social partner proximity). This second model was a logistic mixed effects regression model that utilized an AR(1) structure to account for correlations between repeated measures. Both models were fitted in SAS using the PROC MIXED procedure. If our analyses suggested that overall scores were significant, their constituent subscales were also examined. Covariates considered for the model included gender, socioeconomic status, education, race/ethnicity (aggregated into a binary of black, indigenous, person of color (BIPOC) or not), pet ownership status (yes/no), children (yes/no), treatment assignment (service dog or waitlist), and an aggregated baseline score for the outcome of interest. Each aggregated baseline score is the average of all scores for the outcome of interest across the two-week baseline study period for each individual participant. Demographic covariates were selected based upon the influence that they may have on affect and emotion. If a participant had more than two daily notifications recorded, we selected the first recorded daily notification and the next notification that was at least four hours after the first. The significance level was set at $\alpha = 0.05$, with a Bonferroni correction applied to subscale analyses. Cohen’s *d* effect sizes were calculated from the raw follow-up scores across groups using the `cohens_d()` function in the `effectsize` package in R (version 3.6.3, R Core Team, 2020). Effect sizes were interpreted as small (0.2), medium (0.5) or large (0.8) (Cohen, 1969).

Results

To evaluate daily emotional experiences, a total of 3,780 EMA surveys were collected across $n = 86$ participants at baseline and $n = 72$ participants 3-months later. On average, at baseline, participants completed 23.6 surveys with a total response rate of 84%. At follow

up, participants completed on average 24.6 surveys with a total response rate of 86%. The waitlist group and service dog group did not differ by age ($p = 0.76$), gender ($p = 0.75$), education ($p = 0.70$), race/ethnicity aggregated as BIPOC ($p = 0.48$), having pets ($p = 0.52$) or having children ($p = 0.53$). There was a significant difference in socioeconomic status across groups ($p = 0.02$), such that at baseline (prior to treatment allocation) most subjects in the waitlist group were comfortable (56%) versus most subjects in the service dog group had just enough to make ends meet (62%). Table 2 displays the mean scores and standard deviations for both groups based on the raw data as well as the beta estimates, standard errors, and p-values for the mixed effects model examining group differences.

After controlling for baseline scores and relevant demographic covariates, partners of veterans with service dogs reported significantly higher levels of positive emotion overall than the control group ($p = .006$), with a small effect size calculated from the raw data ($d = 0.39$). Given the overall scale significance, subscales were analyzed to determine which specific positive emotions were salient. After a Bonferroni correction for multiple comparisons, significant differences were identified for partners of veterans with service dogs feeling calmer ($p = .007$, $d = 0.12$) and more confident ($p < .001$, $d = 0.39$) relative to the control group. There were no Bonferroni-adjusted significant differences in feelings of happiness ($p = 0.026$, $d = 0.33$), love ($p = 0.539$, $d = 0.22$), or excitement ($p = 0.088$, $d = 0.54$). There were no statistically significant differences between the waitlist and service dog groups in overall negative emotion among partners of veterans ($p = 0.77$, $d = 0.21$). Additionally, partners did not report significant differences regarding whether they were with or not with their veteran partner when they completed their assessments ($p = 0.43$, *Odds Ratio* = 0.90).

Discussion

The purpose of this study was to investigate positive and negative affect among cohabitating partners of veterans paired with PTSD service dogs, using ecological momentary assessment to capture daily experiences (Robbins & Kubiak, 2014). Findings described that at three months following baseline, partners of veterans paired with service dogs reported higher levels of positive emotions than the control group, but there were no statistically significant group differences in negative emotions.

Though this study was descriptive in nature and did not test mechanisms directly, findings suggest potential mechanisms that should be considered for future studies. Higher positive emotions with the addition of the service dog to the household align with previous research and human-animal interaction theory. Existing literature suggests that veteran partners qualitatively perceive more benefits than challenges with service dogs (McCall et al., 2020). Specifically, partners across multiple studies have reported improvements in their relationships with veterans, as well as lower veteran PTSD symptoms and higher resilience following service dog pairing (McCall et al., 2020; Whitworth et al., 2020). If veterans have fewer symptoms and relationships improve, partners may experience more positive emotions. Additionally, partners may enjoy having a dog in the home as a nonjudgmental source of daily interaction (K. Allen, 2003), which may in turn influence positive emotion in addition to the improved interactions that they have with the veteran. Human-animal

interaction theory suggests that animals may be a source of social support (Beck & Madresh, 2008; Walsh, 2009). Additionally, the biophilia hypothesis (Wilson, 1984) suggests that the service dog may be a positive, external focus of attention that may induce feelings of calmness and confidence for the partner. These positive feelings are key in potentially optimizing well-being in the context of the broaden and build theory (Fredrickson, 2004) which suggests that positive emotions are the catalysts to encouraging improvements to wellbeing over time.

The lack of statistically significant differences in negative emotions could suggest that there are both benefits and challenges to having a service dog in the home. Null findings may also stem from floor effects at baseline, whereby partners reported low levels of negative emotions at the start of the study. Partners in this study do not comprise a clinical population with mental health diagnoses; therefore, subclinical changes may not have been detected. Additionally, although service dogs may increase positive emotions through assisting veterans with PTSD and helping to bridge relationships between veterans and partners, service dogs also initiate increased responsibility or caregiver burden and may create situations of jealousy (Krause-Parello & Morales, 2018; Whitworth et al., 2020; Yarborough et al., 2018).

There were no significant differences in whether or not the partner was with the veteran when they completed their assessments, which suggests that veterans and partners may spend similar amounts of time together regardless of service dog allocation. This is important to understand as previous literature suggests that service dogs assist veterans in developing broader social networks (Crowe et al., 2018), which could be interpreted as more time in the community away from a caregiving partner. Findings from this study suggest that increased social networks for the veteran may not be equivalent to time separate from their partner.

Limitations and Future Directions

While the findings provide insight into the effects of PTSD service dogs on veteran partners, this study is not without limitations and findings should be interpreted with caution. First, the study did not specifically assess the role partners had with PTSD service dogs. It is possible that some partners may have been the primary caregiver of the service dogs (though discouraged to do so by the provider since the dogs are specifically trained for the veteran) while others had very little contact with the service dogs outside of simply sharing the same living space. More direct examination of the role of partners with veterans' service dogs could provide crucial information regarding service dogs' varying impacts within couple dynamics. Second, this study worked with one service dog provider that has their own protocol regarding working with veteran families. Future studies should explore the influence of how the multiple service dog organizations do or do not interact with or provide training for families of veterans who are paired with service dogs. Third, this study focuses on emotion which can be influenced by a multitude of factors at any day or time. Emotions change very frequently and do not occur in a vacuum. Future studies should consider controlling for additional covariates that may affect day-to-day emotions.

Conclusion

Partners of veterans with service dogs reported higher levels of positive emotions, but no differences in negative emotions, in comparison to a usual care control group. Specifically, partners of veterans with service dogs reported feeling calmer and more confident. No differences were identified in a composite of negative emotions (i.e., angry, anxious, depressed, lonely, on guard). Using ecological momentary assessment data, this study descriptively quantifies the experience that partners have with PTSD service dogs. This quantitative evidence is consistent with the qualitative anecdotes of previous studies, thus adding additional information to build a more well-rounded understanding of the PTSD service dog intervention for partners of veterans with PTSD. PTSD service dogs do not provide universal benefits for all and this study helps to identify specific areas where there are both positive changes (significantly different positive emotions) and areas with no changes (no significant differences with negative emotions or time spent with their partner). Bringing awareness to the benefits and challenges of PTSD service dogs in the context of interactions with veteran partners, may help to improve the experience through tempering assumptions and setting reasonable expectations for interaction with service dogs. Understanding the holistic picture creates opportunities for service dog providers and mental health practitioners to prepare and educate veteran families on what to expect through the process of integrating service dogs into their daily lives.

Acknowledgments

This work was supported by the *Eunice Kennedy Shriver* National Institute of Child Health and Human Development (NICHD) and the National Center for Complementary and Integrative Health (NCCIH) of the National Institutes of Health (NIH) under award number R21HD091896; Merrick Pet Care; and the PetCo Foundation. This publication was also made possible with support from the Indiana Clinical and Translational Sciences Institute which is funded in part by Award Number TL1TR002531 from the National Institutes of Health, National Center for Advancing Translational Sciences, Clinical and Translational Sciences Award. The content is solely the responsibility of the authors and does not necessarily represent the official views of funders.

References

- Afifi TD, Merrill AF, & Davis S. (2016). The theory of resilience and relational load. *Personal Relationships*, 23(4), 663–683. 10.1111/per.12159
- Albright G, Goldman R, Shockley KM, Mcdevitt F, & Akabas S. (2011). Using an avatar-based simulation to train families to motivate veterans with post-deployment stress to seek help at the VA. *Games for Health Journal*, 1(1), 21–28. 10.1089/g4h.2011.0003 [PubMed: 26196429]
- Allen E, Knopp K, Rhoades G, Stanley S, & Markman H. (2018). Between- and within-subject associations of PTSD symptom clusters and marital functioning in military couples. *Journal of Family Psychology*, 32(1), 134–144. 10.1037/fam0000363 [PubMed: 29543488]
- Allen K. (2003). Are Pets a Healthy Pleasure? The Influence of Pets on Blood Pressure. *Current Directions in Psychological Science*, 12(6), 236–239. 10.1046/j.0963-7214.2003.01269.x
- Balderrama-Durbin C, Snyder DK, Cigrang J, Talcott GW, Tatum J, Baker M, Cassidy D, Sonnek S, Heyman RE, & Smith Slep AM (2013). Combat disclosure in intimate relationships: Mediating the impact of partner support on posttraumatic stress. *Journal of Family Psychology*, 27(4), 560–568. 10.1037/a0033412 [PubMed: 23772847]
- Beck L, & Madresh EA (2008). Romantic partners and four-legged friends: An extension of attachment theory to relationships with pets. *Anthrozoös*, 21(1), 43–56.
- Bjornestad AG, Schweinle A, & Elhai JD (2014). Measuring secondary traumatic stress symptoms in military spouses with the Posttraumatic Stress Disorder Checklist Military Version: The Journal

of Nervous and Mental Disease, 202(12), 864–869. 10.1097/NMD.0000000000000213 [PubMed: 25386765]

- Blow AJ, Gorman L, Ganoczy D, Kees M, Kashy DA, Valenstein M, Marcus SM, Fitzgerald HE, & Chermack S. (2013). Hazardous drinking and family functioning in National Guard veterans and spouses postdeployment. *Journal of Family Psychology, 27*(2), 303–313. 10.1037/a0031881 [PubMed: 23544925]
- Caska CM, & Renshaw KD (2011). Perceived burden in spouses of National Guard/Reserve service members deployed during Operations Enduring and Iraqi Freedom. *Journal of Anxiety Disorders, 25*(3), 346–351. 10.1016/j.janxdis.2010.10.008 [PubMed: 21112182]
- Clark DM, & Teasdale JD (1982). Diurnal variation in clinical depression and accessibility of memories of positive and negative experiences. *Journal of Abnormal Psychology, 91*(2), 87–95. 10.1037/0021-843X.91.2.87 [PubMed: 7200102]
- Cohen J. (1969). *Statistical Power Analysis for the Behavioral Sciences*. Academic Press.
- Crowe TK, Sánchez V, Howard A, Western B, & Barger S. (2018). Veterans transitioning from isolation to integration: A look at veteran/service dog partnerships. *Disability and Rehabilitation, 40*(24), 2953–2961. 10.1080/09638288.2017.1363301 [PubMed: 28805082]
- Faraway JJ (2014). *Linear Models with R, Second Edition*. CRC Press.
- Fredrickson BL (2001). The role of positive emotions in positive psychology. The broaden-and-build theory of positive emotions. *The American Psychologist, 56*(3), 218–226. 10.1037/0003-066X.56.3.218 [PubMed: 11315248]
- Fredrickson BL (2004). The broaden-and-build theory of positive emotions. *Philosophical Transactions of the Royal Society of London. Series B: Biological Sciences, 359*(1449), 1367–1377. 10.1098/rstb.2004.1512 [PubMed: 15347528]
- Fulton JJ, Calhoun PS, Wagner HR, Schry AR, Hair LP, Feeling N, Elbogen E, & Beckham JC (2015). The prevalence of posttraumatic stress disorder in Operation Enduring Freedom/Operation Iraqi Freedom (OEF/OIF) Veterans: A meta-analysis. *Journal of Anxiety Disorders, 31*, 98–107. 10.1016/j.janxdis.2015.02.003 [PubMed: 25768399]
- Goff BSN, Crow JR, Reisbig AMJ, & Hamilton S. (2007). The impact of individual trauma symptoms of deployed soldiers on relationship satisfaction. *Journal of Family Psychology, 21*(3), 344–353. 10.1037/0893-3200.21.3.344 [PubMed: 17874919]
- Harmon-Jones C, Bastian B, & Harmon-Jones E. (2016). The Discrete Emotions Questionnaire: A New Tool for Measuring State Self-Reported Emotions. *PLOS ONE, 11*(8), e0159915. 10.1371/journal.pone.0159915
- Heilman KM (1997). The neurobiology of emotional experience. *The Journal of Neuropsychiatry and Clinical Neurosciences, 9*(3), 439–448. 10.1176/jnp.9.3.439 [PubMed: 9276845]
- Herzog JR, Everson RB, & Whitworth JD (2011). Do secondary trauma symptoms in spouses of combat-exposed National Guard soldiers mediate impacts of soldiers' trauma exposure on their children? *Child and Adolescent Social Work Journal, 28*(6), 459–473. 10.1007/s10560-011-0243-z
- Knobloch-Fedders LM, Caska-Wallace C, Smith TW, & Renshaw K. (2017). Battling on the home front: Posttraumatic stress disorder and conflict behavior among military couples. *Behavior Therapy, 48*(2), 247–261. 10.1016/j.beth.2016.08.014 [PubMed: 28270334]
- Krause-Parello CA, & Morales KA (2018). Military veterans and service dogs: A qualitative inquiry using interpretive phenomenological analysis. *Anthrozoös, 31*(1), 61–75. 10.1080/08927936.2018.1406201
- Lessard G, Vincent C, Gagnon DH, Belleville G, Auger É, Lavoie V, Besemann M, Champagne N, Dumont F, & Béland E. (2018). Psychiatric service dogs as a tertiary prevention modality for veterans living with post-traumatic stress disorder. *Mental Health & Prevention, 10*, 42–49. 10.1016/j.mhp.2018.01.002
- Liebman R, Whitfield K, Sijercic I, Ennis N, & Monson C. (2020). Harnessing the Healing Power of Relationships in Trauma Recovery: A Systematic Review of Cognitive-Behavioral Conjoint Therapy for PTSD. *Current Treatment Options in Psychiatry, 7*, 1–18. 10.1007/s40501-020-00211-1
- Manguno-Mire G, Sautter F, Lyons J, Myers L, Perry D, Sherman M, Glynn S, & Sullivan G. (2007). Psychological distress and burden among female partners of combat veterans With PTSD: The

Journal of Nervous and Mental Disease, 195(2), 144–151. 10.1097/01.nmd.0000254755.53549.69 [PubMed: 17299302]

- McCall CE, Rodriguez KE, Wadsworth SMM, Meis LA, & O’Haire ME (2020). “A part of our family”? Effects of psychiatric service dogs on quality of life and relationship functioning in military-connected couples. *Military Behavioral Health*, 8(4), 410–423. 10.1080/21635781.2020.1825243 [PubMed: 35316935]
- McLaughlin K, & Hamilton AL (2019). Exploring the influence of service dogs on participation in daily occupations by veterans with PTSD: A pilot study. *Australian Occupational Therapy Journal*, 66(5). 10.1111/1440-1630.12606
- Meehan M, Massavelli B, & Pachana N. (2017). Using Attachment Theory and Social Support Theory to Examine and Measure Pets as Sources of Social Support and Attachment Figures. *Anthrozoös*, 30(2), 273–289. 10.1080/08927936.2017.1311050
- Nieforth LO, Craig EA, Behmer VA, MacDermid Wadsworth S, & O’Haire ME (2021). PTSD service dogs foster resilience among veterans and military families. *Current Psychology*. 10.1007/s12144-021-01990-3
- Nieforth LO, Rodriguez KE, & O’Haire ME (2021). Expectations versus experiences of veterans with posttraumatic stress disorder (PTSD) service dogs: An inductive conventional content analysis. *Psychological Trauma: Theory, Research, Practice, and Policy*, No Pagination Specified-No Pagination Specified. 10.1037/tra0001021
- O’Haire ME, & Rodriguez KE (2018). Preliminary efficacy of service dogs as a complementary treatment for posttraumatic stress disorder in military members and veterans. *Journal of Consulting and Clinical Psychology*, 86(2), 179–188. 10.1037/ccp0000267 [PubMed: 29369663]
- R Core Team. (2020). R: The R project for statistical computing. <https://www.r-project.org/>
- Robbins ML, & Kubiak T. (2014). Ecological Momentary Assessment in Behavioral Medicine: Research and Practice. In *The Handbook of Behavioral Medicine* (1st ed., pp. 429–446).
- Rodriguez KE, Bryce CI, Granger DA, & O’haire ME (2018). The effect of a service dog on salivary cortisol awakening response in a military population with posttraumatic stress disorder (PTSD). *Psychoneuroendocrinology*, 98, 202–210. 10.1016/j.psyneuen.2018.04.026 [PubMed: 29907299]
- Rodriguez KE, LaFollette MR, Hediger K, Ogata N, & O’Haire ME (2020). Defining the PTSD Service Dog Intervention: Perceived Importance, Usage, and Symptom Specificity of Psychiatric Service Dogs for Military Veterans. *Frontiers in Psychology*, 11. 10.3389/fpsyg.2020.01638
- Roy MJ, Taylor P, Runge W, Grigsby E, Woolley M, & Torgeson T. (2012). Web-based post-traumatic stress disorder education for military family members. *Military Medicine*, 177(3), 284–290. 10.7205/MILMED-D-11-00350 [PubMed: 22479915]
- Russell JA, & Barrett LF (1999). Core Affect, Prototypical Emotional Episodes, and Other Things Called Emotion: Dissecting the Elephant. *Journal of Personality and Social Psychology*, 76(5), 805–819. 10.1037/0022-3514.76.5.805 [PubMed: 10353204]
- Sautter FJ, Glynn SM, Cretu JB, Senturk D, & Vaught AS (2015). Efficacy of structured approach therapy in reducing PTSD in returning veterans: A randomized clinical trial. *Psychological Services*, 12(3), 199–212. 10.1037/ser0000032 [PubMed: 26213789]
- Stroup WW (2012). *Generalized Linear Mixed Models: Modern Concepts, Methods and Applications*. CRC Press.
- Trull TJ, Lane SP, Koval P, & Ebner-Priemer UW (2015). Affective Dynamics in Psychopathology. *Emotion Review*, 7(4), 355–361. 10.1177/1754073915590617 [PubMed: 27617032]
- Vincent C, Auger E, Lavoie V, Besemann M, Champagne N, Belleville G, Béland E, Bernier-Banville É, & Bourassa J. (2019). Service Dog Schools for PTSD as a Tertiary Prevention Modality: Assessment Based on Assistance Dogs. *Edelweiss: Psychiatry Open Access*, 29–41. 10.33805/2641-8991.119
- Walsh F. (2009). Human-animal bonds I: The relational significance of companion animals. *Family Process*, 48(4), 462–480. [PubMed: 19930433]
- Wang M-C, Harcrow A-M, Spears A, & Nyutu P. (2018). Affect, Coping, and Satisfaction with Life Among Military Spouses. *Military Behavioral Health*, 6(4), 346–354. 10.1080/21635781.2018.1490225

- Watson D, Clark LA, & Tellegen A. (1988). Development and validation of brief measures of positive and negative affect: The PANAS scales. *Journal of Personality and Social Psychology*, 54(6), 1063–1070. 10.1037//0022-3514.54.6.1063 [PubMed: 3397865]
- Weathers FW, Blake DD, Schnurr PP, Kaloupek DG, Marx BP, & Keane TM (2013). The Clinician-Administered PTSD Scale for DSM-5 (CAPS-5). [Assessment]. National Center for Posttraumatic Stress Disorder. www.ptsd.va.gov
- Whitworth J, O'Brien C, Wharton T, & Scotland-Coogan D. (2020). Understanding partner perceptions of a service dog training program for veterans with PTSD: Building a bridge to trauma resiliency. *Social Work in Mental Health*, 1–19. 10.1080/15332985.2020.1806181
- Wilson EO (1984). *Biophilia*. Harvard University Press. <https://www.hup.harvard.edu/catalog.php?isbn=9780674074422>
- Yarborough BJH, Stumbo SP, Yarborough MT, Owen-Smith A, & Green CA (2018). Benefits and challenges of using service dogs for veterans with posttraumatic stress disorder. *Psychiatric Rehabilitation Journal*, 41(2), 118–124. 10.1037/prj0000294 [PubMed: 29698000]
- Zwanziger T, Anderson C, Lewis J, Ferreira R, & Figley C. (2017). Resilience and knowledge of PTSD symptoms in military spouses. *Traumatology*, 23(1), 43–48. 10.1037/trm0000093

Table 1.

Baseline demographic characteristics of veteran partners in the service dog and waitlist groups

	Waitlist (<i>n</i> =39)	Service Dog (<i>n</i> = 48)	<i>t</i> or χ^2	<i>p</i> -value
Age, M (SD)	37 (8.5)	36 (7.5)	0.31	0.68
Gender, n (%)			-0.34	0.75
<i>Female</i>	34 (87%)	43 (90%)		
<i>Male</i>	5 (13%)	5 (10%)		
Socioeconomic Status, n (%)			-2.39	0.02
<i>Comfortable</i>	22 (56%)	13 (27%)		
<i>Just Enough to make ends meet</i>	14 (36%)	30 (63%)		
<i>Not Enough to make ends meet</i>	3 (8%)	5 (10%)		
Education, n (%)			0.19	0.70
<i>Some High School</i>	0 (0%)	1 (2%)		
<i>High School/GED</i>	8 (21%)	6 (13%)		
<i>Some College</i>	11 (28%)	17 (35%)		
<i>2-year Degree</i>	5 (13%)	6 (13%)		
<i>4-year Degree</i>	9 (23%)	14 (29%)		
<i>Post-graduate Degree</i>	6 (15%)	4 (8%)		
BIPOC, n (%)	15 (38%)	15 (31%)	0.69	0.50
Has Pet(s), n (%)	30 (77%)	34 (71%)	0.64	0.63
Has Child(ren), n (%)	33 (85%)	43 (90%)	-0.68	0.53

Note: This table presents the number and proportion of each demographic characteristic along with a between group comparison (t-test for continuous variables, Fisher's exact test for categorical variables) and related p-value. BIPOC= black, indigenous, person of color.

Table 2.

Positive and negative affect scores among partners of Veterans with PTSD service dogs

	CONTROL Baseline (n=39)			Follow-up (n=32)			SERVICE DOG Baseline (n=48)			Follow-up (n=40)			Group Differences (n=69*)				
	N _{obs}	M	SD	N _{obs}	M	SD	N _{obs}	M	SD	N _{obs}	M	SD	B	SE	t	p	Cohen's d
Positive Affect Total Score	949	17.56	4.44	803	16.82	4.10	1083	17.32	5.01	935	18.75	5.55	1.23	0.43	2.84	0.006	0.39
<i>Calm</i>	949	3.77	1.01	801	3.66	0.85	1082	3.61	1.04	934	3.79	1.26	0.26	0.09	2.79	0.007	0.12
<i>Confident</i>	948	3.57	1.23	802	3.31	1.26	1081	3.50	1.26	935	3.79	1.26	0.43	0.10	4.53	<0.001	0.39
<i>Happy</i>	949	3.82	1.01	802	3.67	1.01	1082	3.68	1.2	933	4.04	1.18	0.25	0.11	2.29	0.026	0.33
<i>Loving</i>	949	4.08	1.12	801	3.97	1.00	1082	4.02	1.35	934	4.23	1.3	0.06	0.10	0.62	0.539	0.21
<i>Excited</i>	949	2.32	1.03	802	2.24	1.11	1083	2.52	1.19	934	2.91	1.35	0.20	0.12	1.74	0.088	0.54
Negative Affect Total Score	949	9.1	3.22	804	8.62	2.98	1083	9.89	4.46	934	9.46	4.82	-0.08	0.27	-0.29	0.773	0.21

	N _{obs}	N _{yes}	%	N _{obs}	N _{yes}	%	N _{obs}	N _{yes}	%	N _{obs}	N _{yes}	%	B	SE	t	p	Odds Ratio
Together With Partner	949	453	49%	804	354	44%	1082	451	42%	938	390	41%	-0.10	0.13	-0.79	0.430	0.91

Note: This table presents the number of total observations for each emotion (N_{obs}), the number of participants who responded to the prompt regarding that emotion (n), the mean and standard deviation of total scores and each individual emotion at baseline and follow up for both the service dog and waitlist group. Additionally, results of the models (B, SE, t, p-values and effect sizes) are noted in the group differences section.

* Number of participants with complete demographic, baseline, and follow-up data.