

An Explorative Clinical Pilot Study Into the Effect of Service Dogs on Chronic Posttraumatic Stress Disorder

Astrid Galsgaard and Kasper Eskelund
The Danish Veteran Center, Ringsted, Denmark

Service dogs are increasingly used with posttraumatic stress disorder (PTSD) patients. This study explores how the companionship of a service dog may increase the control over PTSD symptoms, everyday functional abilities, and quality of life. A group of 4 veterans diagnosed with chronic, severe, combat-related PTSD were included in the study. All participants had undergone several unsuccessful psychotherapeutic and pharmacological treatment attempts. All received a puppy at baseline and participated in training it toward becoming a service dog. All participated in monthly group meetings with a clinical psychologist. Symptom levels were screened at start and end of the intervention, as well as at follow-up, encompassing a 16-month study period. Though 3 out of 4 still had symptoms indicating probable PTSD at follow-up, all group members reported an increased ability to control their daily life problems, such as disturbed sleep, social isolation, physical inactivity, lack of emotional regulation, and reduced quality of life. Findings did not indicate clear and distinct changes in overall PTSD symptom levels. However, all participants reported higher quality of life and an enhanced perceived control of their symptoms. This discrepancy calls for further research into the mechanisms involved in living with a service dog, as well as better controlled research designs. Service dogs may provide a viable alternative intervention for PTSD patients with chronic symptoms, when continued and repeated psychotherapeutic or pharmacological interventions are ineffective.

Keywords: PTSD, service dog, veteran, agency, quality of life

PTSD is a debilitating mental health disorder affecting individuals exposed to trauma such as motor vehicle accidents, interpersonal violence, natural disasters, or combat. Although psychotherapeutic and pharmacological interventions are effective for most PTSD patients (approximately 60% for both intervention types), a considerable minority does not experience sufficient treatment benefits (Bradley, Greene, Russ, Dutra, & Westen, 2005; Ipsier & Stein, 2012).


Combat-exposed, trauma-affected veterans represent a subpopulation of PTSD patients with a higher prevalence of chronic and treatment-resistant symptoms (Goodson et al., 2011). Despite participating in multiple interventions, some veterans with PTSD continue to experience largely unchanged or even exacerbated

symptoms. In a clinical context, their symptoms are often considered chronic. In this group, social withdrawal is commonly seen as a result of an inability to participate in everyday social life (Ray & Vanstone, 2009). This may be caused by different maladaptive coping strategies toward symptoms of hyperarousal or avoidance (Hofmann, Litz, & Weathers, 2003). Furthermore, anger and aggression management difficulties may lead a veteran with PTSD to avoid social settings and thereby evade potential conflicts. Anhedonia and other negative symptoms may hinder participation in or enjoyment of social activities.

In the view that symptom alleviation may currently be unattainable for such veterans, alternative intervention strategies may be relevant for improving quality of life without directly targeting symptom reduction. Furthermore, veterans with treatment-resistant symptoms have often already been subjected to multiple treatment attempts to little avail. This may weaken the motivation and desire for renewed treatment attempts and call for novel strategies. Improving the veteran's ability to function in social settings may provide an alternative route to a better quality of life.

Psychological difficulties associated with trauma may be viewed as alterations in the way a veteran interprets, processes, and responds to stimuli. Along these lines, many psychotherapeutic interventions will alter the way these processes consciously or subconsciously occur, train adaptive behavioral changes, or raise the threshold for somatic and psychological stress responses. For treatment-resistant PTSD, other routes to increased function are needed. For chronic PTSD patients, improving the ability to act and achieve goals in everyday life may be an attractive alternative to repeated attempts at altering psychological functioning through

This article was published Online First October 1, 2020.

Astrid Galsgaard, Department of Military Psychology, The Danish Veteran Center, Ringsted, Denmark;  Kasper Eskelund, Department of Military Psychology and Research and Knowledge Centre, The Danish Veteran Center.

The study took place at the Department of Military Psychological of The Danish Veteran Center and was funded by the independent charity foundation of Viet-Jacobsen (Viet-Jacobsen fonden). Astrid Galsgaard designed and conducted the study; Astrid Galsgaard and Kasper Eskelund produced the manuscript. Both authors have read and approved the final version of the manuscript. The authors have no known conflict of interest to disclose.

Correspondence concerning this article should be addressed to Astrid Galsgaard, Department of Military Psychology, The Danish Veteran Center, DK-4100 Ringsted, Denmark. E-mail: vetc-mpa42@mil.dk

targeted cognitive interventions. Such improvements may be achieved by changes in the patient's environment, rather than changes in her or his cognitions.

Animal-Assisted Intervention

The use of service dogs for blind or debilitated veterans has a long history (Ostermeier, 2010). In recent decades, the use of animals for relieving mental health challenges, improving both life quality and psychosocial functioning in veterans, has been suggested in numerous limited-scale or single-case studies (Fine, 2010; Taylor, Edwards, & Pooley, 2013) and recently in a few controlled or larger scale studies (van Houtert, Endenburg, Wijnker, Rodenburg, & Vermetten, 2018; Whitworth, Scotland-Coogan, & Wharton, 2019; Yarborough, Stumbo, Yarborough, Owen-Smith, & Green, 2018). However, the effects of and mechanisms involved in service dog interventions are poorly understood, as research efforts into this domain have been very limited until recently (Santaniello et al., 2020; van Houtert et al., 2018).

Incorporating a service dog into the veteran's environment is a radically different approach than psychotherapy. Thus, candidate mechanisms involved in psychological changes that may occur owing to the presence of a dog have been investigated in recent studies (Santaniello et al., 2020; Yarborough et al., 2018). Because no unified or inclusive model of how the presence of a service dog may interact with the PTSD-affected individual has been suggested in previous literature, we will here address four dimensions in which the service dog may impact the veteran's life.

Information Processing

Equipping a veteran with a service dog implies placing a sensing, conscious, and responding being in the veteran's environment. With its specific capabilities, the dog will be exposed to the same stimuli as the veteran, process these in its own cognitive apparatus, and respond to them parallel to the veteran. The processing will be dependent on species-specific capabilities, as well as the combination of inherited factors and learned behavior through upbringing and training. Resulting behavior in the dog will be witnessed by the veteran as an alternative interpretation of events. A situation that may be experienced as threatening by the veteran owing to hyperarousal and hypervigilance may be perceived as a normal situation by the dog, offering an anchor in a nonsymptomatic interpretation (Yarborough et al., 2017, 2018). Or the dog may interpret and respond to symptomatic behavior in the veteran, offering comfort, care, or diversion from symptoms.

Dog–Human Relation and Attachment

Research in human–animal relations has shown that skin contact with a dog evokes a higher oxytocin secretion, a neuropeptide associated with attachment, and even more so if the dog belongs to the person (Odendaal & Meintjes, 2003). In studies with psychiatric patients, animals responding to patient's behaviors have been shown to reduce arousal levels (Bernabei et al., 2013; Fecteau et al., 2017; O'Haire, 2013). Recent research has suggested that the dog's attachment behaviors toward the veteran may facilitate a reconnection between the veteran and close relatives (Whitworth et al., 2019; Yarborough et al., 2018), even suggesting attachment

to be a key mechanism in how service dogs alter life of veterans with PTSD (Whitworth et al., 2019).

Compliance and Responsibility

Veterans with chronic PTSD often have participated in multiple treatment attempts with little or no success. Their motivation toward committing time and resources as well as putting a stable, though symptomatic, everyday life at stake by attempting to modify the veteran's cognition and behaviors in psychotherapy may be limited. Here, participating as the primary provider in the upbringing and training of, as well as coexisting with, a service dog demands a strong commitment from the veteran. Being in one view a patient (as recipient of the dog) and in another a primary caregiver (as the individual responsible for the well-being of the dog) offers an opportunity to achieve higher commitment and compliance toward the intervention (McLaughlin & Hamilton, 2019; Yarborough et al., 2018).

Inter- Versus Intraspecies Relations

The demands of a canine are distinctly different from those of a human, and the role of the animal will be clearly subordinate. This asymmetry may have certain advantages over the relation to human relatives. Where a fellow human may require a symmetrical relation as well as interest in attaining her or his own goals, the meaning and purpose of a service dog is to serve the veteran. However, the service dog also depends on a human caregiver who is responsible for the dog's survival. This asymmetry may enable the passing of information from the dog to the veteran without being laden with interpersonal demands and responsibilities, as may be present in human relationships.

Foci of Change

Most psychotherapeutic interventions for PTSD target cognitions and behavior *in* the veteran, whereas a service dog alters the everyday *environment* of the veteran. In this sense, adding a service dog to a veteran's daily life is a way of changing the veteran's environment by trying to adapt it to her or his altered cognitive and behavioral capability after trauma.

Service Dogs in PTSD Treatment

Previous research has highlighted the utility of service dogs for psychiatric patients and to a lesser extent for veterans. Reviewing the limited existing research, service dogs may counteract symptoms of traumatic stress on three levels: *emotional*, *biological*, and *social*.

Emotional dysregulation is a common challenge for PTSD patients (Pietrzak et al., 2015). Through the attachment-based relation, the owner's urge to nurse and comfort the dog requires regulation of her or his behavior and thereby activation of positive emotions (Nimer & Lundahl, 2007; Yount, Ritchie, St. Laurent, Chumley, & Olmert, 2013). Case studies of the interaction between service dogs and war veterans with PTSD illuminate some interesting effects. Veterans with service dogs report decreases in intrusive nightmares (Nevins, Finch, Hickling, & Barnett, 2013; Robyn, 2019), flashbacks, and intrusive memories (Taylor et al., 2013; Yount et al., 2013). A suggested explanation for this is the dog's training in directing the veteran's attention toward the "here and now" and away from symptomatic

inner processes, such as traumatic memories. In a study of six veterans with PTSD, *Robyn (2019)* found a correlation between decreased arousal and decreased nightmares during the time they were equipped with a service dog. *Whitworth and colleagues (2019)* found a decrease in key trauma-related symptoms, such as hyperarousal, anxiety, and intrusion, in a controlled study, mirroring recent findings by *O’Haire and Rodriguez (2018)* and *Rodriguez, Bryce, Granger, and O’Haire (2018)*.

Although service dogs have been the subject of relatively few and mostly case studies, animal-assisted interventions (AAI) have been investigated more systematically (*Nimer & Lundahl, 2007; O’Haire & Rodriguez, 2018*). Daily training with a therapy dog or inclusion of it in psychotherapy has been shown to reduce symptoms of anxiety (*Barker & Dawson, 1998; Barker, Knisely, Schubert, Green, & Ameringer, 2015; Hamama et al., 2011*), subjective reported distress (*Lass-Hennemann, Peyk, Streb, Holz, & Michael, 2014*), and symptoms of depression (*Barker et al., 2015; Souter & Miller, 2007*). Different forms of AAI seem to have a positive effect on social interaction in children with autism (*O’Haire, 2013*) and also reduce distress as measured by cortisol levels in the parents of children with autism (*Fecteau et al., 2017*). Furthermore, AAI has been shown to reduce agitation and aggression among dementia patients (*Bernabei et al., 2013*).

Dogs have further been found to supply social support and create the feeling of a safe environment. The veteran’s experience of “bonding” with the service dog and being accompanied by it to social gatherings has been suggested to strengthen the veteran’s sense of belonging, being physically safe, and becoming secure enough to engage socially (*Taylor et al., 2013; Yarborough et al., 2018; Yount et al., 2013*).

In a nonrandomized efficacy trial including 141 post-9/11 military members and veterans with PTSD, *O’Haire & Rodriguez (2018)* compared treatment-as-usual (TAU) (unrestricted access to mixed care offers) with TAU plus a trained service dog. Although service dog recipients did not lose the PTSD diagnosis, they showed a reduction in PTSD and depression symptoms of PTSD, as well as reduced absenteeism in relation to employment. Moreover, compared to the TAU group, the group receiving TAU and

a service dog had higher levels of overall improvement, social functioning, and life quality.

Current Study

We here report a limited case series in Danish combat veterans with PTSD. The participants had all participated in multiple treatment attempts targeting their PTSD symptoms with limited outcomes. The study thus asks the following questions:

- Are PTSD symptoms in combat veterans reduced by living with a service dog?
- Is subjectively experienced quality of life altered by living with a service dog?
- Is sleep quality increased by living with a service dog?
- Does life with a service dog change the veteran’s sense of agency in her or his own life?

The Study

Overview

At the beginning of the study, a selected group of five veterans diagnosed with PTSD each received a puppy between the ages 6 to 10 weeks. During the following 10 months, the veterans took part in a service dog training program, with weekly group sessions administered by a service dog instructor as well as daily training tasks. At monthly group meetings with a clinical psychologist, each veteran was interviewed about symptom dynamics, current quality of life, and experience with the puppy. Three registrations with a battery of symptom-screening instruments were conducted from baseline in March 2016 to follow-up in July 2017 (*Figure 1*).

Method

Participants and assessment. Participants were recruited among veterans responding to an announcement of the opening of a service dog program at the Department of Military Psychology, Danish Defense. Ten veterans applied. Selection of participants

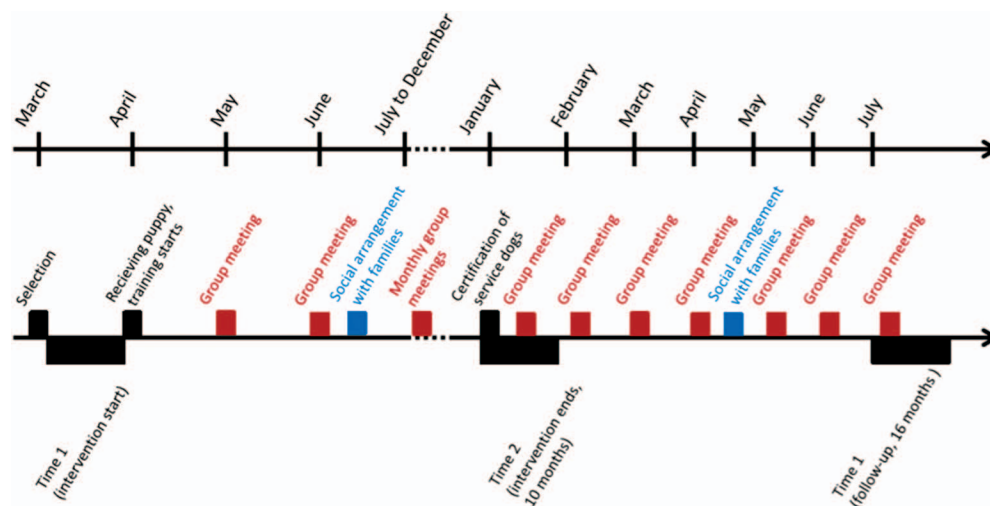


Figure 1. Timeline for interventions, screenings, and social activities related to the service dog program.

Table 1
Demographic Information on Participants

Demographic information on participants	Gender	Age	Social status	Occupation	Diagnosis	Subjectively identified challenges	Number of deployments and mission information
Case 1 Mike	Male	38	Married, children aged 0–10 years	Full time job	PTSD	Nightmares	4
Case 2 Jannik	Male	57	Married, children aged 0–10 and > 18 years	Invalidity pension	PTSD Depression	Aggression Anxiety Periodic alcohol abuse Nightmares	Kosovo (KFOR) Iraq (OIF) Afghanistan (ISAF) 1
Case 3 Michael	Male	49	Married, children > 18 years	Unemployed	PTSD Depression	Rumination before sleep Physical inactivity Lack of motivation Aggression Periodically suicidal Alcohol abuse Rumination before sleep	Croatia (KFOR) 8
Case 4 Hans	Male	47	Married, no children	Full time job	PTSD Depression	Intrusive memories Physical inactivity Lack of motivation Social isolation Aggression Nightmares	Cyprus (UNFICYP) Macedonia (UNPROFOR) Afghanistan (ISAF) Kosovo (KFOR) 2
						Flashbacks Physical inactivity Social isolation Lack of emotional expression	Croatia (KFOR) Bosnia (SFOR)

Note. PTSD = posttraumatic stress disorder; KFOR = Kosovo Force; OIF = Operation Iraqi Freedom; ISAF = International Security Assistance Force; UNFICYP = United Nations Peacekeeping Force in Cyprus; UNPROFOR = United Nations Protection Force; SFOR = Stabilization Force.

was in two steps. First, all applicants responded to an application formula of nine questions about their psychiatric history and gave an account of their social, housing, economic, and occupational situation. Applicants were screened for current psychiatric symptoms. Second, all applicants participated in a 2-hr interview with a clinical psychologist and a service dog instructor. Among the 10 applicants, five male veterans (age range: 38–57) diagnosed with PTSD related to deployment to war zones were chosen to be a part of the study group based on exclusion criteria evaluating feasibility of giving individual applicants the responsibility for the training and well-being of the dog. Suicidal risk; mental, social, economic, and physical capability and stability; social support; previous treatment outcome; and motivation were also assessed.

All participants had completed multiple pharmacological and psychological trauma-focused treatments neither with sufficient reduction in symptom levels nor increase in their capability to develop and maintain a satisfying quality of life (Table 1). To assess their symptom levels and daily life challenges, all participants were screened with a battery of standardized instruments consisting of the Posttraumatic Symptom Checklist, Civilian version (PCL-C; Weathers, Litz, Herman, Huska, & Keane, 1993) and World Health Organization Five Well-Being Index (WHO-5; Topp, Østergaard, Søndergaard, & Bech, 2015).

One participant was excluded 2 days after receiving the puppy owing to increased sleeping difficulties and aggression toward the

puppy. A new participant was immediately selected from the original applicants by the same procedure as described earlier. After 11 months, another participant dropped out of the study owing to logistical problems. Data from these two participants were excluded upon request of the participants. This unfortunately limits the conclusions that can be drawn on factors involved in negative outcomes of service dog interventions for PTSD in veterans. In summary, six veterans were initially included, whereas 2 were excluded owing to dropout.

Screening. During the intake procedure, each applicant described four key individual challenges in their life with PTSD. These descriptions were rephrased into single questionnaire items for evaluation on a rating scale from 0 (*really bad*) to 10 (*excellent*). The key challenges were rated once every day for 30 days intervals at three times: Time 1, a baseline measurement before receiving the puppy; Time 2, a postintervention measurement 10 months after receiving the puppy and just after its certification as a service dog; and Time 3, a follow-up measurement 16 months after receiving the puppy. All participants defined highly similar items recording sleep quality, ability to engage in social life, control of temperament, and overall quality of life. Aggregate scores for the three measurement intervals were computed as an average of each interval's scores. At the same three time points, participants were screened with the PCL-C and WHO-5 (only once at each time point).

Intervention

The puppies. Certified service dog trainers matched puppies and participants by specific needs, according to PTSD symptomatology and individual preferences of the participants. All participants received a puppy in March or April 2016 and attended weekly group training sessions for the dog led by service dog instructors, according to the program for service dogs for psychiatric patients of the Danish Service Dog Association ([Servicehundeforeningen, 2020](#)) The training was targeted at educating both the puppy and participant in being and working with a service dog to achieve an official service dog certificate.

Group meetings. Shortly after receiving the puppies, participants engaged in monthly group meetings led by a clinical psychologist (Astrid Galsgaard). The group meetings ran from May 2016 to July 2017 and had two elements. First, sharing experiences with the puppy and the daily training. Second, an individual assessment by a clinical psychologist of the dynamics of individual challenges in life with PTSD. To relieve and reduce the burden related to the first months of upbringing the puppies, participants' relatives were also invited to meetings in June 2016 and March 2017 ([Figure 1](#)).

Results

Case Reports Based on Monthly Semistructured Interviews

The following section describes the challenges of the participants before entering the intervention, their adjustment to living with and training the service dog, as well as longer term changes in symptoms and life quality aspects. See [Table 1](#) for demographic, deployment, and etiological information.

Case 1. Mike was a 38-year-old diagnosed with PTSD after deployments as an infantryman to Kosovo, Iraq, and Afghanistan from 2011 to 2013. He struggled with several symptoms, such as frequent nightmares and safety-seeking behavior (e.g., securing his house against perceived threats). Pervasive hyperarousal and anger control difficulties led to daily conflict situations with his family and workplace colleagues. He frequently experienced anxiety attacks at work or in crowded places, necessitating absence from work and leading to social isolation. To reduce his nighttime arousal, he sometimes used alcohol. Mike was treated with trauma-focused cognitive-behavioral psychotherapy (TF-CBT) in individual and group settings, and anxiolytics were administered. Neither of these treatment efforts were efficacious.

Immediately after receiving the puppy, Mike's sleep quality was reduced. The puppy had not yet developed a stable sleep pattern, and Mike's sleep was disturbed by the dog's activity and need for care at night. Mike's resources for social activities were reduced in the first weeks. As the puppy's sleep pattern stabilized, Mike noticed that the puppy started to respond to his own behavior during sleep: Before "being caught by a nightmare," the puppy would gently nip Mike's finger or cheek, waking him gently and staying awake with him until he slept again. Mike reported that this disturbance kept him from reaching high-arousal states during sleep, which previously would have resulted in prolonged wake periods with safety-seeking ("patrolling the house") behavior. This change in sleep pattern was associated with an increased mental

capacity for dealing with problems at work and challenges in his family. He made a daily effort in training the dog and noted that their mutual attention while in public spaces sharpened his focus in general and improved his stress tolerance. After 10 months, he started participating in his son's soccer training. Though his anxiety episodes returned periodically, he became increasingly aware of the dynamic relation between his mental state, that is, his mood, and experience of having locus of control and how he experienced being able to relax and enjoy social situations. Initially, the service dog caringly interfered with distraction during anxiety episodes, but later it responded even in the buildup phase of symptoms. Mike experienced how the dog's response to his behavior led him to "...sense the consequences of his actions as fast as lightning strikes."

Case 2. Jannik was a 57-year-old diagnosed with PTSD and major depression after deployment to Croatia in 1992 as a combat medic. Jannik had frequent nightmares about specific combat episodes and found himself ruminating for hours about incidents during deployment. Jannik suffered from reduced energy, motivation, and emotion regulation. These combined challenges led to anger and aggression in social settings and ultimately social withdrawal. When exposed to stressors and feeling overwhelmed by hopelessness, Jannik became suicidal. For many years, he used alcohol to reduce anxiety triggered by traumatic intrusive memories during nighttime and in social situations. Jannik received a number of TF-CBT treatments as well as anxiolytics and antidepressants. Neither sufficiently relieved Jannik's symptoms or improved his experience of being "a good father and husband."

Receiving the puppy was a substantial challenge for Jannik. He had ambivalent feelings of both happiness and frustration. He enjoyed interaction and training in the service dog group, but was meanwhile challenged by the puppy's initially unstable sleep pattern, coinciding family related problems, as well as being under pressure from the welfare system to find new employment. However, he soon found a common interest with his two children in training the puppy daily. This provided a new opportunity for building mutual confidence and trust. However, increased pressure from the welfare system as well as increased alcohol consumption exacerbated Jannik's symptoms, resulting in a suicide attempt and a brief hospitalization. After this incident, Jannik returned to the service dog program. The return of and care for Jannik in the group spurred a stronger group cohesion. Subsequently, Jannik moved to a veteran's facility with his puppy and slowly regained a healthier lifestyle with less alcohol and more social activities. In his interaction with the service dog, he practiced social skills and further improved relationships with family and friends.

Case 3. Michael was a 49-year-old who was deployed to Cyprus, Macedonia, Afghanistan, and Kosovo from 1991 to 2008. After his latest deployment, he was diagnosed with PTSD and depression. Michael was afflicted by frequent traumatic intrusive memories before falling asleep, which caused anxiety and restlessness and postponement of sleep until early in the morning. When Michael finally fell asleep, he often had comprehensive nightmares about war. Lack of motivation and energy led to physical inactivity. Fear of losing his temper and starting verbal fights with strangers led to social withdrawal. Michael participated in both TF-CBT and pharmacological treatments (antidepressants). Although antidepressants produced a slight improvement in mood, Michael did not experience relief from trauma-related symptoms.

In Michael's words, receiving the puppy meant "getting a baby." Owing to its emotional and physical needs, Michael initially experienced exhaustion and sleep deprivation. After a few weeks, he neither had time for nor interest in passively staying at home owing to the puppy's need for activity. After 4 months, he reported that the puppy had started to gently disrupt his sleep just before a nightmare developed. Thus, hyperarousal and prolonged wake intervals associated with nightmares were preempted, resulting in longer and deeper sleep. Michael also felt a new responsibility for both the dog's well-being as well as his own, which he stated as "finally something landed on my plate." As a part of the training program, the dog underwent training at a facility for a short period, away from Michael. During this time Michael's depression symptoms and nightmares returned, though only for the duration of the dog's absence. In the following months, Michael noticed that the dog withdrew from him when he acted verbally aggressive toward it. Contrarily, when he got aggressive toward other people, the dog demanded his attention by jumping on his lap, licking his fingers, or barking. In doing so, the dog helped divert his attention and regulate his emotions, thereby decreasing his arousal. Today, Michael is still challenged by his temper, but he experiences having gained "tools" for controlling it while participating in social activities.

Case 4. Hans was a 47-year-old diagnosed with PTSD and depression after deployments as combat soldier to Croatia and Bosnia in 1994 and 1995. Since then, Hans had suffered intrusion symptoms (nightmares and intrusive memories with deployment-related content). He further reported lack of energy leading to physical inactivity and social isolation. He experienced emotional numbing and a lack of emotional response in general, which caused daily conflicts with his wife and relatives. Hans went through several TF-CBT treatments at the Department of Military Psychology, Danish Defense, and was administered both antidepressants and arousal-reducing medication. Repeated unsuccessful treatment attempts had led to despair and sadness.

Hans quickly bonded with the puppy. By his devoting time and care to the puppy, Hans' wife unfortunately felt neglected. He initially experienced stress from managing both a full-time job and nursing the puppy. After a few months, however, these stressors reduced and Hans' mood improved. This was shared by his wife, who now took part in the puppy's daily training. When accompanied by the puppy, Hans experienced more pleasure from partici-

pating in social life, largely because conversation topics shifted from himself to the puppy. After 6 months, his intrusion symptoms, which he called "the internal film," had decreased substantially. In Hans' understanding, this was owing to the dog's diversion of his attention away from "bad memories." Being less aroused and socially isolated made him feel more self-confident, and he subsequently joined a sports club and completed a marathon with other veterans. During the study period, the puppy was also away for training at a service dog facility for multiple days. To the distress of both Hans and his wife, Hans experienced that his symptoms increased in this period. The couple further reported that Hans' hypervigilance was absent when the dog accompanied him to public spaces. The service dog continually mirrored Hans' emotions, which made emotions in general less "strange" to him and made conversations with his wife and colleagues about emotions more familiar. Hans and his wife decided to join psychotherapy for couples with PTSD as a consequence of the development.

Treatment Outcome Measures

In previous validation of the PCL-C in Danish treatment-seeking veterans, a PCL-C score above 43 has been suggested to indicate a probable PTSD diagnosis (Karstoft, Andersen, Bertelsen, & Madsen, 2014). According to scores on the self-report questionnaire PCL-C, only a single participant ended with a symptom level indicating a potential loss of the PTSD diagnosis (Case 1). Two cases (Cases 1 and 3) had substantial reductions in PCL-C scores, whereas Cases 2 and 4 had similar levels at all three times (Table 2; Figure 2A).

General well-being screened with WHO-5 indicated that all had symptoms of depression and/or distress at Time 1. All participants showed substantial improvement in WHO-5, indicating a considerable reduction in depression and distress symptoms (Table 2; Figure 2B).

The subjective evaluation scales on sleep quality, social and physical activities, emotion regulation, and quality of life show similar patterns of improvement. Sleep quality was improved owing to their reported decrease of nightmares and an increased feeling of being safe in their homes because of the dogs' attentive presence. This pattern was seen uniformly and substantially in all participants. Social and physical activity together with the trained service dog increased for three participants while remaining stable

Table 2
Symptom and Function Scores for Individual Participants at Times 1 to 3

Screening instruments	Case 1			Case 2			Case 3			Case 4		
	Time 1	Time 2	Time 3	Time 1	Time 2	Time 3	Time 1	Time 2	Time 3	Time 1	Time 2	Time 3
Posttraumatic Symptom Checklist, Civilian version	50	43	37	67	65	64	67	55	49	42	45	42
World Health Organization Five Well-Being Index	24	64	64	4	16	28	4	28	28	44	40	64
Emotional regulation	5.27	5.5	6.77	6.52	6.45	6.58	3.0	4.94	6.0	1.03	3.92	4.03
Social and physical activity	3.27	6.67	6.73	4.96	5.58	5.81	2.59	4.9	6.3	5.03	4.77	4.85
Sleep quality	3.27	6.63	7.63	1.89	3.77	4.35	1.0	4.71	6.0	4.76	7.0	6.97
Quality of life	3.81	6.57	6.8	4.93	5.77	5.03	2.64	5.1	5.97	5.56	5.12	5.53
Abuse of substances	Alcohol	None	None	Alcohol	Alcohol	None	None	None	None	None	None	None

Note. Sleep quality, social and physical activity, emotional regulation, and quality of life are average subjective ratings on a 10-point scale (higher is better) performed daily in a 30-day interval at Times 1 to 3. See Figure 1 for an overview of the data collection.

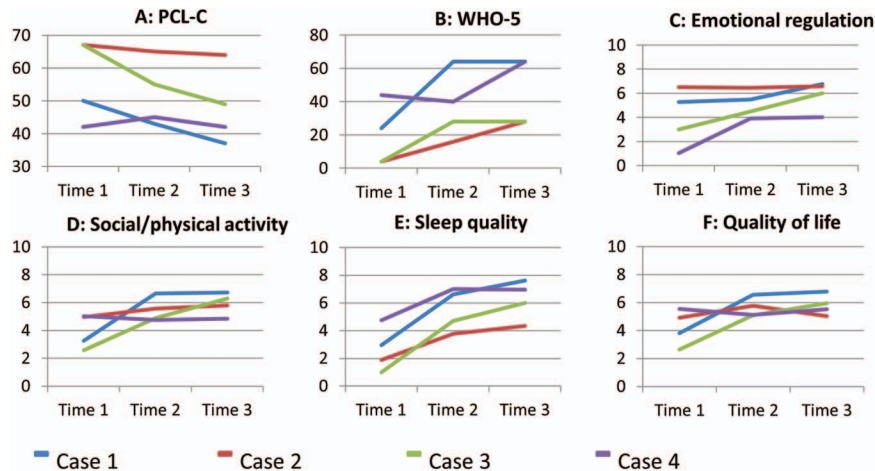


Figure 2. Visual representation of symptom scores at Times 1 to 3 as reported in Table 2. Panel A: Individual Posttraumatic Symptom Checklist, Civilian version scores. Panel B: Individual World Health Organization Five Well-Being Index scores. Panel C: Subjectively experienced emotion regulation score. Panel D: Subjectively experienced social and physical activity score. Panel E: Subjectively experienced sleep quality score. Panel F: Subjectively experienced quality of life score.

for one. Emotion regulation capability increased similarly across the group. Quality of life increased substantially in two participants, whereas two remained unchanged. See Figure 2, Panel C to F for all four participants' scores.

Discussion

Coexisting with a service dog when being a person with PTSD appears to be a complex phenomenon. Our findings delineate some of the multiple levels that are affected. Thinking of the service dog as a part of an *information processing feedback-loop* together with its owner is one candidate, integrative model. PTSD causes problems at cognitive, behavioral, social, and emotional levels, often changing the person's fundamental experience of life. We hypothesize that these four levels are all altered with the service dog. Its inherent and trained ability to sense, process, and respond to not only to the environment but also to the human to whom it is attached creates an information-processing buffer and external loop through which the veteran can explore his own cognitions and process these while being mirrored by the service dog. This enables more appropriately modulated behaviors. For example, being simultaneously exposed to a potentially arousal-increasing stimulus, the dog may act to modulate the veteran's arousal (e.g., by physical contact or behavior). Witnessing the same stimuli in parallel, the response of the service dog may represent an alternative interpretation of events to that of the veteran. If the dog and veteran share a close attachment-based relationship rooted in the upbringing and training of the dog, then changes in emotional behavior will evoke a response from the other part. Thus, a fearful reaction in the veteran may produce comforting or caring behavior in the dog. Likewise, fearful or comfort-seeking behavior in the dog may spur a compatible (e.g., comforting or caring) response in the veteran. If, on the other hand, the veteran exhibits negative symptoms such as social withdrawal, the dog's need for food, physical exercise, and other daily routines as well as its social behavior toward other humans and dogs may motivate the veteran toward being

socially active and gently force her or him to engaging in limited social activities and maintaining a minimal daily routine. In this view, service dog and veteran can contribute to a feedback loop of emotional processing, mutually adjusting to and maintaining an emotional, social, and cognitive equilibrium. Future studies targeting the exact mechanisms in such an information-processing loop between service dogs and their owners are needed to illuminate this.

Recent studies have investigated how service dogs alter attachment behavior in veterans with PTSD (Whitworth et al., 2019; Yarborough et al., 2018), facilitating "reconnecting" with family and relatives. This is another important aspect, which also was reported by the abovementioned four cases.

Unfortunately, data from the two participants who dropped out of the program (after just a few days and around the 11-month midpoint assessment, respectively) were excluded from the study. One of these cases terminated participation owing to uncontrollable aggression toward the puppy. As noted in the abovementioned case descriptions, most of the participants experienced considerable stress in the first weeks, with the young and untrained puppies in need of care at all times. This phenomenon was not captured by the collected quantitative data but contains important information for future use of service dogs among veterans: A young puppy represents a destabilizing, often irritating novelty in the veterans life and a being whose needs sometimes have higher priority than those of the veterans themselves (i.e., training, feeding, and basic care). For most participants, this caused considerable strain for some time, and for a single participant, it led to uncontrollable irritation, arousal, and aggression. In parallel with previous research, this may suggest that above a certain level of anger, temper, and hyperarousal problems, service dogs may be contraindicated (Yarborough et al., 2018).

In the current study, all participants initiated more *social engagement*. Jannik (Case 2) experienced the service dog as a *safe haven* in otherwise stressful social settings. Mike (Case 1) found it easier to engage in family life. Michael (Case 3) and Hans (Case

4) joined demanding sports activities. When accompanied by their service dog, they all reported increased confidence in controlling themselves and their symptoms in social settings.

Responsibility for the puppy and its training, and for collaborating with the trained, adult service dog seemed to give participants a *sense of agency* in their life with PTSD. They experienced becoming responsible for improving their well-being, in contrast to earlier interventions. This observation is in line with recent qualitative research (Yarborough et al., 2018).

The fact that each veteran was approved to be part of the study group and given responsibility for a service dog produced a sense of *acknowledgment* both by society and family. Feeling acknowledged for their daily struggle with PTSD symptoms was supportive and motivating, and the sense of belonging to a like-minded group gave comfort when they felt isolated.

Finally, we noted a sustained *reduction in trauma-related intrusion symptoms*, such as flashbacks and nightmares. In addition to responding to the veterans' emotions and behavior in the *information processing feedback loop* during daytime, the service dogs also assisted in emotional modulation at nighttime. Through being attentive and interfering behaviorally during sleep, service dogs distracted the veterans, leading to improved sleep quality and decreased arousal, as also has been reported recently (Scotland-Coogan, 2019).

Interestingly, our findings do not suggest that the intervention significantly impacts the diagnostic status of PTSD in the patients or general PTSD symptom level. In contrast with previous research (Whitworth et al., 2019), findings of the current case-series suggest that service dogs should not be administered as a *treatment* for PTSD. However, they may greatly enhance PTSD patients' life quality, as the impact of PTSD symptoms seems to be regulated. Before the current study, all participants had received several extensive psychological and medical treatments without sufficient effect, and their PTSD diagnosis was thus declared chronic. Our ambition was to explore if and how other factors than directly targeting PTSD symptoms could alter level of functioning and experienced life quality. We here suggest that life with a service dog can contribute to the modulation and regulation of social behavior, emotion and cognition. This results in an increased sense of self-control and agency, leading to a higher quality of life.

Thus, service dogs may be recommended as a means of improving the life quality of veterans with chronic PTSD, particularly when targeted PTSD treatments have proven ineffective. For PTSD patients who are deemed responsive to symptom-targeted therapies, service dogs may still be relevant, but only as a supplement to such specific treatment efforts. The latter aligns with O'Haire and Rodriguez' (2018) suggestion based on their nonrandomized efficacy trial involving the incorporation of service dogs in the treatment of 141 post-9/11 military members and veterans with PTSD.

Being an explorative study involving a very limited number of participants, the present case series suggests possible mechanisms involved in the intervention. However, findings do not support any specific conclusion as to the effectiveness of the intervention for specific patient groups or for PTSD patients in general. Further research within factors such as attachment style, group dynamics, personality traits especially aggressive and dyssocial traits, species of animal, psychological vulnerability, and socioeconomical background is needed to illuminate the field and involved mechanisms.

References

- Barker, S. B., & Dawson, K. S. (1998). The effects of animal-assisted therapy on anxiety ratings of hospitalized psychiatric patients. *Psychiatric Services*, 49, 797–801. <http://dx.doi.org/10.1176/ps.49.6.797>
- Barker, S. B., Knisely, J. S., Schubert, C. M., Green, J. D., & Ameringer, S. (2015). The effect of an animal-assisted intervention on anxiety and pain in hospitalized children. *Anthrozoös*, 28, 101–112. <http://dx.doi.org/10.2752/089279315X14129350722091>
- Bernabei, V., De Ronchi, D. L. A., Ferla, T., Moretti, F., Tonelli, L., Ferrari, B., . . . Atti, A. R. (2013). Animal-assisted interventions for elderly patients affected by dementia or psychiatric disorders: A review. *Journal of Psychiatric Research*, 47, 762–773. <http://dx.doi.org/10.1016/j.jpsychires.2012.12.014>
- Bradley, R., Greene, J., Russ, E., Dutra, L., & Westen, D. (2005). A multidimensional meta-analysis of psychotherapy for PTSD. *The American Journal of Psychiatry*, 162, 214–227. <http://dx.doi.org/10.1176/appi.ajp.162.2.214>
- Fecteau, S.-M., Boivin, L., Trudel, M., Corbett, B. A., Harrell, F. E., Jr., Viau, R., . . . Picard, F. (2017). Parenting stress and salivary cortisol in parents of children with autism spectrum disorder: Longitudinal variations in the context of a service dog's presence in the family. *Biological Psychology*, 123, 187–195. <http://dx.doi.org/10.1016/j.biopsycho.2016.12.008>
- Fine, A. H. (Ed.). (2010). Incorporating animal-assisted therapy into psychotherapy. In *Handbook on animal-assisted therapy* (pp. 169–191). London, United Kingdom: Elsevier. <http://dx.doi.org/10.1016/B978-0-12-381453-1.10010-8>
- Goodson, J., Helstrom, A., Halpern, J. M., Ferenschak, M. P., Gillihan, S. J., & Powers, M. B. (2011). Treatment of posttraumatic stress disorder in U.S. combat veterans: A meta-analytic review. *Psychological Reports*, 109, 573–599. <http://dx.doi.org/10.2466/02.09.15.16.PR0.109.5.573-599>
- Hamama, L., Hamama-Raz, Y., Dagan, K., Greenfeld, H., Rubinstein, C., & Ben-Ezra, M. (2011). A preliminary study of group intervention along with basic canine training among traumatized teenagers: A 3-month longitudinal study. *Children and Youth Services Review*, 33, 1975–1980. <http://dx.doi.org/10.1016/j.childyouth.2011.05.021>
- Hofmann, S. G., Litz, B. T., & Weathers, F. W. (2003). Social anxiety, depression, and PTSD in Vietnam veterans. *Journal of Anxiety Disorders*, 17, 573–582. [http://dx.doi.org/10.1016/S0887-6185\(02\)00227-X](http://dx.doi.org/10.1016/S0887-6185(02)00227-X)
- Ipsen, J. C., & Stein, D. J. (2012). Evidence-based pharmacotherapy of post-traumatic stress disorder (PTSD). *International Journal of Neuropsychopharmacology*, 15, 825–840. <http://dx.doi.org/10.1017/S14611457111001209>
- Karstoft, K.-I., Andersen, S. B., Bertelsen, M., & Madsen, T. (2014). Diagnostic accuracy of the posttraumatic stress disorder checklist-civilian version in a representative military sample. *Psychological Assessment*, 26, 321–325. <http://dx.doi.org/10.1037/a0034889>
- Lass-Hennemann, J., Peyk, P., Streb, M., Holz, E., & Michael, T. (2014). Presence of a dog reduces subjective but not physiological stress responses to an analog trauma. *Frontiers in Psychology*, 5, 1010. <http://dx.doi.org/10.3389/fpsyg.2014.01010>
- McLaughlin, K., & Hamilton, A. L. (2019). Exploring the influence of service dogs on participation in daily occupations by veterans with PTSD: A pilot study. *Australian Occupational Therapy Journal*, 66, 648–655. <http://dx.doi.org/10.1111/1440-1630.12606>
- Nevins, R., Finch, S., Hickling, E. J., & Barnett, S. D. (2013). The Saratoga WarHorse project: A case study of the treatment of psychological distress in a veteran of Operation Iraqi Freedom. *Advances in Mind-Body Medicine*, 27, 22–25.
- Nimer, J., & Lundahl, B. (2007). Animal-assisted therapy: A meta-analysis. *Anthrozoös*, 20, 225–238. <http://dx.doi.org/10.2752/089279307X224773>

- Odendaal, J. S. J., & Meintjes, R. A. (2003). Neurophysiological correlates of affiliative behaviour between humans and dogs. *Veterinary Journal*, *165*, 296–301. [http://dx.doi.org/10.1016/S1090-0233\(02\)00237-X](http://dx.doi.org/10.1016/S1090-0233(02)00237-X)
- O’Haire, M. E. (2013). Animal-assisted intervention for autism spectrum disorder: A systematic literature review. *Journal of Autism and Developmental Disorders*, *43*, 1606–1622. <http://dx.doi.org/10.1007/s10803-012-1707-5>
- O’Haire, M. E., & Rodriguez, K. E. (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*, 179–188. <http://dx.doi.org/10.1037/ccp0000267>
- Ostermeier, M. (2010). History of guide dog use by veterans. *Military Medicine*, *175*, 587–593. <http://dx.doi.org/10.7205/MILMED-D-10-00082>
- Pietrzak, R. H., Tsai, J., Armour, C., Mota, N., Harpaz-Rotem, I., & Southwick, S. M. (2015). Functional significance of a novel 7-factor model of DSM–5 PTSD symptoms: Results from the National Health and Resilience in Veterans study. *Journal of Affective Disorders*, *174*, 522–526. <http://dx.doi.org/10.1016/j.jad.2014.12.007>
- Ray, S. L., & Vanstone, M. (2009). The impact of PTSD on veterans’ family relationships: An interpretative phenomenological inquiry. *International Journal of Nursing Studies*, *46*, 838–847. <http://dx.doi.org/10.1016/j.ijnurstu.2009.01.002>
- Robyn, N. (2019). *Exploring the experiences of living with psychiatric service dogs for veterans with posttraumatic stress disorder*. Retrieved from <https://habricentral.org/resources/59184>
- Rodriguez, K. E., Bryce, C. I., Granger, D. A., & O’Haire, M. E. (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. <http://dx.doi.org/10.1016/j.psyneuen.2018.04.026>
- Santaniello, A., Dicé, F., Claudia Carratú, R., Amato, A., Fioretti, A., & Menna, L. F. (2020). Methodological and terminological issues in animal-assisted interventions: An umbrella review of systematic reviews. *Animals*, *10*, 759. <http://dx.doi.org/10.3390/ani10050759>
- Scotland-Coogan, D. (2019). Anxiety symptoms and sleep disturbance in veterans with posttraumatic stress disorder: The impact of receiving and training a service dog. *Qualitative Report*, *24*, 2655–2674.
- Servicehundeforeningen. (2020). Retrieved from <http://servicehundeforeningen.dk/>
- Souter, M. A., & Miller, M. D. (2007). Do animal-assisted activities effectively treat depression? A meta-analysis. *Anthrozoös*, *20*, 167–180. <http://dx.doi.org/10.2752/175303707X207954>
- Taylor, M. F., Edwards, M. E., & Pooley, J. A. (2013). “Nudging them back to reality”: Toward a growing public acceptance of the role dogs fulfill in ameliorating contemporary veterans’ PTSD symptoms. *Anthrozoös*, *26*, 593–611. <http://dx.doi.org/10.2752/175303713X13795775535896>
- Topp, C. W., Østergaard, S. D., Søndergaard, S., & Bech, P. (2015). The WHO-5 well-being index: A systematic review of the literature. *Psychotherapy and Psychosomatics*, *84*, 167–176. <http://dx.doi.org/10.1159/000376585>
- van Houtert, E. A. E., Endenburg, N., Wijnker, J. J., Rodenburg, B., & Vermetten, E. (2018). The study of service dogs for veterans with post-traumatic stress disorder: A scoping literature review. *European Journal of Psychotraumatology*, *9*, 1503523. <http://dx.doi.org/10.1080/20008198.2018.1503523>
- Weathers, F. W., Litz, B. T., Herman, D. S., Huska, J. A., & Keane, T. M. (1993). *The PTSD Checklist (PCL): Reliability, validity, and diagnostic utility*. Annual Convention of the International Society for Traumatic Stress Studies, San Antonio, TX.
- Whitworth, J. D., Scotland-Coogan, D., & Wharton, T. (2019). Service dog training programs for veterans with PTSD: Results of a pilot controlled study. *Social Work in Health Care*, *58*, 412–430. <http://dx.doi.org/10.1080/00981389.2019.1580238>
- Yarborough, B. J. H., Owen-Smith, A. A., Stumbo, S. P., Yarborough, M. T., Perrin, N. A., & Green, C. A. (2017). An observational study of service dogs for veterans with posttraumatic stress disorder. *Psychiatric Services*, *68*, 730–734. <http://dx.doi.org/10.1176/appi.ps.201500383>
- Yarborough, B. J. H., Stumbo, S. P., Yarborough, M. T., Owen-Smith, A., & Green, C. A. (2018). Benefits and challenges of using service dogs for veterans with posttraumatic stress disorder. *Psychiatric Rehabilitation Journal*, *41*, 118–124. <http://dx.doi.org/10.1037/prj0000294>
- Yount, R., Ritchie, E. C., St. Laurent, M., Chumley, P., & Olmert, M. D. (2013). The role of service dog training in the treatment of combat-related PTSD. *Psychiatric Annals*, *43*, 292–295. <http://dx.doi.org/10.3928/00485713-20130605-11>

Received September 17, 2019

Revision received June 16, 2020

Accepted July 15, 2020 ■