THE EFFECTS OF SERVICE DOGS ON INDIVIDUALS WITH PHYSICAL DISABILITIES AND MENTAL DISORDERS: A MULTIMETHOD EXAMINATION

by

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ABSTRACT

An increasing number of individuals with physical disabilities or mental disorders are incorporating specially trained service dogs as an assistance aid to improve functionality. In addition to the tasks that service dogs are rained for, studies also suggest that service dogs may benefit psychosocial health and wellbeing. However, current knowledge on these potential benefits is limited by methodological weaknesses without multi-method assessment. There remains a need for empirical and replicable quantification the psychosocial outcomes of service dog assistance and companionship.

The objective of Chapters 1-3 was to summarize, evaluate, and quantify the effects of service dogs on psychosocial health among individuals with physical disabilities. Chapter 1 conducted a systematic literature review of N=24 articles describing the effects of guide, hearing, mobility, and medical service dogs on standardized measures of psychosocial functioning. Chapters 2 and 3 conducted an empirical investigation using quantitative and qualitative methods to quantify the psychosocial effects of mobility and medical service dogs among N=154 individuals with physical disabilities. Results identified specific psychological, social, and emotional benefits that are associated with having an assistance dog or service dog among diverse populations with physical disabilities or chronic conditions.

The objective of Chapters 4-6 was to quantify the role of psychiatric service dogs for post-9/11 military veterans with PTSD. Chapter 4 quantified the perceived importance, frequency of use, and therapeutic value of service dog behaviors for N=216 military veterans with PTSD. Chapters 5 and 6 then quantified the effects that PTSD service dogs on psychosocial outcomes and physiological indicators of functioning, respectively, among a sample of N=141 military veterans with PTSD. Results identified therapeutic components, tangible psychosocial benefits, and potential physiological mechanisms of psychiatric service dogs for military veterans with PTSD.

Overall, this research combined quantitative, qualitative, and physiological measurement to describe outcomes of service dog pairings in two different at-risk populations. Results provide non-causational evidence of psychosocial benefits from service dogs for individuals with physical disabilities or mental disorders. Findings provide

a basis for further large-scale research to disentangle active components of the assistance dog-human partnership and identify potential mediating variables of effects.

CHAPTER 1. PSYCHOSOCIAL EFFECTS OF ASSISTANCE DOGS: A SYSTEMATIC LITERATURE REVIEW

1.1 Abstract

Beyond the functional tasks that assistance dogs are trained for, there is growing literature describing their benefits on the psychosocial health and wellbeing of their handlers. However, this research is not only widely disparate but, despite its growth, has not been reviewed since 2012. Our objective was to identify, summarize, and methodologically evaluate studies quantifying the psychosocial effects of assistance dogs for individuals with physical disabilities. Following PRISMA guidelines, a systematic review was conducted across seven electronic databases. Records were independently screened by two authors. Studies were eligible for inclusion if they assessed outcomes from guide, hearing, medical, or mobility service dogs, if they collected original data on handlers' psychosocial functioning, and if the outcome was measured quantitatively with a validated, standardized measure. Studies on psychiatric service dogs, emotional support dogs, and pet dogs were excluded. Of 1,830 records screened, 24 articles were identified (12 publications, 12 theses) containing 27 studies (15 cross-sectional, 12 longitudinal). Studies assessed the effects of mobility (18), hearing (7), guide (4), and medical (2) assistance dog partnerships with an average sample size of N=83. An analysis of 147 statistical comparisons across the domains of psychological health, quality of life, social health, and vitality found that 68% of comparisons were null, 30% were positive in the hypothesized direction, and 2% were negative. Positive outcomes included significant effects of having an assistance dog on psychological wellbeing, emotional functioning, self-esteem, and vitality. However, it is of note that several methodological weaknesses of the studies make it difficult to draw any definitive conclusions, including inadequate reporting and a failure to account for moderating or confounding variables. Future research will benefit from stronger methodological rigor and reporting to account for heterogeneity in both humans and assistance dogs as well as continued high-quality replication.

1.2 Introduction

The roles of dogs to assist in improving human wellbeing continue to expand. Not only are companion dogs prevalent in modern society, but dogs are also often intentionally incorporated into therapeutic processes in the contexts of animal-assisted activities (AAA) and animal-assisted therapy (AAT; Kruger & Serpell, 2010). In other contexts, dogs can be specially trained to provide specific benefits to individuals with impairments, disabilities, or chronic conditions as trained assistance animals. Assistance dog placements and roles have grown rapidly in recent decades, especially in the United States, Canada, and Europe (Walther et al., 2017).

Assistance Dogs International (ADI) defines three types of assistance dogs: guide dogs who assist individuals with visual impairments, hearing dogs who assist individuals with hearing impairments, and service dogs who assist individuals with disabilities other than blindness or deafness (Assistance Dogs International, 2019). Service dogs can assist individuals with physical disabilities (e.g. performing mobility-related tasks such as pulling a wheelchair or retrieving dropped items), individuals with medical conditions (e.g. alerting or responding to medical crises such hypoglycemia or seizures), and individuals with mental health disorders (e.g. psychiatric service dogs for posttraumatic stress disorder or autism spectrum disorder). Under the Americans with Disabilities Act of 1990, an assistance dog must do work or perform tasks for the benefit of an individual with a physical, sensory, psychiatric, intellectual, or other mental disability in order to receive public access rights (Americans With Disabilities Act, 1990). While there are no legal requirements specifying that an assistance dog must be certified, registered, or receive any specialized training to receive public access rights, independent organizations such as ADI, the International Association of Assistance Dog Partners (IAADP), and the International Guide Dog Federation (IGDF) define a set of minimum training and behavior standards for public access that help guide the assistance dog industry.

In parallel with an increasing amount of research quantifying the therapeutic benefits of companion dogs and therapy dogs on human health and wellbeing (Barker & Wolen, 2008; Matuszek, 2010), there has been an increased focus on quantifying the physical, psychological, and social effects that assistance dogs may have on their handlers (Modlin, 2000; Sachs-Ericsson, Hansen, & Fitzgerald, 2002; Winkle, Crowe, & Hendrix,

2012). Research has indicated that beyond the physical or tangible benefits that an assistance dog is trained to provide (e.g. route finding, retrieving dropped items, alerting to a seizure), the assistance dog's companionship, emotional and social support, and social facilitation effects in public may be particularly salient to improving the quality of life of individuals with disabilities (Modlin, 2000; Sachs-Ericsson et al., 2002; Winkle et al., 2012). After receiving an assistance dog, individuals retrospectively report increases to their social, emotional, and psychological health (e.g., Hart, Hart, & Bergin, 1987; Lane, McNicholas, & Collis, 1998; Valentine, Kiddoo, & LaFleur, 1993). Longitudinal studies have found that individuals report improvements to their emotional wellbeing, social functioning, and quality of life just 3 to 6 months after receiving an assistance dog (Allen & Blascovich, 1996; C. M. Guest, G. M. Collis, & J. McNicholas, 2006; Vincent, Gagnon, & Dumont, 2017). Compared to waitlist control conditions, individuals with an assistance dog report better psychosocial functioning and wellbeing (Rodriguez, Bibbo, & O'Haire, 2018; Shintani et al., 2010). Additionally, research suggests the relationship between an assistance dog and its owner may also serve as a reciprocal attachment and caregiving relationship characterized by secure and strong attachments (Fallani, Previde, & Valsecchi, 2006; Kwong & Bartholomew, 2011).

To date, there have been several reviews summarizing the literature on the psychosocial effects of assistance dogs on their handlers. One of the first reviews published by Modlin in 2000 (Modlin, 2000) summarized nine published quantitative and qualitative studies on the benefits of guide dogs, hearing dogs, and mobility service dogs on their handlers (omitting unpublished theses). Another early review published by Sachs-Ericsson and colleagues in 2002 (Sachs-Ericsson et al., 2002) summarized 14 quantitative studies on both standardized and nonstandardized outcomes following mobility service dog or hearing dog placement (omitting guide dogs). Neither of these early reviews employed a formal methodological assessment of studies, but limitations were listed for each included study. While both reviews found mostly positive findings regarding mobility, guide, and hearing dogs' effects on their handlers' health and wellbeing, social interactions, and activity participation (Modlin, 2000; Sachs-Ericsson et al., 2002), it was concluded that "the small number of studies and methodological limitations of these studies preclude any clear conclusions" (Sachs-Ericsson et al., 2002).

A more recent systematic review published by Winkle and colleagues in 2012 (Winkle et al., 2012) summarized 12 published quantitative studies on both standardized and nonstandardized outcomes following mobility service dog placement (omitting guide dogs, hearing dogs, and unpublished theses). The scientific rigor of each study was rated according to a 5-level system while the methodological quality of each study was scored on a 7-point scale. While results described positive effects of service dogs in terms of social, psychological, and functional benefits for their handlers, it was concluded that all 12 of the studies had weak study designs with limitations including lack of comparison groups, inadequate description of the service dog intervention, and nonstandardized outcome measures. The authors concluded that although results are promising, "conclusions drawn from the results must be considered with caution" (Winkle et al., 2012).

Because medical service dogs are a relatively new category of assistance dog placements (Walther et al., 2017), there has been less research on the psychosocial effects of medical alert and response service dogs on their handlers. However, a recent 2018 review summarized five published quantitative studies describing outcomes from seizure alert and seizure response service dogs. The authors found three studies reporting an association between having a seizure alert or response dog and improvements to quality of life and wellbeing, concluding a need for more research.

Research in the field of human-animal interaction (HAI) and assistance dogs is not only rapidly growing but is often disparately published across multidisciplinary journals and outlets. Conducting periodic systematic reviews of this research is crucial to both disseminate knowledge as well as to identify knowledge gaps for future studies(Griffin, Hurley, & McCune, 2019). As research on the assistance animal-handler relationship continues to increase, there is a need for an updated, comprehensive collation of the literature encompassing studies on the effects of all varieties of assistance dogs (guide dogs, hearing dogs, and both mobility and medical service dogs) including both published studies and unpublished theses and dissertations. Further, as researchers increasingly incorporate standardized outcome measures into this research, collating and pooling findings will allow researchers to compare outcomes across different populations and interventions while estimating the magnitude of effects across domains.

This research aimed to conduct a systematic assessment of the current state of knowledge regarding the potential benefits of assistance dogs on standardized outcomes of the health and wellbeing of individuals with disabilities. Specifically, this review sought to systematically identify, summarize, and evaluate studies assessing psychosocial outcomes from owning an assistance dog (including service, guide, hearing, and/or medical alert or response dogs) with measures tested for reliability and validity among individuals with physical disabilities. The specific aims were to (1) describe the key characteristics of studies (2) evaluate the methodological rigor of studies (3) summarize outcomes.

1.3 Materials and Methods

The systematic literature review was conducted according to The Preferred Reporting Items for Systematic Reviews and Meta-Analyses (PRISMA) guidelines (Liberati et al., 2009). A study protocol was designed a-priori to define the search strategy, inclusion and exclusion criteria, and items for data extraction.

1.3.1 Search Procedure

As the field of animal-assisted intervention is multidisciplinary, a wide and extensive search was conducted encompassing medical and scientific databases. Further, as publication bias and the "file-drawer effect" is an often referenced weakness of the HAI literature (Herzog, 2011), two dissertation and thesis databases and abstracts of two conferences were searched for unpublished studies.

A health information specialist (JY) constructed and executed comprehensive search strategies in six electronic databases: MEDLINE (PubMed platform), Cumulative Index to Nursing and Allied Health Literature (CINAHL) (EBSCOhost platform), ERIC (EBSCOHost), Web of Science Core Collection (Web of Science), PsycINFO (EBSCOhost), and PsycARTICLES (EBSCOhost). The electronic searches were performed on July 23, 2018, and updated on January 23, 2019. The complete MEDLINE search strategy, which was adapted for the other databases, is shown in Supplemental Table 1. Grey literature was addressed by searching ProQuest Dissertations and Theses (ProQuest) and WorldCatDissertations and hand searching the abstracts of the International

Society for Anthrozoology and International Association of Human Animal Interactions Organizations conferences.

1.3.2 Article Selection

Studies were eligible for inclusion if they met the following criteria: (1) The study population consisted of current or prospective owners/handlers of an assistance dog (including service, guide, hearing, and/or medical alert or response dogs) with a physical disability or chronic condition in which the assistance dog is trained to do work or perform tasks directly related to the disability or condition (Americans With Disabilities Act, 1990); (2) The study collected original data on the effect of the assistance dog on their handler with at least one psychosocial outcome, including those quantifying aspects of mental health, social health, and health-related quality of life; and (3) The psychosocial outcome(s) were collected via a standardized measure tested for validity and reliability. The rationale for excluding studies on emotional service dogs and psychiatric service dogs is that the primary benefits of these dogs are psychological in nature, rather than physical or medical, which complicated comparisons of their psychosocial effects. The rationale for excluding qualitative studies from inclusion was to focus on outcomes using standardized measures to facilitate quantitative comparisons across studies.

1.3.3 Article Screening

All articles were screened by two independent reviewers (authors KR and JG) using Covidence systematic review software (Veritas Health Innovation, Melbourne, Australia). In the case of disagreements, inclusion or exclusion was resolved by discussion and consultation with a third independent reviewer (author MO). After removing duplicate articles in EndNote following a validated protocol (Bramer, Giustini, de Jonge, Holland, & Bekhuis, 2016), articles were screened based on their title and abstract. At this stage, articles were excluded if they were (1) non-English; (2) written for a magazine or other non-peer-reviewed source; (3) book reviews, book chapters, editorials, letters, or opinion papers that did not collect original data; (4) conference abstracts or proceedings; (5) studies

assessing companion, therapy, or emotional support animals that were not trained for tasks or work related to a specific disability.

After the initial title and abstract review, articles were screened based on full text. Exclusion criteria were then used to select articles based on the following (in order): (1) irrelevant to study topic; (2) assessed an excluded study population (psychiatric service dogs, therapy dogs, emotional support dogs, or companion dogs); (3) did not report quantitative outcomes from assistance dog placement (literature reviews, instrument development, not original research); (4) reported unrelated outcomes (puppy raising, service dog training, or animal-related outcomes); (5) reported only non-psychosocial outcomes (medical or physical); (6) methodological exclusions (qualitative, case studies, single-subject design); (7) no full text available.

1.3.4 Data Extraction

Articles were extracted for information based on three aims to summarize study characteristics, assess methodological rigor, and summarize outcomes. To summarize study characteristics, extracted items included participant characteristics (sample size, age, gender, country of origin), assistance dog characteristics (type and provider), and details of the study (design, measurement time points, comparison conditions). To assess methodological rigor, a total of 15 extracted items were sourced from methodological assessment tools including the National Institutes of Health (NIH) Study Quality Assessment Tools (LaB), the Consolidated Standards of Reporting Trials (CONSORT) checklist (Schulz, Altman, & Moher, 2010), the Strengthening the Reporting of Observational Studies in Epidemiology (STROBE) checklists (Von Elm et al., 2014), and the Specialist Unit for Review Evidence (SURE) Checklists (Specialist Unit for Review Evidence). Authors JG and KR independently coded 20% of the included articles to establish adequate inter-rater reliability (alpha = 0.822). Author KR then coded 100% of articles. To examine the relationship between methodological rigor score and year of publication as well as sample size, bivariate correlations were performed. To compare methodological rigor by study design, an independent t-test was used to compare mean scores across longitudinal and cross-sectional designs.

To summarize study outcomes, extracted items included raw means, standard deviations, sample sizes, and statistical significance values for any psychosocial outcomes from included studies. Because of the broad inclusion criteria, the 27 studies were widely varied in terms of human and dog participants, assessment time points, statistical analyses, and standardized outcomes. Therefore, due to observed heterogeneity, a meta-analysis was not pursued. We also planned to extract or manually calculate effect sizes to create funnel plots to investigate potential publication biases. However, due to large heterogeneity and poor reporting of effect sizes and raw data, a narrative synthesis of findings in comparison to unpublished theses and published articles was pursued instead.

1.4 Results

Figure 1-1 displays the PRISMA flow diagram of the study selection process. A total of 1,830 records were screened via title and abstract in which 1,576 records were excluded due to irrelevancy. A total of 254 records were screened via full text in which 230 were excluded. Exclusions included those based on population, outcomes, and methodology (see **Figure 1-1**). The final sample included 24 articles (12 peer-reviewed publications, 12 unpublished theses/dissertations) containing 27 individual studies. Articles were published from 1994 – 2018 with publication dates in the 1990s (5), 2000s (9) and 2010s (10) indicating an increasing publication rate on this topic over time.

1.4.1 Study Characteristics

To achieve the first aim of the review – to describe and summarize study characteristics of current literature on the psychosocial effects of assistance dogs – we extracted several features each study and article (**Table 1.1**).

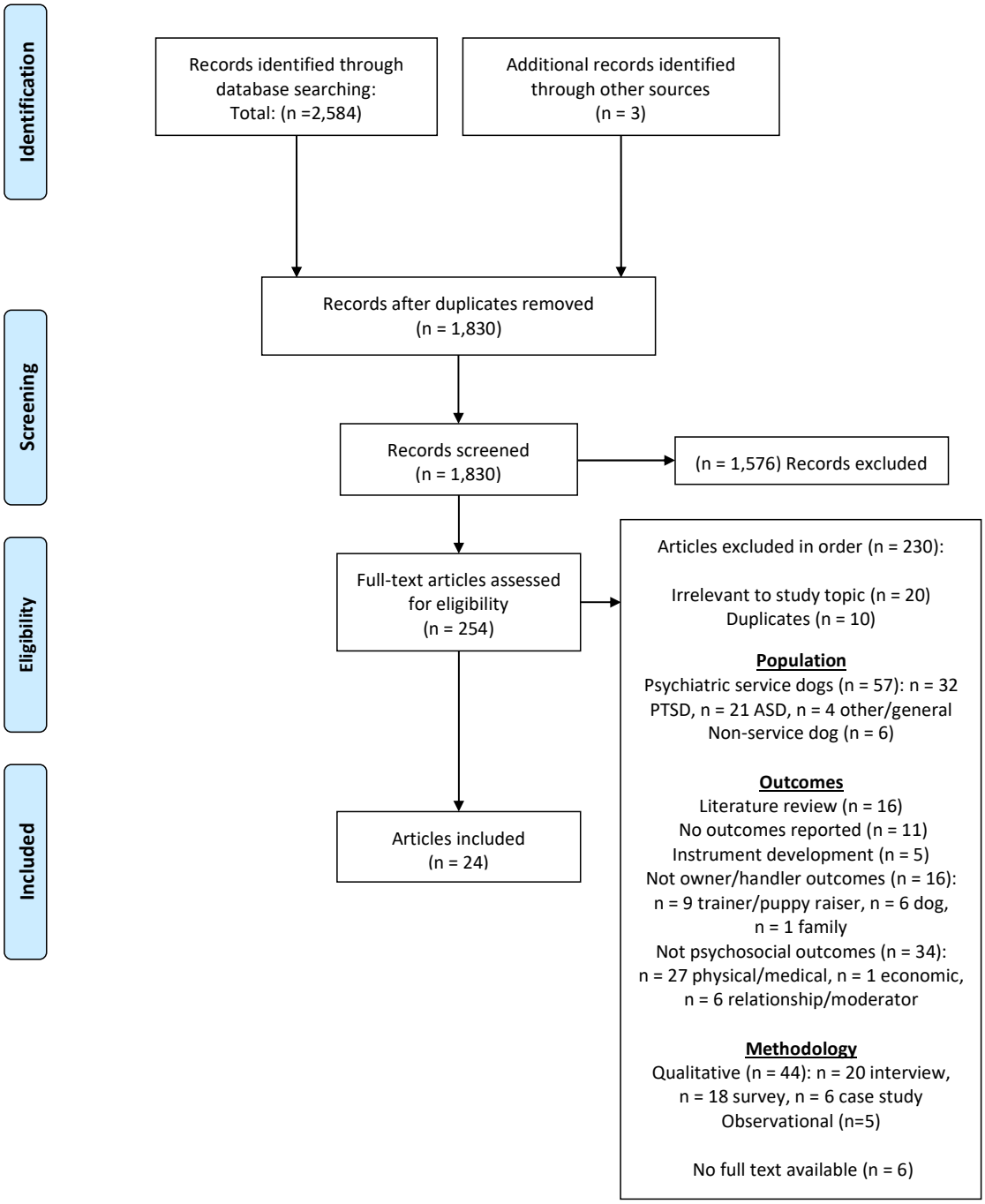

Figure 1-1. PRISMA Flow Diagram.

Table 1.1 Study characteristics of N=27 studies separated by longitudinal and cross-sectional designs.

Study, Publication type[a]	Country/ Region	Dog type	Comparison condition	N (treatment / control)	Participant age (years)			% Male	Provider organization(s)	Impairments (% total sample)	Assessment time points
					M[b]	SD[b]	Range[c]				
LONGITUDINAL											
Allen & Blascovich 1996P	USA	Mobility	Waitlist; Pre	48 (24/24)	25	1.3	NR	50%	NR	46% SCI, 8% MD, 33% MS, 13% TBI	T1: 0mo, T2: 6mo, T3: 12mo, T4: 18mo, T5: 24mo
Collins 2004T	USA	Mobility	Waitlist; Pre	20 (11/9)	42.0	11.2	18+	62%	Paws with a Cause, CCI	100% Wheelchair/ scooter users	T1: 0mo, T2: 3mo, T3: 9mo
Donovan 1994T	USA	Mobility	Waitlist; Pre	52 (26/26)	35.1	10.9	NR	50%	CCI	23% Genetic disability, 45% disability caused by accident, 17% disability caused by illness, 14% CP	T1: 0mo, T2: 4mo
Gilbey 2003T, Study #1	UK	Hearing	Pre	14 (14/NA)	NR	NR	NR	NR	HDDP	100% Hearing-impaired	T1: 0mo, T2: 6mo
Guest et al. 2006P	UK	Hearing	Pre	51 (51/NA)	51	NR	22 - 87	22%	HDDP	2% Moderate hearing loss, 43% severe hearing loss, 55% profound hearing loss	T1: 0mo, T2: 9.5 +/-6.1mo (end of waiting period), T3: 5 days after T2 (end of 5-day resident training to receive dog), T4: 3.9 +/- 1.4mo after T3, T5: 20.3 +/- 5.4mo after T3

Table 1.1 continued

Hubert et al. 2013P	Canada	Mobility	Pre	11 (11/NA)	32.7	12.8	18+	77%	MIRA Foundation	38% Paraplegia, 38% quadriplegia, 23% low level spina bifida	T1: 0mo, T2: 7mo
Lundqvist et al. 2018P	Sweden	Mobility, hearing, diabetic, seizure	Pre	55 (55/NA)	43.8	14.0	17-68	15%	Swedish Association of Service Dogs	36% Diabetes, 27% neurological, 22% musculoskeletal, 6% deaf/hard of hearing, 4% epilepsy, 5% other	T1: 0mo, T2: 3mo
Rabschutz 2006T	USA, Canada	Mobility, hearing	Pre	15 (15/NA)	46.7	14.2	29-73	33%	NEADS	33% Deafness, 66% mobility impaired, 20% multiple disabilities	T1: 0mo, T2: 6mo
Rintala 2008P, Study #1	USA	Mobility	Waitlist; Pre	33 (18/15)	47.2	12.5	21-69	24%	THSD, NEADS, PPSD	64% Quadriplegia, 36% paraplegia	T1: 0mo, T2: 7.09 +/- 0.98mo (treatment), 6.87 +/- 0.50mo (control)
Rintala 2008P, Study #2	USA	Hearing	Waitlist; Pre	10 (6/4)	48.5	17.5	21-76	20%	THSD, NEADS	90% Severe hearing loss, 10% moderate hearing loss	T1: 0mo, T2: 6.89 +/- 0.61mo (treatment), 6.70 +/- 0.77mo (control)
Spence 2015T	New Zealand	Mobility	Pet Dog; Pre	17 (7/10)	49.1	13.6	21-68	35%	MADT	12% CP; 29% MS, 18% 18% MD, 18% Parkinson's disease, 18% SCI, 6% stroke, 6% other	T1: 0mo, T2: 12mo

Table 1.1 continued

Vincent et al. 2017P	Canada	Mobility	Pre	17 (17/NA)	41.9	15.3	18-64	53%	MIRA Foundation	59% Paraplegia, 24% tetraplegia, 6% leg amputation, 12% CP	T1: 0mo, T2: 3mo, T3: 6mo, T4: 9mo
CROSS-SECTIONAL											
Study, Publication type[a]	Country/ Region	Dog type	Comparison condition	N (treatment / control)	Participant age (years)			% Male	Provider organization(s)	Impairments (% total sample)	Time (years) with assistance dog[e]
					M[b]	SD	Range[c]				
Collins et al. 2006P	USA	Mobility	No assistance dog	152 (76/76)	44.4	12.1	18+	62%	Paws with a Cause, CCI	41% SCI, 24% non-progressive disability, 34% progressive disability	M=3.1, SD=NR, Range=0-13.1
Craft 2007T	USA	Mobility	Waitlist	86 (76/10)	44.2	NR	19 - 72	17%	IAADP, CCI, CST, ADI	100% Chronic physical disability	NR
Crudden et al. 2017P	USA	Guide	No assistance dog	316 (101/215)	47.7	12.3	18 - 65*	NR	NR	40% Totally blind, 55% legally blind, 6% less severe visual impairment	NR
Davis 2017T	USA	Mobility	No assistance dog	140 (91/49)	41.0	14.9	18 - 73	40%	AVD, ADW, ADInst, Canine Assistants, CCI, CPL, FSD, HTAD, NEADS, NSD, PPSD	26% Amputation, 74% neurologically impaired	NR

Table 1.1 continued

Gilbey 2003T Study #2	UK	Hearing	Waitlist	131 (98/33)	55.4	17.3	NR	25%	Hearing Dogs for Deaf People	100% Hearing-impaired	NR
Hacket 1994T	USA	Mobility	Waitlist	40 (24/16)	37.1	10.1	21 - 70	43%	Paws with a Cause	31% SCI, 8% arthritis, 10% CP, 10% MD, 13% MS, 28% Other	M=1.82, SD=NR, Range=0.25-4
Hall et al. 2017P Study #1	UK	Mobility	Waitlist	96 (72/24)	NR	NR	18+	20%	Dogs for Good	30% wheelchair user, 24% MS, 45% other impairments, 5% non-disclosed	NR
Hall et al. 2017P Study #2	UK	Hearing	Waitlist	141 (111/30)	NR	NR	18+	23%	Hearing Dogs for Deaf People	100% Hearing-impaired	NR
Matsunaka & Koda 2008P	Japan	Guide	No assistance dog	80 (30/50)	34.1	NR	15 - 67	55%	Japan Guide Dog Association	100% Visually impaired	NR
Milan 2007T	USA	Mobility	No assistance dog	214 (99/115)	44.1	12.9	18+	36%	Paws with a Cause, CCI	17% Tetraplegia 20% paraplegia, 39% progressive disability, 21% non-progressive disability	M=3.4, SD=2.1, Range=1.2-8.5
Refson 1999P	UK	Guide	No assistance dog	167 (82/85)	53	76	19 - 94	40%	Guide Dogs for the Blind	100% Visually impaired	M=9.2, SD=NR, Range=0.3-45

Table 1.1 continued

Rodriguez et al. 2018[P]	USA	Mobility, diabetic, seizure	Waitlist	154 (97/57)	26.3	17.4	4 - 72	53%	Canine Assistants	26% Seizure disorder, 22% musculoskeletal, 46% neuromuscular, 3% developmental or intellectual, 4% diabetes	M= 4.7*, SD=3.4*, Range= 0.6-13.7*
Rushing 1994[T]	USA	Mobility	Waitlist	53 (32/21)	33.4[g]	7.5[g]	20 - 55	85%	CCI	100% Quadriplegia	NR
Shintani et al. 2010[P]	Japan	Mobility	No assistance dog	38 (10/28)	50.0	14.0	20 - 67	45%	NR	45% SCI, 26% RA, 11% Stroke, 18% other	M=1.7, SD=0.7, Range=0.7-3.2
Yarmolkevich 2017[T]	USA	Guide	No assistance dog	87 (50/37)[h]	NR	NR	18+	61%	Guiding Eyes for the Blind	52% Totally blind, 12% Near-totally blind, 19% profoundly vision impaired, 9% severely vision impaired, 4% moderately vision impaired, 5% mildly vision impaired	M=NR, SD=NR, Range=0.5-5+

Table 1.1 continued

M, Mean; SD, Standard deviation; NR = Information not reported; * = Information was obtained via email correspondence with a study author.

Provider Organizations: CCI, Canine Companions for Independence; HDDP, Hearing Dogs for Deaf People; NEADS, National Education for Assistance Dog Service; PPSD, Patriot Paws Service Dogs; THSD, Texas Hearing and Service Dogs; MADT, Mobility Assistance Dogs Trust; IAADP, International Association of Assistance Dog Partners; CST, Canine Support Teams; ADI, Assistance Dogs International, Inc.; AVD, America's Veterans Dogs; ADInst, Assistance Dog Institute; CPL, Canine Partners for Life; FSD, Freedom Service Dogs; HTAD, Honor Therapy and Assistance Dogs; NSD, National Service Dogs.

Disabilities/Conditions: SCI, Spinal cord injury; MD, Muscular dystrophy; MS, Multiple sclerosis; TBI, Traumatic brain injury; CP, Cerebral palsy; RA, Rheumatoid Arthritis.

[a] P, Peer-reviewed publication in an academic journal; T, Thesis or dissertation for a Ph.D. or Master's degree.
[b] Values reported to one decimal place unless not reported by authors.
[c] 18+ indicates that authors specified that participants were over 18, but did not provide an upper limit to age range.
[d] Wording used is identical to the original manuscript.
[e] Time since initial assistance dog placement for the treatment/assistance dog group in cross-sectional designs.
[f] Only median age was provided.
[g] Only age values for the treatment group were provided.
[h] Guide dog and guide dog + pet dog groups were collapsed to form the treatment group; Pet dog + no dog groups were collapsed to form the control group.

1.4.2 Study Designs

Of 27 studies, 15 were cross-sectional and 12 were longitudinal. Studies compared outcomes of individuals with an assistance dog to before they received the dog (six longitudinal studies), to participants on the waitlist to receive an assistance dog (five longitudinal and seven cross-sectional studies), or to participants without an assistance dog (eight cross-sectional studies). Longitudinal assessment time points were varied. Most longitudinal studies (8/12) assessed participants at two time points: at baseline prior to receiving an assistance dog, and an average of 5.8 +/- 3.3 months after participants received an assistance dog (range of 3-12 months follow-up). The remaining four longitudinal studies assessed participants 3-5 times with final follow-up ranging from 9-24 months after receiving an assistance dog.

1.4.3 Study Participants

Most studies (15/27; 56%) were conducted in the United States, followed by the United Kingdom (6/27; 22%). Other countries where studies took place included Canada (3), Japan (2), New Zealand (1), and Sweden (1). A majority of studies (18/27; 67%) assessed outcomes from mobility service dogs for individuals with physical disabilities. These 18 studies recruited study populations with a range of physical impairments including para- or quadriplegia, musculoskeletal disorders, and neuromuscular disorders. Other studies assessed outcomes from hearing dogs (7/27; 26%), guide dogs (4/27; 15%), and medical alert/response service dogs (2/27; 7%). Human participants in these studies included those with hearing or visual impairments, diabetes, and seizure disorders. Most studies (24/27; 89%) assessed outcomes from a single type of assistance dog (e.g. mobility or guide), thus restricting human participants to a single category of impairments. However, three studies collapsed analyses across several types of assistance dogs and impairments. Most studies (17/27; 63%) recruited from a single assistance dog provider organization, while the remaining studies recruited from a range of providers (7/27; 26%) or did not report the source of the assistance dogs in the study (3/27; 11%). The most common provider organizations represented were Canine Companions for Independence (CCI; six mobility service dog studies), Paws with a Cause (four mobility service dog studies), and Hearing Dogs for Deaf People (HDDP; four hearing dog studies).

Samples sizes ranged from 10 to 316 participants with an average sample size across all studies of N=83 +/- 74 participants and a median sample size of N=53. Seven studies (26%) had sample sizes less than or equal to N=20, all of which were longitudinal. However, more than half of all studies (16/27; 59%) had sample sizes greater than or equal to N=50. Cross-sectional studies had the highest sample sizes with an average sample size of N=126 +/- 73 participants (range of N=38 - 316), while longitudinal studies averaged N=29 +/- 18 participants (range of N=10 - 55). Only a single study (Rodriguez et al., 2018) assessed outcomes from child participants under the age of 18 (an additional study (Refson et al., 1999) had a minimum inclusion age of 16, but the youngest participant was 19). Average age across all studies was 42 +/- 13 years old. Samples ranged from 15% male to 85% male, with an average of 42% male participants across all studies.

1.4.4 Study Methodologies

To achieve the second aim of the review – to evaluate the methodological rigor of studies – each study was scored on a yes/no scale on if they met a set of 15 methodological rating items (**Table 1.2**). **Figure 1-2** displays the total scores across each of the 15 items, separated by introduction, methods, results, and discussion sections (see Appendix A, **Table A.2** for individual study scores). Overall, studies addressed an average of 62% of methodological consideration items with a range of 23% (3/13) to 100% (15/15; denominators were variable as there were two items not applicable to all study designs). Longitudinal studies addressed an average of 59% of methodological items while cross-sectional studies averaged 65%. However, methodological rigor did not significantly differ by study design ($t(25) = -0.940$, $p = 0.356$). Methodological rigor also did not significantly correlate with year of publication ($r = 0.327$, $p = 0.096$) nor total sample size ($r = 0.258$, $p = 0.194$).

Table 1.2 Summary of methodological ratings for N=27 studies ordered by reporting section (Introduction, Methods, Results, Discussion).

Methodological Rating Item			# of Studies		
			Yes	**No**	**N/A**
Introduction	Objective	Was an aim, purpose, objective, or research question stated?	27	0	0
	Hypothesis	Was a hypothesis stated?	17	10	0
Methods	Ethical approval	Was ethical approval sought, received, and stated?	16	11	0
	Demographics	Were key demographic characteristics of study participants described including average age and percent of each sex?	23	4	0
	Disabilities	Were details provided regarding participant's disabilities in terms of type/diagnosis, severity, progressiveness, or duration since onset?	22	5	0
	Inclusion/ exclusion	Is there a description of inclusion/ exclusion criteria of participants?	17	10	0
	Service dogs	Was the service dogs' source/provider and breeds described?	5	22	0
	Control	Does the design include a control/comparison condition?	21	6	0
Results	Equal groups	Was there a statistical demonstration that groups or baseline characteristics were equivalent on key demographic variables? [N/A if no control or comparison condition]	15	6	6
	Variability	Does the study provide estimates of variability for most outcomes?	21	6	0
	Statistical values	Were statistical values (e.g. *t*, *F*, *B*) for most outcomes reported?	12	15	0
	Effect sizes	Is an effect size estimate given for most outcomes provided?	6	21	0
	Precise *p* values	Have actual probability values been reported for most outcomes? (e.g. 0.035 rather than <0.05, except when less than 0.001)	15	12	0
	Service dog time	Was time since service dog placement considered for analyses? [N/A for longitudinal studies]	4	11	12
Discussion	Limitations	Were at least two limitations of the study discussed?	22	5	0

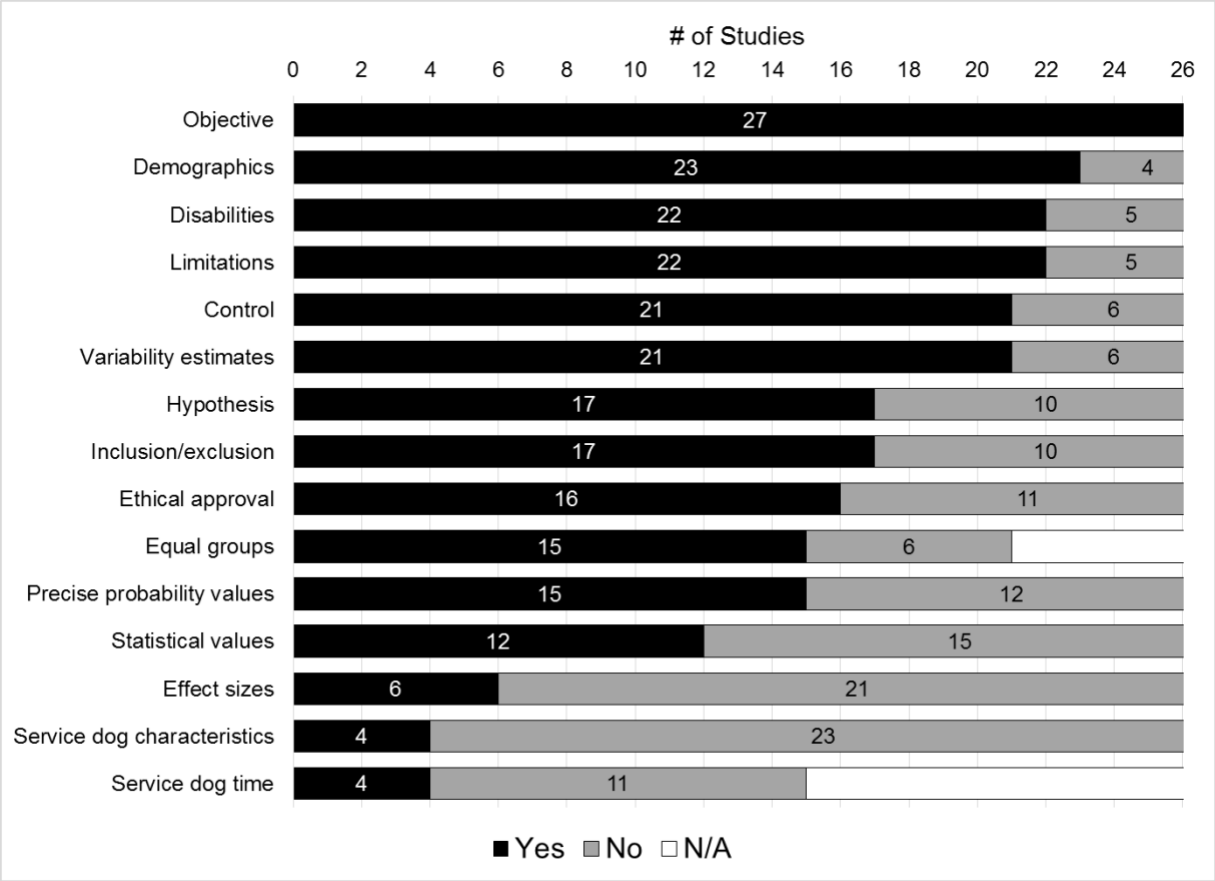

Figure 1-2 Visual display of methodological ratings for N=27 studies ordered by the number of studies addressing each item.

In introduction sections, all studies described an objective, but only 17/27 (63%) of studies stated a directional hypothesis. In methods sections, only 16/27 (59%) of studies indicated whether ethical approval for conducting human subjects research was sought and received. Most studies reported adequate detail on participant demographics such as age and sex (23/27; 85%) as well as disability characteristics such as primary diagnoses or severity (22/27; 81%). However, inclusion and exclusion criteria were less commonly described (17/27; 63%). Only 5 of 27 studies (19%) described dogs' breeds and source. Finally, most studies (21/27;78%) compared outcomes to a control or comparison condition.

In results sections, 15/21 studies with a control or comparison condition (71%) demonstrated that participants in each condition were comparable on demographic variables. This occurred by either matching groups on select criteria or statistically comparing groups' demographic characteristics before performing main analyses. When reporting statistical results, 78% of studies (21/27) provided estimates of variability for outcomes, including confidence intervals, standard deviations, or standard error of the mean. However, only 44% (12/27) of studies reported statistical values (e.g. *t, F,* or *B* values) and only 55% (15/27) of studies reported exact probability values from analyses. Of 27 studies, only 6 (22%) reported any estimates of effect size in their results. Of 15 cross-sectional studies that surveyed individuals who owned assistance dogs for variable periods of time, only four studies (27%) considered length of time of assistance dog ownership as a potential explanatory or moderating variable in analyses. Finally, in discussion sections most studies (22/27; 81%) discussed at least two limitations of their study.

1.4.5 Study Outcomes

To achieve the third aim of the review – to summarize outcomes – psychosocial outcomes within each study were extracted. Studies made an average of 5.4 statistical comparisons on psychosocial outcomes, ranging from 1-15 comparisons. In total, 147 comparisons were made across the 27 studies that examined the effect of having an assistance dog on a standardized scale or sub-scale on a psychosocial outcome: 58 psychological outcomes, 43 social outcomes, 34 quality of life outcomes, and 12 vitality outcomes. Of 147 comparisons, 44 (30%) were positive (improved or better functioning in comparison to pre- or control conditions), 100 (68%) were null (no observed difference), and three (2%) were negative (decreased or worse functioning in

comparison to pre- or control conditions). Of the 44 positive comparisons, 36 (82%) were from published papers and 8 (18%) were from unpublished theses. Of the 100 null comparisons, 43 (43%) were from published papers and 57 (57%) were from unpublished theses.

Psychological Outcomes

Table 1.3 summarizes psychological outcomes across studies in terms of general psychological health, emotional health, mental health, and self-evaluation. Of 27 studies, 20 (74%) assessed at least one psychological outcome with a total of 24 different standardized measures. Of 58 total psychological outcomes, 21 (37%) were positive (improved or better psychological health in comparison to pre- or control conditions), 37 (63%) were null (no difference), and zero (0%) were negative (decreased or worse functioning in comparison to pre- or control conditions).

Table 1.3 Summary of psychological outcomes across N=27 studies ordered by sub-category.

Sub-Category	First author (year)	Standardized Measure	Outcomes (relative to comparison condition)
General Psychological Health	Guest (2006)	GHQ-30	↑ General health (pre-3mo**, pre-12mo**)
	Lundqvist (2018)	SF-36	— General health (pre-3mo)
	Shintani (2010)	SF-36	— General health (control)
	Donovan (1994)	SF-36	— General health (pre-4mo, control)
	Lundqvist (2018)	SF-36	↑ Health transition (pre-3mo*)
	Gilbey (2003) #1	SSC	— Health symptoms (pre-6mo)
	Gilbey (2003) #2	SSC	— Health symptoms (control)
	Allen (1996)	ABS	↑ Psychological well-being (pre-6mo***, pre-12mo***, pre-18mo***, pre-24mo***; control***)
	Lundqvist (2018)	WHO-5	↑ Well-being (pre-3mo*)
	Spence (2015)	WHOQOL-BREF	— Psychological health (pre-12mo, control)[a]
	Rodriguez (2018)	PedsQL GCS	↑ Overall psychosocial health (control***)
Emotional Health	Yarmolkevich (2017)	SPANE	↑ Positive affect (control) [a]
	Gilbey (2003) #1	PANAS	— Positive affect (pre-6mo)
	Gilbey (2003) #2	PANAS	— Positive affect (control)
	Collins (2006)	PANAS	— Positive affect (control)
	Gilbey (2003) #2	PANAS	— Negative affect (control)
	Collins 2006)	PANAS	— Negative affect (control)
	Guest (2006)	POMS	↓ Overall mood disturbance (pre-3mo**, pre-12mo**)
	Guest (2006)	POMS	↓ Tension (pre-3mo**, pre-12mo**)

Table 1.3 continued

Emotional Health	Guest (2006)	POMS	— Aggression (pre-3mo, pre-12mo)
	Guest (2006)	POMS	↓ Confusion (pre-3mo**, pre-12mo**)
	Rodriguez (2018)	PROMIS Anger	— Anger (control)
	Lundqvist (2018)	SF-36	↑ Role emotional (pre-3mo*)
	Shintani (2010)	SF-36	↑ Role emotional (control**)
	Donovan (1994)	SF-36	— Role emotional (pre-4mo, control)
	Rodriguez (2018)	PedsQL GCS	↑ Emotional functioning (control**)
Mental Health	Donovan (1994)	SF-36	— Mental health (pre-4mo, control)
	Lundqvist (2018)	SF-36	— Mental health (pre-3mo*)
	Shintani (2010)	SF-36	— Mental health (control)
	Shintani (2010)	SF-36	↑ Mental component summary (control**)
	Rintala (2008) #1	SF-12	— Mental health (pre-7mo, control)
	Rintala (2008) #2	SF-12	— Mental health (pre-7mo, control)
	Milan (2007)	CES-D	— Depression (control)
	Collins (2006)	CES-D	— Depressive symptoms (control)
	Craft (2007)	CES-D	— Depression (control)
	Donovan (1994)	CES-D	— Depression (pre-4mo, control)
	Guest (2006)	POMS-SF	↓ Depression (pre-3mo**, pre-12mo**)
	Guest (2006)	GHQ-30	↓ Depression (pre-3mo**, pre-12mo**)
	Guest (2006)	GHQ-30	↓ Anxiety (pre-3mo**, pre- 12mo**)
Self-Evaluation	Allen (1996)	RSES	↑ Self-esteem (pre-6mo***, pre-12mo***, pre-18mo***, pre-24mo***; control***)
	Lundqvist (2018)	RSES	↑ Self-esteem (pre-3mo*)
	Rabschutz (2006)	RSES	↑ Self-esteem (pre-6mo*) [a]
	Yarmolkevich (2017)	RSES	↑ Self-esteem (control*) [a]
	Collins (2006)	RSES	— Self-esteem (control)
	Milan (2007)	RSES	— Self-esteem (control)
	Hackett (1994)	ISE	— Self-esteem (control)
	Donovan (1994)	CSEI	— Self-esteem (pre-4mo, control)
	Vincent (2017)	PIADS	— Self-esteem (3mo-6mo, 6mo-12mo, 3mo-12mo)
	Vincent (2017)	PIADS	— Adequacy (pre-3mo, pre-6mo, pre-12mo)
	Vincent (2017)	PIADS	— Competency (pre-3mo, 3mo-6mo, 6mo-12mo, 3mo-12mo)
	Vincent (2017)	RNLI	— Comfort with self (pre-3mo, pre-6mo, pre-12mo)
	Refson (1999)	AIS	— Acceptance of disability (control)
	Donovan (1994)	ATDP	— Positive attitude towards disability (pre-4mo, control)
	Allen (1996)	SCS	↑ Internal locus of control (pre-6mo***, pre-12mo***, pre-18mo***, pre-24mo***; control***)

Table 1.3 continued

Self-Evaluation	Yarmolkevich (2017)	SCCS	— Self-concept clarity (control) [a]
	Yarmolkevich (2017)	FS	— Flourishing (control) [a]
	Rushing (1994)	TSCS	— Total self-concept (control)
	Rushing (1994)	TSCS	— Total positive self-concept (control)

↑, Increase/Higher; ↓, Decrease/Lower; ***, $p \leq 0.001$; **, $p \leq 0.01$; *, $p \leq 0.05$

Standardized Measures: GHQ-30, 30-item General Health Questionnaire; SF-36, RAND 36-Item Short Form Health Survey; SSC, Shortened Symptom Checklist; ABS, Affect Balance Scale; WHO-5, The World Health Organisation- Five Well-Being Index; WHOQOL-BREF, World Health Organization Quality of Life Instrument (shortened version); PedsQL GCS, Pediatric Quality of Life Inventory Generic Core Scales; SPANE, Scale of Positive and Negative Experience; PANAS, Positive and Negative Affect Scale; POMS-SF, Profile of Mood States Scale Short Form; PROMIS Anger, Patient-Reported Outcome Measurement Information System Anger Adult Short Form 5A; SF-12, 12-Item Short Form Health Survey; CES-D, Center for Epidemiologic Studies Depression Scale; RSES, Rosenburg Self-Esteem Scale; ISE, Index of Self-Esteem; CSEI, Coopersmith Self-Esteem Inventory; PIADS, Psychosocial Impact of Assistive Devices Scale; RNLI, Reintegration to Normal Living Index; AIS, Felton's Acceptance of Illness Scale; ATDP, Attitudes Towards Disabled Persons Scale; SCS, Spheres of Control Scale; SSCS, Self-Concept Clarity Scale; FS, The Flourishing Scale; TSCS, Tennessee Self-Concept Scale.

[a] Statistical significance was calculated manually via raw data reported in manuscript text.

For general psychological health, 5/11 (45%) outcomes were significant across group or condition. Six studies used standardized measures to assess general health and health symptoms, three of which (Donovan, 1994; Lundqvist et al., 2018; Shintani et al., 2010) reported null findings on the general health domain of the RAND 36-Item Short Form Health Survey (SF-36; Ware Jr & Sherbourne, 1992). However, Lundqvist et al. (Lundqvist et al., 2018) found increased SF-36 health transition scores after 3-months of having a mobility, hearing, or medical service dog, while Guest (C. M. Guest et al., 2006) found an increase in general health 3-months after receiving a hearing dog using the 30-item General Health Questionnaire (GHQ-30; Huppert, Walters, Day, & Elliott, 1989). Three studies found positive findings on measures of overall psychological wellbeing or psychosocial health, including increased psychological wellbeing 3-months after receiving a mobility, hearing, or medical service dog (Lundqvist et al., 2018), 6-months after receiving a mobility service dog (Allen & Blascovich, 1996), and better overall psychosocial health in those with a mobility or medical service dog compared to a control group (Rodriguez et al., 2018). On the other hand, Spence (Spence, 2015) found no improvement to a composite score of psychological health 12-months after receiving a mobility service dog.

Regarding emotional health, 7/15 (46%) outcomes were significant across group or condition. Yarmolkevich (Yarmolkevich, 2017) found a significant effect of having a guide dog on positive affect using the Scale of Positive and Negative Experience (SPANE; Diener et al., 2010) compared to a control group, while others studies found no effect of having a hearing dog (Gilbey, 2003) or mobility service dog (Collins et al., 2006) on affect via the Positive and Negative Affect Scale (PANAS; Watson, Clark, & Tellegen, 1988). Guest (C. M. Guest et al., 2006) used the Profile of Mood States Scale (POMS; McNair, Lorr, & Droppleman, 1992), finding less overall mood disturbance, less tension, and less confusion 3-months after hearing dog placement. In terms of emotional functioning, two studies found positive results using the SF-36 role emotional domain; Lundqvist et al. (Lundqvist et al., 2018) found increased functioning 3-months after receiving a mobility, hearing, or medical service dog, while Shintani et al. (Shintani et al., 2010) found better functioning among those with a mobility service dog compared to a control group. On the other hand, Donovan (Donovan, 1994) found no change in emotional functioning 4-months after receiving mobility service dog. Using a different measure of emotional functioning, Rodriguez et al. (Rodriguez et al., 2018) found higher emotional functioning in those with a mobility or medical service dog compared to a control group.

A total of 13 mental health outcomes were assessed in which 4 (31%) were significant across group or condition. Of 5 studies that used the mental health domain of the SF-36 or the shorter 12-Item Short Form Health Survey (SF-12), only Shintani et al. (Shintani et al., 2010) found an effect of having an assistance dog on mental health. The other four studies reported no changes in participants' mental health 3-months after receiving a mobility, hearing, or medical service dog (Lundqvist et al., 2018), 4-months after receiving a mobility service dog (Donovan, 1994), and 7-months after receiving a hearing or mobility service dog (Rintala et al., 2008). Six comparisons were made to measure the effect of having an assistance dog on clinical measures of depression or anxiety. However, none of the four studies using the Center for Epidemiologic Studies Depression Scale (CES-D; Radloff, 1977) found significant differences in self-reported depression among those with a mobility service dog compared to a control group (Collins et al., 2006; Craft, 2007; Milan, 2007) or after 4-months with a mobility service dog (Donovan, 1994). However, Guest et al. found significantly lower depression and anxiety using the POMS and GHQ-30, respectively, 6-months after receiving a hearing dog (C. M. Guest et al., 2006).

In the self-evaluation subcategory, 5/19 (26%) outcomes found a significant effect of having an assistance dog on standardized measures of self-esteem, self-concept, and other measures of self-evaluation. Nine studies assessed self-esteem as a primary outcome, with four studies (Allen & Blascovich, 1996; Lundqvist et al., 2018; Rabschutz, 2007; Yarmolkevich, 2017) finding a significant effect of having a guide, hearing, mobility, or medical service dog on self-esteem as measured by the Rosenberg Self Esteem Scale (RSES; Rosenberg, 1965). However, other studies reported no relationship between having a mobility service dog and self-esteem via the RSES (Collins et al., 2006; Milan, 2007) or other standardized measures of self-esteem (Donovan, 1994; Hackett, 1994; Vincent et al., 2017). Using the Psychosocial Impact of Assistive Devices Scale (PIADS; Jutai & Day, 2002), Vincent et al. (Vincent et al., 2017) found no difference in self-esteem, adequacy, or competency over 12-months following receiving a mobility service dog. Other self-evaluation outcomes assessed with null findings included no differences in self-concept between control groups and those with mobility service dogs (Rushing, 1995) or guide dogs (Yarmolkevich, 2017), no differences in attitude towards a disability 4-months after receiving a mobility service dog (Donovan, 1994) or among guide dog users compared to a control group (Refson et al., 1999), and no differences in flourishing among guide dog users compared to a control group (Yarmolkevich, 2017). The only other positive outcome was from Allen et al. (Allen & Blascovich, 1996) which found significantly higher internal locus of control 6-months after receiving a mobility service dog.

Social Outcomes

Table 1.4 summarizes the social outcomes across studies within the sub-categories of general social functioning, loneliness, and social participation. Of 27 studies, 18 (67%) reported outcomes from at least one standardized measure of social health with a total of 18 different standardized measures. Of 43 total social outcome comparisons, seven (16%) were positive (improved or better social health in comparison to pre- or control conditions), 36 (84%) were null (no difference) and zero (0%) were negative (decreased or worse social health in comparison to pre- or control conditions).

Table 1.4 Summary of social outcomes across studies ordered by sub-category.

Sub-Category	First author (year)	Standardized Measure	Outcomes (relative to comparison condition)
General Social Functioning	Lundqvist (2018)	SF-36	— Social functioning (pre-3mo)
	Shintani (2010)	SF-36	— Social functioning (control)
	Donovan (1994)	SF-36	— Social functioning (pre-4mo, control)
	Rodriguez (2018)	PedsQL GCS	↑ Social functioning (control*)
	Guest (2006)	GHQ-30	↑ Social functioning (pre-3mo**, pre-12mo**)
	Vincent (2017)	RNLI	— Family role (pre-3mo, pre-6mo, pre-12mo)
	Rushing (1994)	TSCS	— Family self-concept (control)
	Rushing (1994)	TSCS	— Social self-concept (control)
	Spence (2015)	WHOQOL-DIS	— Discrimination (pre-12mo, control) [a]
	Spence (2015)	WHOQOL-DIS	— Social inclusion (pre-12mo, control) [a]
Loneliness	Gilbey (2003) #2	UCLA-LS	— Loneliness (control)
	Gilbey (2003) #1	UCLA-LS	— Loneliness (pre-6mo)
	Milan (2007)	UCLA-LS	— Loneliness (control)
	Yarmolkevich (2017)	UCLA-3	↓ Loneliness (control**) [a]
	Collins (2006)	UCLA-3	— Loneliness (control)
	Gilbey (2003) #2	LDS	— Loneliness distress (control)
	Gilbey (2003) #1	LDS	— Loneliness distress (pre-6mo)
	Gilbey (2003) #2	6-CLS	— Need to keep busy to avoid feeling lonely (control)
	Gilbey (2003) #1	6-CLS	— Need to keep busy to avoid feeling lonely (pre-6mo)
	Gilbey (2003) #2	6-CLS	— Need to care for others (control)
	Gilbey (2003) #1	6-CLS	— Need to care for others (pre-6mo)
	Gilbey (2003) #2	6-CLS	— Need for tactile affection (control)
	Gilbey (2003) #1	6-CLS	— Need for tactile affection (pre-6mo)
	Gilbey (2003) #2	6-CLS	— Need to feel valued and loved (control)
	Gilbey (2003) #1	6-CLS	— Need to feel valued and loved (pre-6mo)
	Gilbey (2003) #2	6-CLS	— Belief of being perceived as lonely (control)
	Gilbey (2003) #1	6-CLS	— Belief of being perceived as lonely (pre-6mo)
	Gilbey (2003) #2	6-CLS	— Need to share (control)
	Gilbey (2003) #1	6-CLS	— Need to share (pre-6mo)
Social Participation	Donovan (1994)	SSBP	— Social participation (pre-4mo, control)
	Hubert (2013)	LIFE-H	↑ Social participation (pre-7mo*)
	Vincent (2017)	RNLI	— Participation in recreational activities (pre-3mo, pre-6mo, pre-12mo)
	Vincent (2017)	RNLI	↑ Participation in social activities (pre-3mo*, pre-6mo*, pre-12mo*)
	Vincent (2017)	RNLI	— Personal relationships (pre-3mo, pre-6mo, pre-12mo)
	Milan (2007)	CHART	— Social integration (control)

Table 1.4 continued

	Davis (2017)	CHART-SF	— Social integration (control)
Social Participation	Rabschutz (2006)	SCS-R	↑ Social connectedness (pre-6mo*) [a]
	Allen (1996)	CIQ	↑ Community integration (pre- 6mo***, pre-12mo***, pre-18mo***, pre-24mo***; control***)
	Donovan (1994)	SSBP	— Friendship (pre-4mo, control)
	Rodriguez (2018)	PROMIS Comp	— Companionship (control)
	Spence (2015)	WHOQOL-BREF	— Social relationships (— pre-12mo, control*) [a]
	Matsunaka (2008)	SCLVI	— Conflict stress (control)
	Matsunaka (2008)	SCLVI	— Interactions with others (control)

↑, Increase/Higher; ↓, Decrease/Lower; ***, $p \leq 0.001$; **, $p \leq 0.01$; *, $p \leq 0.05$

Standardized Measures: SF-36, RAND 36-Item Short Form Health Survey; PedsQL GCS, Pediatric Quality of Life Inventory Generic Core Scales; GHQ-30, 30-item General Health Questionnaire; RNLI, Reintegration to Normal Living Index; TSCS, Tennessee Self-Concept Scale; WHOQOL-DIS, World Health Organization Quality of Life Disability Module; UCLA-LS, UCLA Loneliness Scale; UCLA-3, 3-item version of the UCLA-LS; LDS, Loneliness Distress Scale; CLS, 6-Complementary Loneliness Scales; SSBP, Survey of Social Behavior Patterns; LIFE-H, The Assessment of Life Habits; CHART, Craig Handicap Assessment and Reporting Technique; CHART-SF, Craig Handicap Assessment and Reporting Technique Short Form; SCS-R, Social Connectedness Scale; CIQ, Community Integration Questionnaire; PROMIS Companionship, Patient-Reported Outcome Measurement Information System Companionship Adult Short Form 6A; WHOQOL-BREF, World Health Organization Quality of Life Instrument (shortened version); SCLVI, Stress Checklist for People with Visual Impairments.

[a] Statistical significance was calculated manually via raw data reported in manuscript text.

In terms of general social functioning, 2/10 comparisons made were significant. Three studies using SF-36 failed to find significant effects on the social domain; Lundqvist et al. (Lundqvist et al., 2018) found no improvement 3-months after receiving a mobility, hearing, or medical service dog, Donovan (Donovan, 1994) found no improvement 4-months after receiving a mobility service dog, and Shintani et al. (Shintani et al., 2010) found no difference among mobility service dog users compared to controls. However, on different measures of social functioning Rodriguez et al. found better social functioning in those with a mobility or medical service dog compared to a control group (Rodriguez et al., 2018) while Guest found improved social functioning 3- and 12-months after receiving a hearing dog (C. M. Guest et al., 2006). In addition, null findings were reported on standardized measures of family role 3-, 6-, and 12-months after receiving a mobility service dog (Vincent et al., 2017), discrimination and social inclusion 12-months after receiving a mobility service dog (Spence, 2015), and family and social self-concept among mobility dog users compared to a control group (Rushing, 1995).

The sub-category of loneliness had 19 comparisons in which only 1/19 (5%) was significant. Of five studies using a version of the UCLA Loneliness Scale (Russell, 1996) only Yarmolkevich (Yarmolkevich, 2017) found significantly lower self-reported loneliness in those with a guide dog compared to a control group. Four studies found no effect of having a hearing dog (Gilbey, 2003) or mobility service dog (Collins et al., 2006; Milan, 2007) on the UCLA Loneliness Scale. Two studies from the a single thesis (Gilbey, 2003) made the remaining 14 comparisons on measures of loneliness distress and complementary loneliness, finding no significant changes to loneliness six months after receiving a hearing dog and no significant group differences in loneliness compared to those without a hearing dog.

Regarding social participation, 14 comparisons were made in which 4/14 were significant (29%). Two studies found increased social participation 3-, 6-, and 12-months (Vincent et al., 2017) as well as 7-months (Hubert et al., 2013) after receiving a mobility service dog, while Donovan (Donovan, 1994) found no change in social participation 4-months receiving a mobility service dog. Other studies found increased social connectedness 3-months after receiving a mobility or hearing dog (Rabschutz, 2007) and increased community integration 6, 12, 18, and 24 months after receiving a mobility service dog (Allen & Blascovich, 1996). Using the CHART, both Milan (Milan, 2007) and Davis (E. Davis, 2017) found no group differences in social integration among those with a mobility service dog control groups. Other null findings included no effect of having a guide dog on social conflict stress and interactions with others (Matsunaka & Koda, 2008), no improvement in social relationships 12-months after receiving a mobility service dog, and null findings regarding self-reported friendship and companionship with a mobility or medical service dog (Rodriguez et al., 2018) or 4-months after receiving a mobility service dog (Donovan, 1994).

Quality of Life Outcomes

Table 1.5 displays all quality of life outcomes across studies within the sub-categories of overall quality of life, life satisfaction, and independence. Of 27 studies, 19 (70%) reported outcomes from at least one quality of life measure with a total of 13 different standardized measures used. Of 34 total quality of life outcomes, nine (26%) were positive (improved or better quality of life in comparison to pre- or control conditions), 22 (65%) were null (no difference) and

three (9%) were negative (decreased or worse quality of life in comparison to pre- or control conditions).

Table 1.5 Summary of quality of life outcomes across studies ordered by sub-category.

Sub-Category	First author (year)	Standardized Measure	Outcomes (relative to comparison condition)
Overall Quality of Life	Lundqvist (2018)	EQ-VAS	↑ Health-related quality of life (pre-3mo**)
	Lundqvist (2018)	EQ-5D-3L	— Health-related quality of life (pre-3mo)
	Lundqvist (2018)	SF-36	— Health-related quality of life (pre-3mo)
	Hall (2017) #1	QOLS	↑ Health-related quality of life (control***)
	Hall (2017) #2	QOLS	— Health-related quality of life (control)
	Hubert (2013)	QLI	— Quality of life (pre-7mo)
	Spence (2015)	WHOQOL-BREF	— Physical quality of life (pre-12mo, control) [a]
	Spence (2015)	WHOQOL-BREF	— Environmental quality of life (—pre-12mo, control*) [a]
Life Satisfaction	Yarmolkevich (2017)	SWLS	↑ Life satisfaction (control*) [a]
	Gilbey (2003) #2	SWLS	— Life satisfaction (control)
	Gilbey (2003) #1	SWLS	— Life satisfaction (pre-6mo)
	Refson (1999)	SWLS	— Life satisfaction (control)
	Rintala (2008) #1	SWLS	— Life satisfaction (pre-7mo, control)
	Rintala (2008) #2	SWLS	— Life satisfaction (pre-7mo, control)
Independence	Davis (2017)	CHART-SF	↓ Occupation (control**)
	Rintala (2008) #2	CHART	↓ Occupation (pre-7mo*, — control) [b]
	Rintala (2008) #1	CHART	— Occupation (pre-7mo, control)
	Milan (2007)	CHART	— Occupation (control)
	Davis (2017)	CHART-SF	↓ Economic self-sufficiency (control*)
	Collins (2004)	CHART	— Economic self-sufficiency (pre-3mo, pre-9mo; control)
	Milan (2007)	CHART	— Economic self-sufficiency (control)
	Davis (2017)	CHART-SF	— Mobility (control)
	Milan (2007)	CHART	↑ Mobility (control)
	Rintala (2008) #1	CHART	— Mobility (pre-7mo, control)
	Rintala (2008) #2	CHART	— Mobility (— pre-7mo, control*)
	Matsunaka (2008)	SCLVI	↓ Mobility stress (control*)
	Crudden (2017)	TSS	↓ Walking stress (control*)
	Crudden (2017)	TSS	— Public transportation stress (control)
	Hubert (2013)	RNLI	↑ Ability to return to normal life (pre-7mo*)
	Vincent (2017)	RNLI	— Self-care (pre-3mo, pre-6mo, pre-12mo)
	Vincent (2017)	RNLI	↑ Daily work activities (pre-3mo†, — pre-6mo, pre-12mo†)
	Vincent (2017)	RNLI	— Ability to deal with life events (pre-3mo, pre-6mo, pre-12mo)

Table 1.5 continued

Independence	Rodriguez (2018)	PedsQL GCS	↑ Work/school functioning (control***)
	Craft (2007)	A-IIRS	— Perceived intrusiveness of disability (control)

↑, Increase/Higher; ↓, Decrease/Lower; ***, $p \leq 0.001$; **, $p \leq 0.01$; *, $p \leq 0.05$; †, $p > 0.017$ but < 0.10

Standardized Measures: EQ-VAS, EuroQol visual analogue scale; EQ-5D-3L, EuroQol EQ-5D-3L; SWLS, Satisfaction with Life Scale; SF-36, RAND 36-Item Short Form Health Survey; QOLS, Flanagan Quality of Life Scale; QLI, Quality of Life Index; WHOQOL-BREF, World Health Organization Quality of Life Instrument (shortened version); RNLI, Reintegration to Normal Living Index; SWLS, Satisfaction with Life Scale; CHART, Craig Handicap Assessment and Reporting Technique; CHART-SF, Craig Handicap Assessment and Reporting Technique Short Form; SCLVI, Stress Checklist for People with Visual Impairments; TSS, Transportation Stress Survey; RNLI, Reintegration to Normal Living Index; PedsQL GCS, Pediatric Quality of Life Inventory Generic Core Scales; A-IIRS, Adapted Illness Intrusiveness Ratings Scale.

[a] Statistical significance was calculated manually via raw data reported in manuscript text.
[b] Both the experimental and control groups had lower (worse) occupation scores at follow-up than at baseline.

In the overall quality of life sub-category, 2/8 (25%) comparisons were significant. Lundqvist et al. (Lundqvist et al., 2018) found higher health-related quality of life 3-months after receiving a mobility, hearing, or medical service dog on one of three measures used (EuroQol Visual Analog Scale; Rabin & Charro, 2001). Hall et al. (Hall et al., 2017) found higher health-related quality of life among those with a mobility service dog compared to a control group, but not among those with a hearing dog. Other studies found no effect of having a mobility service dog on quality of life including more specific measures such as physical and environmental quality of life (Hubert et al., 2013; Spence, 2015).

In the next sub-category, six studies assessed life satisfaction outcomes using Satisfaction with Life Scale (SWLS; Diener, Emmons, Larsen, & Griffin, 1985). However, only 1/6 (17%) found a significant effect, in which Yarmolkevich found higher life satisfaction among those with a guide dog compared to a control group. The other five studies found no effect of having a mobility service dog (Rintala et al., 2008), hearing dog (Gilbey, 2003; Rintala et al., 2008), or guide dog (Refson et al., 1999) on life satisfaction using SWLS.

In the sub-category of independence, a total of 20 comparisons were made in which 9 (45%) were significant, but 3 (15%) were in the negative direction. The most commonly used measure was the Craig Handicap Assessment and Reporting Technique (CHART; Whiteneck, 1992) which assesses how people with disabilities function as active members of their communities. Using the occupation domain of the CHART, Rintala et al. (Rintala et al., 2008)

found no difference in occupational functioning 7-months after receiving a mobility service dog and Milan (Milan, 2007) found no group difference in those with and without a mobility service dog. However, 2 studies found *worse* occupational functioning in terms of employment, schooling, or homemaking. Rintala et al. (Rintala et al., 2008) found that participants reported worse occupational functioning 7-months after receiving a hearing dog while Davis (E. Davis, 2017) found that individuals with a mobility service dog reported worse occupational functioning compared to a control group.

In the economic domain of the CHART, which assesses socio-economic independence, Davis (E. Davis, 2017) again found that those with a mobility service dog reported worse economic functioning than controls while two mobility dog studies reported null findings (Collins, 2004; Milan, 2007). In the mobility domain, only Milan (Milan, 2007) found a significant effect of having a mobility service dog on the CHART mobility domain (which includes hours per day out of bed and days per week out of the house) while Davis (E. Davis, 2017) and Rintala et al. (Rintala et al., 2008) reported no relationship between the mobility domain and having a service dog or hearing dog. Using other standardized measures of independence, Matsunaka & Koda (Matsunaka & Koda, 2008) found that those with guide dogs reported and lower stress while being mobile. Similarly, Crudden et al. (Crudden et al., 2017) found that individuals who had guide dogs reported less stress while walking, but not while using public transportation. Using the Reintegration to Normal Living Index (RNLI; Wood-Dauphinee, Opzoomer, Williams, Marchand, & Spitzer, 1988), Hubert found improvements in the ability to return to 'normal life' after 7-months with a mobility service dog while Vincent et al. (Vincent et al., 2017) found improvements to daily work activities 3- and 12-months after receiving mobility service dog (but not in self-care or dealing with life events). Finally, Rodriguez et al. (Rodriguez et al., 2018) found that those with a mobility or medical service dog reported significantly higher work/school functioning than a control group.

Vitality Outcomes

Table 1.6 summarizes vitality outcomes across studies within the sub-categories of general energy/vitality and sleep. Of 27 studies, seven (26%) reported outcomes from at least one standardized measure of vitality with a total of five different standardized measures. Of 12 total vitality comparisons, six (50%) were positive (improved or better vitality in comparison to pre- or

control conditions), six (50%) were null (no difference) and zero (0%) were negative (decreased or worse vitality in comparison to pre- or control conditions).

Table 1.6 Summary of vitality outcomes across studies ordered by sub-category.

Sub-Category	First author (year)	Standardized Measure	Outcomes (relative to comparison condition)
Energy/Vitality	Donovan (1994)	SF-36	— Vitality (—pre-4mo, control*)
	Lundqvist (2018)	SF-36	— Vitality (pre-3mo)
	Shintani (2010)	SF-36	— Vitality (control)
	Vincent (2017)	SF-36	↑ Pep (pre-3mo*, —pre-6mo, —pre-12mo)
	Vincent (2017)	SF-36	↑ Energy (pre-3mo*, —pre-6mo, —pre-12mo)
	Vincent (2017)	SF-36	↓ Worn out (pre-3mo†, pre-6mo*, pre-12mo†)
	Vincent (2017)	SF-36	— Tiredness (pre-3mo, pre-6mo, pre-12mo)
	Guest (2006)	POMS	↑ Vigor (pre-3mo**, pre-12mo**)
	Guest (2006)	POMS	↓ Fatigue (pre-3mo**, —pre-12mo)
	Craft (2007)	EFS	— Energy/Fatigue (control)
Sleep	Guest (2006)	GHQ-30	↑ Sleep (pre-3mo**, pre-12mo**)
	Rodriguez (2018)	PROMIS SD	— Sleep disturbance (control)

↑, Increase/Higher; ↓, Decrease/Lower; ***, $p \leq 0.001$; **, $p \leq 0.01$; *, $p \leq 0.05$; †, $p > 0.017$ but < 0.10

Standardized Measures: SF-36, RAND 36-Item Short Form Health Survey; POMS, Profile of Mood States Scale; EFS, Energy/Fatigue Scale; GHQ-30, 30-item General Health Questionnaire; PROMIS SD, Patient-Reported Outcome Measurement Information System Sleep Disturbance Adult Short Form 6A.

In terms of general vitality and energy, four studies used the SF-36 to measure the effect of having an assistance dog on the vitality domain. Only Vincent et al. (Vincent et al., 2017) found a significant increase in pep, energy, and feeling less worn out 3- and 6-months after receiving a mobility service dog while three studies found no relationship between the vitality domain and having a mobility service dog (Donovan, 1994; Shintani et al., 2010) or a mobility, hearing, or medical service dog (Lundqvist et al., 2018). Using the Profile of Mood States Scale (POMS; McNair et al., 1992), Guest found increased self-reported vigor 3- and 12-months after receiving a hearing dog and less fatigue 3-months after receiving a hearing dog. Using another measure of energy and fatigue, Craft (Craft, 2007) found no difference in those with or without a mobility service dog. Regarding sleep, Guest found better self-reported sleep quality 3- and 12-months after receiving a hearing dog while Rodriguez et al. (Rodriguez et al., 2018) found no difference in sleep disturbance between individuals with mobility or medical service dog and a control group.

1.5 Discussion

This systematic review summarized the current state of knowledge regarding the effects of owning an assistance dog (including service, guide, hearing, and/or medical alert or response dogs) on standardized outcomes of psychosocial health and wellbeing of individuals with disabilities. Our search procedure identified 24 articles containing 27 studies assessing psychosocial outcomes from a wide variety of human and assistance dog populations. These studies were reviewed to complete three specific aims: to describe the key characteristics of studies, to evaluate the methodological rigor of studies, and to summarize outcomes. The discussion section aims to review the findings from each aim and to provide targeted suggestions for future research.

1.5.1 Study Characteristics

There were substantial variances observed in the characteristics, populations, and designs of the included studies. Most studies were conducted in either the United States or the United Kingdom. However, there was international representation of the research in Canada, Sweden, New Zealand, and Japan. Most articles were published in the 2010s, indicating an increasing publication interest in this topic over time. In fact, nine new articles were identified (three theses, six publications) that had been published since the last review on this topic in 2012 (Winkle et al., 2012). Increased research on this topic is likely in parallel with the increased roles and demands for different types of assistance dogs worldwide (Walther et al., 2017) as well as increased interest in the benefits of animal interaction for human health and wellbeing (McCune et al., 2014). The most commonly studied type of assistance dog was mobility service dogs, followed by hearing dogs. Guide dogs were only assessed in four studies (all of which were cross-sectional, and one of which was an unpublished thesis(Yarmolkevich, 2017)). The lack of guide dog-specific research is especially surprising given that guide dogs not only have the longest history of any type of assistance dog (Fishman, 2003) but are also the most commonly placed assistance dog placed by professional facilities worldwide (Walther et al., 2017). Future longitudinal research in this population is necessary to understand the complex psychosocial and physical roles that guide dogs play in the lives of their handlers. Medical service dogs for diabetes and seizure alert/response were rarely studied (Lundqvist et al., 2018; Rodriguez et al., 2018), and were assessed in conjunction with mobility service dogs rather than on their own. However, these are relatively new

categories of assistance dogs (Walther et al., 2017), many of which may also be self-trained (Yamamoto & Hart, 2019), and it appears that emerging research on this population has centered on medical benefits (Catala, Cousillas, Hausberger, & Grandgeorge, 2018) rather than psychosocial. Future research should focus on assessing outcomes from these medical alert and response assistance dogs and how their roles may be similar or different than mobility, guide, or hearing dogs.

Study designs included both cross-sectional and longitudinal studies, with only one randomized longitudinal study identified (Allen & Blascovich, 1996). However, it should be noted that this study by Allen & Blascovich has received considerable critique due to incredibly large effect sizes, unrealistic retention and response rates, and severe methodological omissions including a lack of reporting on recruitment, funding, or where assistance dogs were sourced and trained (despite repeated requests for clarification; Eames & Eames, 1997; Rowan, 1996). The remaining studies were quasi-experimental in that they did not use randomized assignment to treatment or control groups. Therefore, the current literature is limited to correlational, rather than causal conclusions regarding the benefits of assistance dogs on the psychosocial health of their owners. Overall, sample sizes were higher than what is usually observed in targeted animal-assisted intervention studies with dogs (e.g.(Lundqvist, Carlsson, Sjödahl, Theodorsson, & Levin, 2017; Zafra-Tanaka, Pacheco-Barrios, Tellez, & Taype-Rondan, 2019)) but smaller than that of pet dog research (Christian et al., 2013). Interestingly, only one included study (Rodriguez et al., 2018) assessed outcomes from participants under the age of 18. Although outcomes from assistance dog placement for children and adolescents have been quantified with qualitative (e.g., Burgoyne et al., 2014; B. W. Davis, Nattrass, O'Brien, Patronek, & MacCollin, 2004; P. Ng, James, & McDonald, 2000) and observational (e.g., Mader, Hart, & Bergin, 1989) study designs, effects on standardized measures of psychosocial wellbeing including social functioning have not been explored. Therefore, future studies are warranted that specifically assess health and wellbeing using validated parent-proxy or self-report measures to fully understand the potential effects that assistance dogs can have on children and adolescents with disabilities.

1.5.2 Methodological Rigor

Similar to the range of study characteristics observed, there was considerable variation in the methodological rigor of included studies. The most notable weaknesses included a lack of

adequate reporting in the methodological sections, which not only limits interpretation of findings but prevents reproducibility. First, only 59% of studies stated whether ethical approval for human subjects was sought and received. Future research should specify not only ethical protocols for human subjects research, but also for animal subjects, which is often underutilized and/or underreported in AAI research (Z. Ng, Morse, Albright, Viera, & Souza, 2019). Second, only 63% of studies described inclusion and/or exclusion criteria of recruited participants, and some studies did not report all demographic or disability characteristics of participants. Future studies should provide detailed researcher-specified criteria for participation as well as organizational-specified criteria for placing/receiving an assistance dog, if applicable. For example, organizations that place assistance dogs may have housing, familial, physical, or even financial requirements for potential recipients that should be subsequently reported in the manuscript to fully define the population. It is unreasonable to assume that the changes to an individual's life following receipt of an assistance dog is identical for all ages, gender identities, backgrounds, and disabilities. Therefore, detailed descriptions of study populations is critical for helping the field understand for whom assistance dogs are beneficial regarding social, emotional, or psychological health and under what contexts or conditions (Serpell, McCune, Gee, & Griffin, 2017).

Finally, one of the most notable examples of poor methodological reporting across studies was the omission of information regarding assistance dogs' sources (e.g. purpose-bred from a provider, self-trained) and breeds (e.g., Labrador Retriever, Golden Retriever, Mixes). As the assistance dog itself is the key component of the intervention, details regarding the dog's breeding, rearing, selection, and training, as well as the assistance dog-handler matching process are critical to disentangling potential mechanisms (Marino, 2012). In addition, reporting detailed information on assistance dogs allows for the consideration of the dogs as individual agents in the therapeutic process rather than as uniform tools (Kruger & Serpell, 2010; Serpell et al., 2017).

In addition to poor methodological reporting, many studies were restrained by statistical weaknesses. Many studies did not confirm that participants across groups were statistically equivalent on key demographic variables such as age and sex/gender before conducting statistical analyses. This poses a severe threat to the validity of findings as group differences in outcomes could be caused by underlying differences in certain demographics or characteristics and cannot be confidently attributed to the presence of the assistance dog. Secondly, many studies did not report sufficient detail in results in terms of estimates of variability and effect size. Thorough

reporting in terms of the magnitude and variability of effects observed will allow researchers to make informed comparisons across populations and interventions and conduct critically needed meta-analyses in the field.

1.5.3 Study Outcomes

The final aim of the review was to summarize psychosocial outcomes within and across each study. Studies reported mostly psychological outcomes (74%), followed by social outcomes (67%), quality of life outcomes (70%), and vitality (26%) outcomes. Overall, most (68%) of comparisons made across studies were null in which no statistical difference was found in the outcome compared to before getting an assistance dog or compared to a control group. Importantly, only a few comparisons were made in the negative direction (2%) indicating that there is limited reason to believe that acquiring an assistance dog is associated with *worse* functioning. A total of 30% of comparisons made were positive in which having an assistance dog was associated with improved psychosocial functioning among individuals with disabilities. In fact, positive findings were identified in all domains and sub-domains of psychosocial health and wellbeing. Promising areas include psychological wellbeing, emotional wellbeing, and social participation in which several positive outcomes were identified. However, almost all positive findings were accompanied by a null finding using the same or similar standardized measure in a different study. The below discussion considers various potential explanations for the inconsistencies in findings across studies.

Variability in Assessment Times

One of the main considerations in understanding the potential variability across findings is the aspect of time since assistance dog placement. In longitudinal studies, the first follow-up time point varied from 3- to 12-months after receiving an assistance dog. Within cross-sectional studies, number of years since first partnering with an assistance dog ranged from 6-months to 45 years with means ranging from 2- 9 years. This variation in assessment times makes it difficult to draw definitive conclusions on conflicting findings. Further, the number of years spent with the assistance dog at the time of surveying was unknown for half of the cross-sectional studies (Craft, 2007; Crudden et al., 2017; E. Davis, 2017; Gilbey, 2003; Hall et al., 2017; Matsunaka & Koda, 2008; Rushing, 1995). Therefore, in the cases where positive outcomes were reported in these

studies, it is unknown what amount of time with an assistance dog the finding was associated with (and therefore difficult to compare to findings from other studies).

Variability in Interventions

Another potential explanation for inconsistent findings across studies lies in the inherent variability of the assistance dog intervention itself. Assistance dog categories (guide, hearing, mobility, and medical) were collapsed for the purposes of this review, but undoubtedly contribute to the lives of individuals with disabilities in diverse ways. However, even within a single category, there are differences in assistance dog breeds, temperaments, and training that may significantly contribute to observed variance across studies. Second, there is inherent variation in both the quality and quantity of interactions from one assistance dog-owner pair to the next. In addition to the different human and dog phenotypes that contribute to this heterogeneity, there are likely differences in the strength of the human-animal bond and attachment relationships formed between assistance dogs and handlers (Fallani et al., 2006; LaFollette, Rodriguez, Ogata, & O'Haire, 2019). Moderator analyses will be useful in determining the potential explanatory effects that handler-service dog relationships have on psychosocial outcomes.

Variability in Standardized Measures

Another potential reason for the inconsistencies in findings from studies assessing the same construct is disparities across standardized measures. Measures of the same outcome not only can have different wording and items, but also can measure functioning over different time periods or contexts.In one example, four studies included in this review failed to find significant results in comparisons of depression using the CES-D (Collins et al., 2006; Craft, 2007; Donovan, 1994; Milan, 2007). However, positive findings were found in depression using the POMS by a different study (C. M. Guest et al., 2006). The CES-D asks participants to rate how often they had experienced 20 depressive symptoms in the prior week using statements such as “I thought my life had been a failure,” while the POMS asks participants to rate from not at all to extremely how they feel *right now* using single words such as “sad” and “unhappy.” It is also possible that some standardized measures do not capture the intended effects from having an assistance dog. One author argued that an “important methodological issue is the absence of appropriate measures” in measuring the effect of an assistance dog on recipients' lives (Rintala et al., 2008). Future research

is necessary to determine if in fact some measures are inappropriate to measure change following an assistance dog, which may be addressed using interviewing and focus group techniques among assistance dog handlers. The replicated measures identified in this review can serve as a basis for future researchers to collate the existing literature when making assessment choices.

Variability in Study Rigor

A final potential reason for outcome discrepancies is variation in methodological rigor across studies. In particular, not only did studies vary largely in terms of sample size, but they also varied in the manner in which statistical analyses were conducted. As mentioned above, a surprisingly high number of studies did not ensure that assistance dog and control groups were statistically equal across demographic and disability characteristics prior to outcome analyses. In these studies, positive findings (i.e., better social functioning in those with an assistance dog compared to a control group) may be partially attributed to an unmeasured variable driving the group difference (Stern & Chur-Hansen, 2013). In addition, many studies did not account for confounding variables such as having a pet dog, the progressiveness or type of disability, or relationship status.

Other Considerations

An important finding from this review was that most positive findings were reported in published studies, while unpublished theses were more likely to report null findings. This pattern suggests a potential publication bias present in which disproportionately more positive findings are in the published studies than the unpublished theses (Dickersin, 2005). Importantly, unpublished theses had a similar average sample size as published studies, with similar power to detect effects compared to published studies. Thus, this pattern may be better explained by the "file drawer effect" in which there is a bias towards publishing positive findings over null findings (Fanelli, 2010). Although this tendency occurs in many fields, the file-drawer bias may especially be prevalent in human-animal interaction research due to the preconceived notion that animals are beneficial for humans (Herzog, 2015). In fact, positive, null, and negative findings are equally instrumental in understanding the complexities of the role that assistance dogs play in the lives of individuals with physical disabilities. As Serpell and colleagues point out, individuals that don't benefit from animal-assisted interventions may be just as informative from a scientific perspective

as the ones that do, and "the entire field potentially suffers when these sorts of contrary or ambiguous findings get buried or ignored" (Serpell et al., 2017). Therefore, future efforts should be made to publish null findings in peer-reviewed journals and to encourage scientific transparency (Herzog, 2015).

As a final consideration, it is possible that assistance dogs may not confer significant psychosocial benefits as quantified by some of the standardized measures used. First, there may be ceiling effects present whereby individuals are functioning at initially healthy levels of the measured construct (e.g., depression, self-esteem) prior to receiving an assistance dog and thus may not significantly improve on these measures. This effect may be compounded by the possibility that those who apply for an assistance dog may inherently have certain positive characteristics (e.g., stable housing, stable finances, has a familial support system) that contribute to overall psychosocial health. Further, in contrast to a psychiatric service dog or an emotional support dog, the assistance dogs in this review are not explicitly trained for mental health-related support and their effects on the psychosocial health of their handlers may be variable rather than population-wide. For example, the benefits of an assistance dog for a socially isolated individual who experiences periodic anxiety and depression may be significantly different than an individual without these characteristics. An important question for the field moving forward will be to determine for whom an assistance dog may confer the most significant psychosocial health benefits for, and under what contexts or conditions.

1.5.4 Conclusions

This systematic review identified 24 articles containing 27 studies that assessed a psychosocial outcome of having an assistance dog (guide dog, hearing dog, mobility service dog, or medical service dog). Included studies assessed psychosocial outcomes via standardized measures from assistance dogs that were trained for functional tasks related to a physical disability or medical condition (omitting psychiatric service dogs or emotional support dogs). Despite the purpose of these assistance dogs specifically for physical tasks, positive outcomes were noted in psychological, social, quality of life, and vitality domains. However, results suggested that for most outcomes, having an assistance dog had no effect on psychosocial health and wellbeing. Methodological weaknesses including poor reporting of assistance dog interventions and statistical limitations prevent any clear conclusions made regarding the psychosocial effects of assistance

dogs on individuals with disabilities. Inconsistencies in findings were discussed in terms of wide variability in assessment times, interventions, measures, and rigor, and recommendations were made to contribute to the knowledge of this growing application of the human-animal bond. Continued efforts are required to improve methodological rigor, conduct replicable research, and account for heterogeneity in both humans and animals to advance the state of knowledge in this field.

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CHAPTER 2. THE EFFECTS OF SERVICE DOGS ON PSYCHOSOCIAL HEALTH AND WELLBEING FOR INDIVIDUALS WITH PHYSICAL DISABILITIES OR CHRONIC CONDITIONS

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2.1 Abstract

Purpose: To evaluate the effects of service dogs on psychosocial health and indicators of wellbeing among individuals with physical disabilities or chronic conditions.

Materials and Methods: A total of 154 individuals participated in a cross-sectional survey including 97 placed with a mobility or medical service dog and 57 on the waitlist to receive one. Hierarchical regression evaluated the effect of having a service dog on standardized measures of psychosocial health (Pediatric Quality of Life Inventory) as well as anger, companionship, and sleep disturbance (Patient Reported Outcome Measurement Information System). Among those with a service dog, the Monash Dog-Owner Relationship Scale quantified the human-animal bond.

Results: Results indicated that compared to those on the waitlist, individuals with a service dog exhibited significantly better psychosocial health including higher social, emotional, and work/school functioning. There was no significant effect of having a service dog on anger, companionship, or sleep disturbance. Among those with a service dog, emotional closeness, dog-owner interaction, and amount of time since the service dog was placed were weak correlates of outcomes.

Conclusions: Findings suggest that service dogs may have measurable effects on specific aspects of psychosocial health for individuals with physical disabilities or chronic conditions.

2.2 Introduction

For those with physical disabilities or chronic conditions, it is often difficult to maintain functionality during daily activities without a form of aid or assistance. One form of assistance that can improve independence and functionality is a service dog (Herlache-Pretzer et al., 2017; Vincent, Gagnon, & Dumont, 2017; M Winkle & Zimmerman, 2009). A service dog is defined by the American for Disabilities Act as "any dog that is individually trained to do work or perform tasks for the benefit of an individual with a disability" (1990). In addition to guide dogs for the vision impaired and hearing dogs for the hearing impaired, mobility service dogs can assist those with physical disabilities by performing tasks such as retrieving dropped items, opening doors, or pulling a wheelchair. For individuals who require diabetic or epileptic monitoring, medical service dogs can be trained to provide alert or response for seizures or hypoglycemic episodes. As the potential roles that service dogs can fulfil have expanded over time, placements of service dogs both in the United States and internationally continue to increase (Walther et al., 2017).

Beyond the functional physical benefits that a service dog is trained to provide (e.g. Blanchet et al., 2013), there is a growing literature describing the effects of service dogs on psychosocial health and quality of life. Initial studies suggest that a service dog's presence, companionship, and assistance can have measurable effects on their handler's health and wellbeing (Sachs-Ericsson, Hansen, & Fitzgerald, 2002; Melissa Winkle, Crowe, & Hendrix, 2012). Specifically, individuals retrospectively report that since receiving a service dog, they require less assistance from others, have more confidence and self-esteem, and are more able to participate in social activities (Fairman & Huebner, 2001; Lynette A. Hart, Hart, & Bergin, 1987; Lane, McNicholas, & Collis, 1998; Rintala, Sachs-Ericsson, & Hart, 2002; Valentine, Kiddoo, & LaFleur, 1993). In addition, as individuals with both physical and "invisible" disabilities are often subject to social isolation, low self-esteem, and significant challenges when navigating their social environment (Kinney & Coyle, 1992; MacLeod & Austin, 2003; Swanson, Cronin-Stubbs, & Sheldon, 1989), the effects of a service dog's companionship and social support may be particularly salient for improving positive interpersonal interactions in this population. Observational studies have found that when accompanied by a service dog, individuals in wheelchairs are more likely to be smiled at, approached by strangers, and receive positive social interactions than when alone (Crowe et al., 2014; Eddy, Hart, & Boltz, 1988; Mader, Hart, & Bergin, 1989). These social facilitation effects are thought to be moderated by the positive implicit

social bias caused by the service dog, whereby the dog's presence may increase positive attitude towards an individual with a disability and act as a social lubricant to promote positive social interactions (Coleman, Ingram, Bays, Joy-Gaba, & Boone, 2015; Guéguen & Ciccotti, 2008; Schneider & Harley, 2006).

To date, two systematic reviews have described the literature on the effects of service dogs on psychosocial health of individuals with physical disabilities or chronic conditions (Sachs-Ericsson et al., 2002; Melissa Winkle et al., 2012). Existing literature consists of a variety of study designs including longitudinal, retrospective, and cross-sectional studies which largely vary in methodological rigor. The first longitudinal, randomized study on this topic in 1996 found that after only six months with a service dog, individuals with ambulatory disabilities exhibited significant improvements in psychological wellbeing, self-esteem, and community integration (Allen & Blascovich, 1996). However, the validity of these findings has been controversial as a result of unrealistically large effect sizes and several methodological omissions by the authors (Eames & Eames, 1997; Rowan, 1996). Since then, other longitudinal pilot studies have provided promising findings regarding increases in independence, self-esteem, and social functioning after receiving a service dog, but are limited by small sample sizes and the lack of a control group (Noël Champagne & Psy, 2013; Rintala et al., 2002; Vincent, Gagnon, Dumont, & group, 2017). Findings from longitudinal studies with a control group have not been as uniformly positive; a 2008 pre-post study compared eight individuals who received a service dog to 15 on the waitlist at baseline and after six months and found no significant effect of time or having a service dog on standardized measures of mental health and life satisfaction (Rintala, Matamoros, & Seitz, 2008).

Most published research on the effects of service dogs has featured retrospective designs, which have been valuable to understand long-term impacts of the dog's assistance and companionship. In one of the largest studies to date on this topic, a majority of 202 individuals with physical disabilities who had a service dog retrospectively reported that since obtaining a service dog they were more confident, needed less assistance from others, and had been more able to participate in social activities [25]. Other retrospective studies found that those with a service dog reported increases in self-esteem, social interactions, and positive affect from their service dog's assistance and companionship (Lane et al., 1998; Valentine et al., 1993). However, these studies lack a control group, are limited by the biases of retrospective report, and rely on unstandardized measures.

Several cross-sectional studies have provided promising evidence by using larger sample sizes and standardized outcome measures, but findings have been mixed. For example, a recent large cross-sectional study compared 76 individuals using wheelchairs with a service dog to 76 matched controls and found no significant group differences on standardized measures of loneliness, depression, self-esteem, positive affect, and community integration (Collins et al., 2006). Although those with a service dog and those on the waitlist did not statistically differ in outcomes, depression and progressiveness of disease were key moderating variables of outcomes among those with a service dog. A small cross-sectional study found that 10 individuals with a mobility service dog reported higher quality of life on a standardized measure compared to a matched control group (Shintani et al., 2010). Recently, a 2017 cross-sectional survey also found that 72 individuals with a mobility service dog reported significantly higher quality of life (specifically in the areas of social health, work/school functioning, and independence) than a control group of 24 individuals on the waitlist (Hall, MacMichael, Turner, & Mills, 2017).

In addition to service dogs trained for mobility assistance, a number of recent studies have begun to examine the psychosocial effects of having medical alert dogs such as those who are trained for diabetic individuals or those with seizure disorders (Gonder-Frederick, Rice, Warren, Vajda, & Shepard, 2013; Rooney, Morant, & Guest, 2013). In one retrospective study, 36 participants reported that since obtaining a diabetic alert service dog, individuals not only experienced significant decreases in the frequency of hypoglycemia episodes, but also reported that they were less worried, had greater quality of life, and were more able to participate in physical activities (Gonder-Frederick et al., 2013). Similarly, retrospective study of 22 individuals with epilepsy found that all participants reported major to moderate increases in their quality of life (including improvements in interpersonal relationships, self-confidence, and independence) since getting a seizure response service dog (Kirton, Winter, Wirrell, & Snead, 2008). Thus, preliminary studies with this population indicate that the assistance and companionship from a medical alert or response service dog are likely to facilitate similar psychosocial effects to mobility service dogs.

Despite several studies offering promising findings that service dogs may have a significant effect on their handler's psychosocial functioning, the most recent systematic review concluded that the current state of knowledge is "inconclusive and limited" as a result of widespread methodological weaknesses (Melissa Winkle et al., 2012). Specifically, a majority of the existing literature lacks a control/comparison group, is limited by small sample sizes, or has relied on

retrospective reports. In addition, many studies have used unstandardized measures with minimal or absent psychometrics resulting in findings that are not generalizable across studies. Another methodological limitation of the current literature is that statistical analyses have often failed to account for important covariates explaining variance in quality of life. Specifically, disability-specific characteristics such as daily functional limitation and progressiveness of the chronic condition can be key variables explaining individual differences in psychosocial outcomes (e.g. Collins et al., 2006).

An additional important consideration that most published studies have not accounted for is the confounding variable of having a pet dog in the home. Not only has previous research found that dog ownership can provide significant social support and fulfil many social needs (McConnell, Brown, Shoda, Stayton, & Martin, 2011), but they may also facilitate community involvement and social interaction (McNicholas & Collis, 2000; Wood, Giles-Corti, & Bulsara, 2005). For example, a 2012 observational study quantified the social interactions of a confederate in a wheelchair who was alone, with a service dog, or with a pet dog in public. Although the individual received more social interaction when a dog was present, there was no significant difference between the pet dog and service dog conditions, suggesting that pet dogs may have similarly significant effects on social facilitation as service dogs (Shyne, Hall, Masciulli, Faustino, & O'Connell, 2012). Therefore, the presence of a pet dog may be an important confounding variable to account for which may explain variance in psychosocial outcomes, especially for those in waitlist control groups.

As applications for service dogs continue to increase (Walther et al., 2017), there remains a need for replicable, reliable quantification of the effects of this unique human-animal relationship. Our objective in this research was to evaluate the effects of service dogs on psychosocial health and indicators of wellbeing in a population of individuals with physical disabilities or chronic conditions. This study adds to current knowledge by assessing outcomes with standardized measures, controlling for the presence of a pet dog and disability-specific variables, and including a large and representative sample of individuals with a service dog compared to a waitlist control group. We hypothesized that individuals placed with a service dog would exhibit significantly better psychosocial functioning as well as significantly lower anger, higher social companionship, and lower sleep disturbance when compared to a waitlist control group with no service dog. Among those with a service dog, we also hypothesized that time since

placement and the strength of the human-animal bond would be significant positive correlates of outcomes.

2.3 Materials and Methods

This study was approved by the Purdue University Institutional Review Board (IRB Protocol #1602017187). No interactions occurred with any service dogs, therefore a waiver was obtained from the Purdue Institutional Animal Care and Use Committee (IACUC).

2.3.1 Participants

Participants were recruited between September and December 2016 from the database of Canine Assistants, an Assistance Dog International (ADI) certified provider of mobility and medical service dogs for a variety of physical conditions and disabilities. Inclusion criteria for study participants included being accepted by the Canine Assistants program, which excludes those with dog allergies, fear of dogs, or family members convicted of violent crime or animal abuse. No exclusions were made based on participant's age, gender, diagnosis, living situation, or presence of a pet dog in the home.

Participants recruited from the waitlist group (n = 165) had applied for a service dog, had been approved by the organization, and were currently waiting until their scheduled date to receive a service dog. Participants recruited from the service dog group (n = 219) had already been provided a service dog from the provider, and were selected for recruitment based on approximate age (+/- 5 years) and primary diagnosis from those on the waitlist. Participants who had been paired with their service dog within the past six months of the study's beginning were excluded from the study (based on an estimated adjustment period following service dog placement (Sachs-Ericsson et al., 2002)).

Service dogs were primarily pure bred or crosses between Labrador Retrievers, Golden Retrievers and Standard Poodles. All dogs were born, raised, and prepared at Canine Assistants' facilities. Service dogs consisted of mobility service dogs, seizure response dogs, and diabetic alert dogs. Mobility service dogs assisted individuals with physical disabilities by performing such behaviours as turning lights on and off, opening and closing doors, and retrieving dropped objects. Seizure response service dogs are placed with those with epilepsy or seizure conditions to remain

next to the individual during a seizure or summon help/retrieve a phone in the event of a seizure (certain seizure response dogs also develop the ability to predict an oncoming seizure in advance, but this was not a task specifically taught by Canine Assistants). Diabetic alert dogs are placed with those with type 1 diabetes to alert to changes in blood sugar, summon help, or retrieve medication.

2.3.2 Procedures

All potential participants were emailed an invitation to participate in the study. A research assistant then called individuals within one to three days to give an overview of the study and obtain informed consent or minor assent. Participants who were either younger than 13 or lacked sufficient verbal skills had a parent or guardian report on their functioning via proxy. All participants were entered into a drawing for one of 20 cash prizes ranging from $25 to $100. The survey, which took approximately 10 to 20 minutes to complete, could be completed online, over the phone, or on paper through the mail.

2.3.3 Measures

Demographic and Medical Variables

By participating in the research study, participants consented for the researchers to access their records on file with Canine Assistants. Records included key demographic variables (e.g., the recipient's date of birth and gender) as well as the date of service dog placement or waitlist assignment. Records also included the original application to obtain a service dog, which contained a medical history form filled out by a physician or medical professional verifying the primary diagnosis and progressiveness of condition. Primary diagnoses were categorized into five categories: seizure disorders (e.g. epilepsy, Koolen DeVries syndrome), musculoskeletal disorders (e.g. Duchenne's muscular dystrophy, osteogenesis imperfecta, Charcut-Marie-Tooth disease), neuromuscular disorders (e.g. cerebral palsy, spinal cord injury, spinal muscular atrophy, para/tetra/quadriplegia), developmental or intellectual disorders (e.g. Down syndrome, fetal alcohol syndrome), and a general 'other' category (e.g. Type 1 diabetes, cystic fibrosis).

The medical history form also contained a section for the physician or medical professional to rate the participant's ability to perform activities of daily living (ADL). The section contained

eight items about the extent to which the participant was able to physically and mentally function (e.g. “Is the patient able to control physical or motor movement sufficient to sustain ADL?”, “Is the patient capable of perception and memory to the degree necessary to sustain ADL?”). Responses were yes (2), minimally (1), and no (0). An ADL Capability score was then calculated by averaging responses (of forms which had at least 5/8 items completed), such that a score of 0 indicated the individual was fully dependent on a caregiver to sustain ADL and a score of 2 indicated the individual was fully independent and capable to sustain ADL.

Pediatric Quality of Life Inventory (PedsQL)

Psychosocial health was measured via the Paediatric Quality of Life (PedsQL) 4.0 Generic Core Scales (Varni, Seid, & Kurtin, 2001). The measure asked how often the individual had problems with an item in the past month on a scale of 0 (never) to 4 (almost always). The subscales of Emotional Functioning (4 items), Social Functioning (3 items), and Work/School Functioning (3 items) contributed to an Overall Psychosocial Health summary score. For each subscale, scores were linearly transformed to a 0–100 scale, so that higher scores indicated better functioning (Varni et al., 2001).

The PedsQL Generic Core Scales were age-specific, such that each participant was automatically directed to an age-appropriate form (either self-report or proxy) based on the reported age of the service dog recipient (Varni, Limbers, & Burwinkle, 2007). The three age-specific forms were: Adult (ages >18), teenage (ages 13-18), and children (ages 4-12). Each version was identical except for slight variations in wording. For example, the Social Functioning subscale asked how often in the past month the individual has had a problem with “Other X teasing me”, “Other X not wanting to be my friend”, and “Getting along with other X” in which X could be “children” (ages 4-12), “teens” (ages 13-18), or “adults” (ages 18+). Similarly, the Work/School Functioning subscale asked how often in the past month the individual has had a problem with “Keeping up with X” in which X could be “schoolwork” (child/teen forms), or “work or studies” (adult form).

Cronbach’s α indicated high reliability for all subscales (Overall Psychosocial Health Cronbach’s $\alpha = 0.79$, Emotional Functioning $\alpha = 0.80$, Social Functioning $\alpha = 0.74$, Work/School Functioning $\alpha = 0.73$).

Patient Reported Outcomes Measurement Information System (PROMIS)

Additional outcomes were measured with the Patient Reported Outcomes Measurement Information System (PROMIS), a system of reliable patient-reported outcomes developed by the National Institutes of Health (Cella et al., 2010). Three PROMIS short forms (SF) were used: Anger (SF-5a), Companionship (SF-4a), and Sleep Disturbance (SF-4a). Similar to the PedsQL, PROMIS measures could be worded for either proxy of self-report. The anger short-form consisted of five Likert-style questions that measured the degree to which the participant agreed with statements regarding their irritability and anger in the past seven days (e.g. "In the past seven days, I felt like I was ready to explode"). The companionship short-form consisted of four Likert-style questions that measured the participant's level of general social companionship (e.g. "Do you have someone with whom to have fun?"). Finally, the sleep disturbance short-form consisted of four Likert-style questions that measured the recipient's sleep quality and intensity of sleep disturbance over the past seven days (e.g. "In the past seven days, my sleep was refreshing"). For all PROMIS measures, a higher score indicates more of the domain being measured. Cronbach's α for all three PROMIS measures indicated high reliability (Companionship $\alpha = 0.92$, Anger $\alpha = 0.90$, and Sleep Disturbance $\alpha = 0.85$).

Monash Dog Owner Relationship Scale (MDORS)

Those with a service dog completed the Monash Dog Owner Relationship Scale (MDORS), a 28-item standardized and validated measure of the human-animal bond (Dwyer, Bennett, & Coleman, 2006). The MDORS contains three subscales: Emotional Closeness, Dog-Owner Interaction, and Perceived Costs. Only the two subscales of Emotional Closeness and Dog-Owner Interaction were used for this study, with $\alpha = 0.82$ and $\alpha = 0.65$, respectively. For each Emotional Closeness question, participants were asked to rate on a Likert scale the degree to which they agreed with a series of statements about their relationship with their dog (e.g. "My dog helps me get through tough times", "My dog gives me a reason to get up in the morning"). For each Dog-Owner Interaction question, participants were asked to rate on a Likert scale the frequency in which they engaged in a series of activities with their dog (e.g. "How often do you hug your dog?", "How often do you play games with your dog?"). Higher scores on both subscales indicated more of the construct being measured (i.e., greater emotional closeness or more frequent daily interaction).

2.3.4 Statistical Analysis

Demographic and medical characteristics of the two groups were compared with independent t-tests or chi-squared tests as appropriate. A series of hierarchical multiple linear regressions predicted each outcome with two sets of independent variables. Set 1 included the demographic variables of age, gender, the recipient's ADL capability, and disease progressiveness. Set 2 included the primary predictor of interest, having a service dog or being on the waitlist, as well as whether the recipient had a pet dog living with them or not.

To examine the potential effect of the human-animal bond, bivariate correlations were calculated for those with a service dog between the MDORS human-animal bond subscales and all outcome variables and continuous demographic variables. In addition to the MDORS, the length of time that had elapsed since the service dog was placed (in years, as a continuous variable) was also included in the bivariate correlations.

2.4 Results

Total response rate was 46%; 65% of participants completed the survey online, 30% via phone, and 5% on paper. Demographic and medical characteristics of the sample are displayed in Table **2.1**. A total of 154 individuals participated, including 97 with a service dog and 57 on the waitlist. The sample consisted of a wide range of ages (M = 26.32 +/- 17.35 years, range of 4 - 72 years), with those on the waitlist slightly younger on average (t = 1.847, p = 0.068). Those on the waitlist also exhibited less capability to sustain ADLs than those with a service dog (t = 2.367, p= 0.020). Surveys included both self-report (68%) and parent proxy (32%), with the waitlist having significantly more proxy surveys (54%) than the service dog group (19%; X_2 = 19.828, p < 0.001) because of the higher distribution of younger children. While there were trending group differences, those with a service dog and on the waitlist did not significantly differ in sex, primary diagnosis category, progressiveness of disability or condition (all p's > 0.059). However, those on the waitlist were more likely to be currently living with a pet dog at the time of surveying than those with a service dog (X_2 = 5.504, p = 0.019).

Table 2.1 Demographic and medical characteristics of study sample

Variable	Group			Group difference		
	Waitlist (n = 57)	Service Dog (n = 97)	Total (N = 154)	*t*	X_2	*p*
Age, years, M ± SD	22.70 ± 20.50	28.44 ± 14.92	26.32 ± 17.35	1.847		0.068
ADL capability, M ± SD [a]	1.26 ± 0.45	1.41 ± 0.26	1.35 ± 0.35	2.367		0.020
Sex, n (%) Male	36 (63%)	46 (47%)	82 (53%)		3.571	0.059
Has a pet dog, n (%)	37 (65%)	44 (45%)	81 (53%)		5.504	0.019
Progressive disability, n (%)	32 (56%)	40 (41%)	72 (47%)		3.203	0.073
Survey type, n (%)					19.828	<0.001
Self-Report	26 (46%)	78 (80%)	104 (68%)			
Proxy	31 (54%)	19 (20%)	50 (32%)			
Primary Diagnosis, n (%)					8.936	0.063
Seizure	15 (26%)	25 (26%)	40 (26%)			
Musculoskeletal	15 (26%)	18 (19%)	33 (22%)			
Neuromuscular	20 (35%)	50 (52%)	70 (46%)			
Developmental/Intellectual	2 (4%)	2 (2%)	4 (3%)			
Diabetes	5 (9%)	1 (1%)	6 (4%)			
Unknown	0 (0%)	1 (1%)	1 (0%)			

Note: n, partial sample size; N, full sample size; M, Mean; SD, Standard deviation; ADL, activities of daily living on a scale of 0 – 2, with higher scores indicating a higher capability to sustain ADL.
[a] ADL capability was missing for n = 6 participants with a service dog

Descriptive information on psychosocial variables by group is displayed in Table **2.2**, while **Table 2.3** displays the statistical output from the regression models. Demographic and disability-specific variables alone including age, sex, ADL capability, and disease progressiveness significantly explained variance observed in overall psychosocial health ($R^2 = 0.12$, $p = 0.002$), work/school functioning ($R^2 = 0.17$, $p < 0.001$), and social functioning ($R^2 = 0.18$, $p < 0.001$). Base models predicting emotional functioning, anger, companionship, and sleep disturbance were not significant (all R^2's < 0.05, p's > 0.128). Both age ($\beta = 0.24$, $p = 0.012$) and sex ($\beta = 0.28$ $p = 0.003$) were significant predictors of overall psychosocial health, with older age and males associated with better psychosocial health. Older age was also associated with higher social functioning ($\beta = 0.31$, $p = 0.001$), while, while being male was associated with higher work/school functioning ($\beta = 0.33$, $p < 0.001$) and less anger ($\beta = -0.24$, $p = 0.009$). ADL capability was a significant predictor of social functioning, such less impairment was associated with better social functioning. There were no significant relationships between any demographic or disability variables and emotional functioning, companionship, or sleep disturbance.

After the addition of the service dog and pet dog variables to the models, final models explaining overall psychosocial health and work/school, emotional, and social functioning

subscales were significant with R^2 values between 0.16 and 0.28. However, final models predicting anger, companionship, and sleep disturbance remained not significant (all R^2's < 0.07, *p*'s > 0.132). Results indicated that having a service dog was a significant predictor of overall psychosocial health ($\beta = 0.36$, $p < 0.001$) as well as its three subscales of work/school functioning ($\beta = 0.33$, $p < 0.001$), emotional functioning ($\beta = 0.27$, $p = 0.002$), and social functioning ($\beta = 0.20$, $p = 0.016$). Specifically, there was a 0.36 standard deviation increase in overall psychosocial health among those with a service dog compared to those on the waitlist while holding all other predictors constant. However, having a service dog was not significantly associated with anger, companionship, or sleep disturbance (all *p*'s > 0.098).

Having a pet dog was associated with lower emotional functioning ($\beta = -0.22$, $p = 0.010$). Specifically, while controlling for the presence of a service dog, those with a pet dog had a 0.22 standard deviation lower emotional functioning score than those without a pet dog in the home. There was no significant effect of having a pet dog on work/school functioning, social functioning, anger, companionship, or sleep disturbance (all *p*'s > 0.109).

Table 2.2 Descriptive statistics of psychosocial outcomes across group

	Waitlist (n = 57)			Service Dog (n = 97)			
Measure	M ± SD	Min	Max	M ± SD	Min	Max	Instrument Range
PedsQL Overall Psychosocial Health	59.11 ± 16.29	16.67	90	72.42 ± 14.38	32.50	97.50	0 – 100
PedsQL Work/School Functioning	46.81 ± 26.50	0	100	64.47 ± 23.11	0	100	0 – 100
PedsQL Emotional Functioning	58.13 ± 22.35	12.50	100	69.85 ± 17.98	37.50	100	0 – 100
PedsQL Social Functioning	72.14 ± 19.39	25	100	82.60 ± 19.23	16.67	100	0 – 100
PROMIS Anger	51.06 ± 10.90	32.90	79.60	49.46 ± 9.03	31.50	72.60	29 – 85
PROMIS Companionship	49.19 ± 7.62	25.20	63.10	51.59 ± 8.77	29.50	63.10	25.20 – 63.10
PROMIS Sleep Disturbance	53.18 ± 3.21	43.80	63.80	52.77 ± 3.78	41.10	61.70	32 – 73.30

Note: M, mean; SD, standard deviation; Min, minimum value; Max, maximum value; PedsQL, Pediatric Quality of Life Inventory; PROMIS, Patient-Reported Outcomes Measurement Information System

Table 2.3 Hierarchical linear regressions summarizing the effect of a service dog on primary outcomes

	PedsQL Overall Psychosocial Health		PedsQL Work/School Functioning		PedsQL Emotional Functioning		PedsQL Social Functioning		PROMIS Anger		PROMIS Companionship		PROMIS Sleep Disturbance	
Variable	β	*p*	β	*p*	β	*p*	β	*p*	β	*p*	β	*p*	β	*p*
Age	0.24	0.012	0.18	0.052	0.08	0.429	0.31	0.001	-0.08	0.425	0.05	0.652	0.16	0.103
Sex	0.28	0.003	0.33	<0.001	0.16	0.098	0.15	0.096	-0.24	0.009	0.11	0.212	0.07	0.440
ADL	0.12	0.181	0.16	0.070	-0.07	0.477	0.21	0.016	0.04	0.672	0.15	0.118	-0.14	0.130
Progressive	0.06	0.480	0.14	0.082	-0.04	0.621	0.05	0.505	0.04	0.636	0.01	0.890	0.00	0.972
Model 1 R^2	0.12	0.002	0.17	<0.001	0.03	0.494	0.18	<0.001	0.05	0.128	0.03	0.324	0.03	0.446
Age	0.20	0.025	0.16	0.082	0.03	0.767	0.31	0.001	-0.06	0.577	0.04	0.721	0.15	0.142
Sex	0.29	0.001	0.35	<0.001	0.16	0.083	0.17	0.055	-0.24	0.010	0.12	0.179	0.05	0.563
ADL	0.06	0.458	0.11	0.201	-0.10	0.280	0.17	0.057	0.04	0.654	0.12	0.211	-0.11	0.240
Progressive	0.09	0.226	0.18	0.020	-0.03	0.696	0.08	0.299	0.04	0.635	0.03	0.701	-0.02	0.800
Service Dog	0.36	<0.001	0.33	<0.001	0.27	0.002	0.20	0.016	-0.09	0.320	0.15	0.098	-0.10	0.279
Pet Dog	-0.13	0.109	-0.05	0.531	-0.22	0.010	0.04	0.639	0.10	0.276	-0.02	0.840	-0.13	0.120
Model 2 R^2	0.27	<0.001	0.28	<0.001	0.16	0.001	0.22	<0.001	0.07	0.132	0.05	0.258	0.05	0.346

Note: PedsQL, Pediatric Quality of Life Inventory; PROMIS, Patient-Reported Outcomes Measurement Information System; β, standardized regression coefficient; R^2, variance explained; ADL, activities of daily living; Disease progressiveness (1=Yes, 0=No); Service dog (1=Yes, 0=No); Pet dog (1=Yes, 0=No); Sex (1=Male, 0=Female).

For those with a service dog, scores were high on both human-animal bond scales (Emotional Closeness subscale: $M = 4.31$, $S.D. = 0.58$; Dog-Owner Interaction subscale: $M = 4.14$, $S.D. = 0.61$, on a scale from 1-5). **Table 2.4** displays the relationships between the outcome variables and human-animal bond variables among those with a service dog. There were no significant correlations between Emotional Closeness and any outcome or demographic variable (all r's < 0.16). There was a moderate negative correlation between the level of Dog-Owner Interaction and the participant's work/school functioning ($r = -0.30$, $p = 0.004$), in which better work/school functioning was associated with less dog-owner interaction. There was a small positive correlation with the number of years with the service dog and overall PedsQL psychosocial health ($r = 0.23$, $p < 0.05$).

Table 2.4 Bivariate Pearson's r correlations between human-animal bond variables and outcome variables among n = 97 participants with a service dog

Variable	Emotional Closeness (MDORS)	Dog-Owner Interaction (MDORS)	Time since service dog placement
Age	0.14	0.07	0.21**
ADL capability[a]	0.16	0.19	0.08
PedsQL Overall Psychosocial Health	0.00	-0.16	0.23*
PedsQL Work/School Functioning	-0.16	-0.30**	0.19
PedsQL Emotional Functioning	0.05	0.01	0.16
PedsQL Social Functioning	0.07	-0.11	0.16
PROMIS Anger	0.01	0.10	-0.12
PROMIS Companionship	0.03	0.10	0.05
PROMIS Sleep Disturbance	0.06	-0.08	0.20

Note: MDORS, Monash Dog Owner Relationship Scale; ADL, Activities of daily living; PedsQL, Pediatric Quality of Life Inventory; PROMIS, Patient-Reported Outcomes Measurement Information System; * $p < 0.05$; ** $p < 0.01$

2.5 Discussion

The results of this study suggest that having a service dog for mobility or medical assistance was significantly associated with psychosocial health in a large and diverse sample of individuals with disabilities or chronic conditions. Specifically, after controlling for demographics, having a pet dog, and disability-specific variables such as ADL capability and progressiveness, having a service dog was significantly associated with higher overall psychosocial health including higher emotional, social, and work/school functioning, supporting our main hypothesis. However, having

a service dog was not significantly related to wellbeing measures of anger, companionship, or sleep disturbance. Among those with a service dog, the human-animal bond and time since being placed with a service dog were only weak correlates of outcomes, refuting our secondary hypothesis. The findings of the study demonstrate the distinctive role that a service dog may have on the lives of individuals with a disability or chronic condition.

Findings demonstrated a significant relationship between having a service dog and better overall psychosocial health among individuals with physical disabilities or chronic conditions. This result is in line with other cross-sectional studies that have found significant associations between having a service dog and standardized measures of health-related quality of life (Hall et al., 2017; Shintani et al., 2010). However, results are in contrast with Collins et al.'s 2009 study that found no significant group differences on standardized measures of loneliness, depression, self-esteem, positive affect, and community integration (Collins et al., 2006). While different measures were used across studies, it is possible that the PedsQL subscales may have captured a more precise level of age-appropriate functioning that may be more susceptible to observing group differences from a service dog's companionship and assistance. In addition, as the sample from Collins et al. was older on average (M = 44.4 +/- 12.1 years compared to M = 26.3 +/- 17.4 years in this study) and did not include individuals with chronic conditions such as epilepsy, discrepancy in findings may be a result of the populations studied. Further research and replication is needed to determine the extent to which these variations or mediating factors may influence outcomes.

Of the psychosocial functioning subscales studied, the presence of a service dog had the largest impact on work/school functioning. This finding is supported by studies which have found that the presence of a dog can increase social interaction and engagement in classrooms (Hergovich, Monshi, Semmler, & Zieglmayer, 2002; Kotrschal & Ortbauer, 2003) and in the workplace (Perrine & Wells, 2006; Wells & Perrine, 2001). In addition, an early observational study found that children in wheelchairs with service dogs received more social acknowledgment by peers at school than children in wheelchairs without a service dog (Mader et al., 1989). Therefore, our results support previous research in this domain and provide justification for further research on the integration of service dogs into schools or the workplace (Herlache-Pretzer et al., 2017).

Our results did not indicate a relationship between having a service dog and standardized measures of anger, companionship, or sleep disturbance. Of these, the most surprising finding is

the lack of a significant association between having a service dog and companionship. The PROMIS companionship measure was developed to measure human companionship, but was broadly worded (e.g. “Do you have someone to have fun with?”) such that some participants may have interpreted the “someone” to be their service dog, while others may have interpreted the questions as referring to human interactions. In regards to human companionship, while there is published evidence of the social facilitation effects of service dogs (e.g., Lynette A. Hart et al., 1987; Mader et al., 1989), it may be that the social benefits experienced in work, school, or in the public from having a service dog are short-term in nature compared to the deeper social interaction involved in companionship. Regarding canine companionship, those with a service dog exhibited near-ceiling MDORS Emotional Closeness scores, indicating that companionship was indeed received from the relationship with their dog. Further research will need to explore the constructs of social companionship that are the most susceptible to changes from being placed with a service dog in order to understand the underlying mechanisms of socio-emotional improvement in this population.

Having a service dog did not significantly impact sleep disturbance. To our knowledge, no other quantitative studies on service dog partnerships have directly examined sleep as an outcome variable. Our null findings may be due to the fact that sleep problems are common with many of the disabilities in our sample (e.g. cerebral palsy (Kotagal, Gibbons, & Stith, 1994), muscular dystrophy (Barbe et al., 1994), and epilepsy (Bazil, 2003)). While it is possible that the sleep disturbance measure may not have been precise enough to capture the effects that a service dog may have on night time functioning, sleep may be too inflexible or complex of a construct in this population to be significantly affected by a service dog.

Among those with a service dog, results indicated a strong human-animal bond among our sample. This mirrors findings from several qualitative studies that cite the human-animal bond as a central theme when describing the service dog relationship (e.g. Camp, 2001; Valentine et al., 1993; Whitmarsh, 2005). However, among those with a service dog, the degree of emotional closeness with the service dog was not a significant correlate of outcomes which did not support our hypothesis. This was likely due to a ceiling effect, whereby participants were highly bonded with their service dogs with little variance. In regards to dog-owner interactions, we found that individuals with higher work/school functioning tended to interact less with their service dog on a daily basis. This may be a function of the fact that those who need more assistance are likely

utilizing their service dog more frequently than those who may have less impairment and/or are thriving at work or school. To our knowledge, no other studies have examined the relationship between the human-animal bond among those with service dogs and psychosocial outcomes using standardized measures. However, a 2017 study surveying 73 service dog owners in the U.K. did find a significant positive relationship between participant's quality of life and their level of anxious attachment towards the service dog (White, Mills, & Hall, 2017). While our study did not measure attachment styles, findings from this study and ours indicate that relationship-specific variables may have measurable effects on outcomes in service dog owners.

Although not one of our primary aims of the study, we found a relationship between having a pet dog and lower emotional functioning after controlling for the presence of a service dog in the home. While several studies have described a positive relationship between pet ownership and measures of human health and wellbeing (e.g. McConnell et al., 2011), studies have also noted significant associations between pet ownership and negative outcomes such as depression (Mueller, Gee, & Bures, 2018; Parslow, Jorm, Christensen, Rodgers, & Jacomb, 2005). Our findings should not be interpreted as definitive for several reasons: groups were not matched for or equal in distribution of pet ownership, the sub-group of pet owners was a relatively small sample size, and there are likely many explanatory variables contributing to pet ownership that were not included in the study. More research is necessary to determine how having a pet dog may fit into the lives of individuals with disabilities or chronic conditions with rigorous and replicable research methodology (Herzog, 2011).

Lastly, as hypothesized, we did find a significant positive correlation with time since being placed with the service dog and overall psychosocial health. However, time did not significantly relate to any subscales of the PedsQL including work/school functioning, emotional functioning, or social functioning. A similar range of service dog placement times was observed in Collins et al.'s 2006 study (M = 3.1 years, range of 0-13.1 years), however no significant relationships were observed between time since placement and depression, positive affect, loneliness, self-esteem, or community participation among 76 participants with a service dog (Collins et al., 2006). Because of these mixed findings, future research is necessary to determine the extent that time with a service dog influences outcomes, as well as the potential individual differences that may moderate the relationship.

This study contributes to the disparate literature assessing the effects of mobility or medical service dogs on quality of life and psychosocial health, and highlights the need for more rigorous, replicable research on this topic using standardized measures. A specific important finding from this study is that demographic and disability-specific variables such as activities of daily living are critical to include as covariates in future studies aiming to determine the impact of service dogs on quality of life. Further, future studies should be careful to also assess and include the presence of a pet dog in the home to avoid the exclusion of a possibly confounding variable impacting psychosocial health. Future research will also benefit from exploring the potential mechanisms of action underlying the relationship between a service dog and an individual with a disability or chronic condition, as well as potential moderating individual differences in either human or canine variables that may contribute to outcomes.

2.5.1 Limitations

This study has several limitations. Due to the cross-sectional design, we cannot infer causation between variables. The treatment group was not randomized, so results may have been partially due to changes over time rather than the placement of a service dog. We also lack longitudinal information on individual differences regarding the temporal pattern of change after receiving a service dog, which likely varies with individual and environmental factors. Further research will benefit from employing longitudinal designs to explore patterns of change across individuals as the relationship with the service dog develops.

Another limitation of the research is that the results are based off of self-report, which may be subject to expectancy biases (Stone, Bachrach, Jobe, Kurtzman, & Cain, 1999). We also relied on proxy reports for children in a substantial portion of our data, which could have introduced bias by underestimating quality of life (Andresen, Vahle, & Lollar, 2001). In addition, we also relied on a medical professional to assess functioning and ADL capability, which could have biased results. Future research will benefit from assessing disability-related impairment with a more objective and/or sensitive measure to fully capture the individual differences in physical and mental functioning across the population of service dog recipients.

Finally, results should be interpreted in caution as our population may not be fully representative of the disabled population; our recruitment pool had already applied for and/or received a service dog, thus were amenable to service dog ownership. However, the focus of this

study was to quantify the psychosocial effects among those would receive service dogs as a realistic representation of the population and to preserve ecological validity.

2.5.2 Conclusion

In this study, the provision of a medical or mobility service dog was associated with better psychosocial health among a large, heterogeneous sample of individuals with disabilities and chronic conditions. Specifically, having a service dog was significantly associated with higher social, emotional, and work/school functioning, but was not significantly associated with anger, companionship, or sleep disturbance. These effects were independent of variation due to age, sex, disability impairment and progressiveness, and having a pet dog in the home. Overall, the results of this study suggest that in addition to the functional benefits of a service dog such as mobility assistance, medical alert, and seizure response, their placement may also afford measurable psychosocial benefits to the daily lives of individuals with physical disabilities or chronic conditions.

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CHAPTER 3. MOBILITY AND MEDICAL SERVICE DOGS: A QUALITATIVE ANALYSIS OF EXPECTATIONS AND EXPERIENCES

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3.1 Abstract

Purpose: To qualitatively describe and compare the expectations and experiences of living with a mobility or medical service dog among those with a physical disability or chronic condition.

Materials and Methods: A total of 64 participants living with a service dog and 27 on the waitlist to receive a service dog participated in a cross-sectional open-ended survey. Qualitative content analysis was used to identify themes and sub-themes.

Results: A total of 101 codes were summarized into themes of Physical Benefits, Psychosocial Benefits, and Drawbacks to having a service dog. Psychosocial benefits included the human-animal relationship as well as emotional, quality of life, and social benefits. Drawbacks included service dog care, public access and education, lifestyle adjustments, and dog behavior. While participants on the waitlist were more likely to anticipate physical benefits of having a service dog, those with a service dog largely described psychosocial benefits. Findings also suggest that some drawbacks, such as public discrimination, may be unanticipated by the waitlist.

Conclusions: A comparison of expectations and experiences of service dog ownership highlights both the positive and negative aspects of the service dog-owner relationship and identifies potential aspects of having a service dog that may be unanticipated or overestimated by those on the waitlist.

3.2 Introduction

Service dogs are a potential complementary and integrative assistive aid for individuals with disabilities or chronic conditions. Their roles in society continue to grow as they can be

trained to provide assistance, guidance, or medical alert and response to individuals with a wide variety of disabilities and conditions (Walther et al., 2017). In the United States, service dogs have been legally protected since 1990 as an assistive aid for those with a disability by the Americans with Disabilities Act (ADA) (Americans With Disabilities Act, 1990). As a form of assistive technology, service dogs can be trained for tasks that can improve independence for those with physical or mental limitations. For example, mobility service dogs can retrieve dropped items, open and close doors, or pull a wheelchair (Herlache-Pretzer et al., 2017; Vincent, Gagnon, & Dumont, 2017; M Winkle & Zimmerman, 2009). In addition, medical service dogs can be trained to alert to low blood sugar or respond to seizures for those needing diabetic or epileptic monitoring. However, in addition to the physical and medical functions they are uniquely trained for, service dogs may also provide their owners with psychosocial benefits due to their presence, companionship, and the impact of their assistance.

There is growing literature examining the psychosocial effects of service dogs on individuals with disabilities or chronic conditions. Specifically, studies using retrospective, longitudinal, and cross-sectional designs suggest that service dogs can significantly impact health-related quality of life including psychological well-being, self-esteem, and social functioning (Sachs-Ericsson et al., 2002; Melissa Winkle et al., 2012). For example, findings from retrospective studies suggest that the addition of a service dog can improve confidence and self-esteem, decrease the need for assistance from others, and promote positive social interactions in public (Fairman & Huebner, 2001; Lynette A. Hart et al., 1987; Lane et al., 1998; Rintala et al., 2002; Valentine et al., 1993). Longitudinal pilot studies have also provided promising findings regarding increases in independence, self-esteem, and social functioning after receiving a service dog, but are limited by small sample sizes and the lack of a control group (Noël Champagne & Psy, 2013; Rintala et al., 2002; Vincent, Gagnon, & Dumont, 2017). Cross-sectional studies comparing those with a service dog to matched controls without a service dog have found mixed results regarding outcomes, but some have reported a significant relationship between having a service dog and higher quality of life and psychosocial health (Hall et al., 2017; Kerri E. Rodriguez, Bibbo, & O'Haire, Under Review; Shintani et al., 2010). Observational studies have also found that individuals in wheelchairs with a service dog present are more likely to be smiled at and engaged in conversation with strangers than individuals without a dog present (Crowe et al., 2014; Eddy et al., 1988; Mader et al., 1989).

Though the physical and psychosocial benefits of having a service dog have been the subject of several studies, many studies often fail to consider the potential drawbacks of service dog ownership. These drawbacks are important to quantify as they may have important psychological impacts on an individual with a physical disability/chronic condition or their family members. For example, as many individuals with disabilities experience significant societal discrimination, additional difficulties with public access or negative attention from having a service dog may be particularly relevant. In addition, service dogs require care, maintenance, and financial responsibility which may be additionally taxing on parents or caregivers, who already experience significant burden and stress (Plant & Sanders, 2007; Schulz & Sherwood, 2008).

While findings from empirical studies offer evidence that service dogs can have measurable effects on standardized measures of health and well-being among individuals with physical disabilities, they fail to describe the specific characteristics of the service dog's assistance, behavior, or demeanor that promote a successful service dog-owner relationship. They also fail to quantify *how* a service dog may affect quality of life from the owner's point of view, which is critical for understanding the theoretical mechanisms that may explain the psychosocial benefits seen in quantitative studies. In this way, qualitative research can provide a richer and more in-depth exploration of the relationship between service dogs and their owners to aid in interpreting results from complementing quantitative research (Onwuegbuzie & Leech, 2005).

To date, there has been limited qualitative research exploring an individual's relationship with a mobility or medical service dog. While some studies have quantified service dog use, benefits, and drawbacks with closed-ended response options (Davis, Nattrass, O'Brien, Patronek, & MacCollin, 2004; Fairman & Huebner, 2001; Rintala et al., 2008), this method does not allow participants to express their opinions in their own words and prevents responses that are unanticipated by the researchers. Few studies have taken a content or thematic analysis approach to exploring open-ended qualitative data regarding the relationship with a service dog, but have been largely limited by small sample sizes or lack in objective coding methodology. For example, a 2001 study explored common themes regarding experiences with mobility service dogs using ethnographic observation and interview, but was limited to five individuals (Camp, 2001). Another study used a pre-post design to measure expectations (before getting a service dog) and actual experiences (after getting a service dog) among 22 individuals with mobility impairments, but lacked in a standardized coding methodology and a control group (Rintala et al., 2002).

While service dog owners' experiences are important to quantify, the relative perspectives of those without a service dog or on the waitlist to receive one are equally essential to quantify. In particular, understanding the expectations of those anticipating the benefits of a service dog has critical implications for rehabilitation. Specifically, recognizing the potential discrepancies between expectations and real-life experiences with a service dog is critical for rehabilitation professionals to fully prepare those considering incorporating a service dog as a new assistive technology in their lives. For similar reasons, an understanding of client expectations is also important for organizations who train and place service dogs. Knowing the expectations of the applying population may not only assist in setting realistic expectations about the potential negative aspects of owning a service dog, but may also assist with the preparation of service dogs for future owners.

The objective of the present study was to describe and compare both the experienced and expected benefits and drawbacks of partnering with a service dog by using a conventional content analysis approach. Specifically, the research focused on assessing the benefits and drawbacks of mobility and medical service dogs due to the population sampled. Our specific research goals were (1) to describe the specific physical and/or psychosocial aspects of having a service dog that are the most beneficial, (2) to explore the drawbacks of having a service dog, and (3) to compare the relative frequency of experienced and expected responses across those with a service dog and those on the waitlist. This study builds on current knowledge by using a standardized qualitative analysis approach to include the perspectives of both those with a service dog *and* those on the waitlist in a large and diverse sample of individuals with physical disabilities and chronic conditions.

3.3 Methods

This study was approved by the Purdue University Human Research Protection Program Institutional Review Board (IRB Protocol #1602017187). No interactions occurred with any service dogs, therefore a waiver was obtained from the Purdue University Institutional Animal Care and Use Committee (IACUC).

3.3.1 Participants

Participants were recruited from the database of Canine Assistants, a national service dog provider of mobility, seizure response, and diabetic alert service dogs. Mobility service dogs are trained to assist individuals with physical disabilities by performing such behaviors as picking up objects from the floor, providing balance, or opening doors. Seizure response service dogs assist individuals with seizure disorders, and remain next to the individual during a seizure or summon help in the event of a seizure. Diabetic alert service dogs alert individuals to changes in blood sugar or may summon help in the case of a medical event. Canine Assistants service dogs are purpose-bred Golden Retrievers, Labrador Retrievers, Poodles, or hybrids/crosses of these breeds. Service dogs are prepared for placement during the first year and a half of their lives while being cared for and raised at the service dog provider facility by puppy-raising volunteers and Canine Assistants staff.

All recruited participants had been screened and accepted by the Canine Assistants program. Inclusion criteria for both current and service dog recipients included: (1) Evidence of a physical disability, seizure condition or other special need (i.e. diabetes) verified via a physician-completed and signed medical history form (2) No history or conviction of any violent crime or animal abuse (3) A demonstrated ability of either the recipient or a family member to care for and maintain the health of a service dog. Service dogs are given at no cost to recipients; Canine Assistants covers the medical, food and training costs for the lifetime of every dog placed through sponsorships and donations.

Waitlist participants had been approved to receive a service dog but had not yet been placed with a dog. Service dog participants had already been placed with a dog at the time of the study, which involves attending a 2-week placement class at the service dog facility in which recipients learn how to care for, maintain training of, and work with their service dog. Recruited service dog participants were matched to those on the waitlist based on approximate age (+/- 5 years) and the primary diagnosis of the service dog recipient (e.g. epilepsy, cerebral palsy).

3.3.2 Procedures

The present study represents the qualitative data from a large cross-sectional study; a complete detailed account of procedures is described in a previously published manuscript (Kerri

E. Rodriguez et al., Under Review). All potential participants were recruited with an email and a phone call invitation to participate in the study, which consisted of completing a 10-20 minute long survey. After informed consent, participants completed the survey online (65%), over the phone (30%), or on paper through the mail (5%). Participant remuneration consisted of a randomized drawing of 20 cash prizes ranging from $25 to $100.

By choosing to participate in the study, participants gave consent for the researchers to access their application materials from the service dog provider. Demographic data obtained from applications included the date of waitlist assignment or service dog placement, date of birth, and primary medical diagnosis. Primary diagnoses were categorized into five categories: seizure disorders (e.g. epilepsy, Koolen DeVries syndrome), musculoskeletal disorders (e.g. Duchenne's muscular dystrophy, osteogenesis imperfecta, Charcot-Marie-Tooth disease), neuromuscular disorders (e.g. cerebral palsy, spinal cord injury, spinal muscular atrophy, para/tetra/quadriplegia), developmental or intellectual disorders (e.g. Down syndrome, fetal alcohol syndrome), and a general 'other' category (e.g. Type 1 diabetes, cystic fibrosis).

3.3.3 Measures

This study is based on data collected from four open-ended questions given to each participant at the end of the survey. The first three qualitative questions were phrased specifically to capture experiences (for those who lived with a service dog) and expectations (for those on the waitlist). The first question (Q1) asked, "What is (do you think will be) the most helpful aspect of having a service dog?" The second question (Q2) asked, "What does (do you think) the service dog (will) do that helps the most?" The third question (Q3) asked, "What are (do you think will be) the drawbacks of having a service dog?" The final open-ended question (Q4) was worded the same for all participants and asked, "Is there anything else you would like to share to advance the science and understanding of service dogs for individuals with disabilities and their families?" For those who completed the survey online or through the mail, the exact written text was used for analysis. For those who completed the survey on the phone, participants gave consent to record their answers to the open-ended questions which allowed for post-study transcription. For online and mailed surveys, simple grammatical errors and spelling mistakes were fixed by the authors, meaning that some quotes reported are not verbatim to original typed text (e.g. "She's sometimes stuborn" is represented as "She's sometimes stubborn" in the text).

3.3.4 Analysis

This study employed a conventional content analysis to answer whether there were differences between the expected and experienced impact of a service dog. Conventional content analysis is an inductive approach which aims to describe a phenomenon (Elo & Kyngäs, 2008; Hsieh & Shannon, 2005). The analysis is appropriate for describing differences between groups when there are no concrete hypotheses. While the researchers did have knowledge about the subject, it was based on the limited amount of existing evidence, particularly for the expectations of individuals hoping to receive a service dog in the future. Codes and themes were not created a priori; instead, they emerged directly from the data through the process of open coding (Elo & Kyngäs, 2008). All coding and analyses were conducted with NVivo 11 (QSR International, 2008) qualitative data analysis software.

The process of developing and refining a coding manual was iterative and dependent on recurrent readings of the entire qualitative data set. The unit of analysis was defined as a single linguistic clause; each clause was assigned a "code". In clauses which contained multiple codes, two codes were assigned (e.g. "[My service dog] makes me feel safe and happy" would receive both the codes *Security* and *Joy)*. Clauses which could not be could not be interpreted without more context were coded as *Ambiguous*. Codes which were expressed more than once in a single response were coded as *Redundant* (e.g. "Our only drawback is the hair. She is a Golden Retriever - lots of hair." would only receive the code *Shedding/Hair* once. This was done to accurately account for the percentage in each group that reported each code in their responses. Finally, clauses which were unrelated to the questions asked were coded as *Irrelevant.*

The coding manual was further refined through the establishment of inter-coder agreement. To establish this criterion, a minimum Cohen's kappa value of acceptability was set to 0.80. Multiple rounds of inter-coder agreement were conducted. In each round, 20% of the data was randomly selected and coded independently by authors JB and SV. The authors conferred after each round and together refined the codes and their definition. A kappa at 0.87 was attained in the fifth round of coding. Author SV then independently coded 100% of the dataset and consulted with author JB as necessary.

3.4 Results

3.4.1 Participants

A total of 91 of the 154 participants from the larger study were included for qualitative analysis after the following exclusions. Of the 154 participants in the larger study, 48 had responded as a proxy for those who were either under the age of 13 or unable to complete the survey on their own. These proxy responses were not included in the present analysis to preserve the validity of the data and focus solely on first-hand experiences. In addition, one case was excluded because the service dog had been in the home less than six months (this exclusion criterion was to account for the adjustment period following placement of a service dog; (Sachs-Ericsson et al., 2002)). Finally, 14 participants were excluded as they only partially completed the survey and thus did not receive the qualitative questions at the end of the survey.

Demographic characteristics of the service dog and waitlist groups are displayed in **Table 3.1**. Of 91 participants included in this study, 64 were currently living with a service dog while 27 participants were on the waitlist to receive a service dog. Participants on the waitlist had been waiting for placement with a service dog an average of 2.1 years +/- 2.0 years. Participants with a service dog had been placed with their dogs for an average of 5.0 years +/- 3.2 years. Half of all participants (50%) had neuromuscular diagnoses, followed by 28% with seizure disorders, 18% with musculoskeletal disorders, 3% with Type 1 diabetes and 2% with developmental or intellectual disorders. Groups did not significantly differ in age ($p = 0.119$), gender ($p = 0.727$), or in diagnosis distribution ($p = 0.061$). However, those on the waitlist were significantly more likely to have a pet dog living in the home ($p = 0.029$).

Table 3.1 Demographic and clinical characteristics of participants across group

	Group			Group difference		
	Waitlist (n = 27)	Service Dog (n = 64)	Total (N = 91)	*t*	X_2	*p*
Age, years, M (S.D.)	38.30 (20.23)	31.34 (15.79)	34.82 (18.01)	-1.593		0.119
Female, n (%)	15 (56%)	33 (52%)	48 (53%)		0.121	0.727
Primary diagnosis category, n (%)					8.987	0.061
Seizure	9 (33%)	16 (25%)	25 (28%)			
Musculoskeletal	5 (19%)	11 (17%)	16 (18%)			
Neuromuscular	10 (37%)	35 (55%)	44 (50%)			
Developmental/ intellectual	0 (0%)	2 (3%)	2 (2%)			
Diabetes	3 (11%)	0 (0%)	3 (3%)			
Has a pet dog, n (%)	19 (70.37)	29 (45.31)	48 (52.75)		4.784	0.029

Note. M, mean; S.D., standard deviation; n, partial sample size; N, total sample size; %, percentage of participants

3.4.2 Themes and Sub-Themes

Responses were coded with an average of 1.97 +/- 1.66 codes per question, and groups did not significantly differ in their response length (service dog group = 2.03 +- 1.59 codes per response, Waitlist group = 1.83 +/- 1.83 codes per response, t(89)= 0.524, p = 0.602). A total of 101 codes describing the expectations and experiences of living with a mobility or medical service dog were summarized into the two central categories of Benefits and Drawbacks. These central categories were further split into themes and sub-themes, described below. **Table 3.2** provides the frequency and percentage for each theme and sub-theme for each group.

Table 3.2 Number and percentages of participants in each group reporting themes and sub-themes

	Waitlist (n = 27)	Service Dog (n = 64)
Benefits		
Physical	**24 (89%)**	**45 (70%)**
Medical Assistance	18 (67%)	20 (31%)
Physical Assistance	12 (44%)	32 (50%)
Psychosocial	**20 (74%)**	**63 (98%)**
Human-Animal Relationship	13 (48%)	51 (80%)
Emotional	10 (37%)	35 (55%)
Quality of Life	9 (33%)	29 (45%)
Social	3 (11%)	19 (30%)
Drawbacks		
None	**10 (37%)**	**19 (30%)**
Drawbacks	**18 (67%)**	**52 (81%)**
Dog Care	10 (37%)	28 (44%)
Public Education & Access	6 (22%)	28 (44%)
Lifestyle Adjustments	7 (26%)	12 (19%)
Dog Behavior	2 (7%)	15 (23%)

Note. Values represent the total number and percentage of participants in each group whose qualitative responses contained a code classified in each listed theme or sub-theme.

3.4.3 Benefits

Benefits of having a service dog were mainly described in responses to the first two questions, "What is (do you think will be) the most helpful aspect of having a service dog" and "What does (do you think) the service dog (will) do that helps the most?" The *Benefits* category was split into two themes: (1) Physical Benefits and (2) Psychosocial Benefits.

Physical Benefits

A total of 70% of participants with a service dog and 89% of those on the waitlist described physical benefits they've received or expect to receive from their service dog. Physical benefits of having a service dog were described in terms of two sub-themes, (1) *Medical Assistance* and (2) *Physical Assistance.* As the central role of the service dogs in the recruited sample was to provide mobility or medical assistance to the individual, this theme was prevalent across responses from both groups but was especially prominent among those on the waitlist.

Medical Assistance

The sub-theme of *Medical Assistance* included responses in which individuals described the service dog's role in providing alert, response, and recovery behaviors for medical events such as a seizure, low blood sugar, or a fall. While medical benefits were the most commonly represented physical benefit described, only 31% of those with a service dog mentioned medical assistance in their responses compared to 67% of participants on the waitlist.

Of the codes included in *Medical Assistance*, 25% of all respondents described the service dogs' abilities to aid with their seizures, reflecting the demographics of the sample. This included the service dog signaling or notifying the participant of an oncoming seizure ("she alerts to my seizures 30 minutes in advance so I can get somewhere to be safe"), responding to a seizure ("my service dog is the wet nose I get to wake up to after or during a seizure"), or helping the individual cope with their condition ("if I have a seizure, I know I will get through it with his help").

Another common code in this sub-theme (mentioned by 19% of those on the waitlist and 11% of those with a service dog) was the service dog's ability to get help in the event of a medical emergency. One individual on the waitlist described how she expects her service dog to "summon help if I fall or faint" while others noted how their service dog will retrieve help in the event of a seizure or hypoglycemic episode. One participant described how "when [I'm] unable to, my service dog can get my meds, the phone and go get help."

Physical Assistance

The sub-theme of *Physical Assistance* included responses in which individuals described the service dog's role in providing assistance for balance, mobility, and tasks involving movement and/or strength. Physical assistance was described in 50% of responses from those with a service dog and 44% of responses from the waitlist.

Within the *Physical Assistance* sub-theme, both those with a service dog and on the waitlist often described the service dog's ability to help with dropped items. A total of 31% of participants with service dogs reported that the dog's ability "to pick things up without having to ask others" was one of the most helpful behaviors. For those on the waitlist, 30% of participants similarly anticipated their future service dog to help with item retrieval ("[the service dog] could help me pick up my dropped pencil, book, toy, utensils, etc. so I wouldn't be embarrassed to ask for help").

Other behaviors in this sub-theme included help with performing tasks and providing a

steady physical support for balance. For participants with neuromuscular or musculoskeletal disabilities, responses described how their service dogs have assisted with daily tasks that are difficult to perform such as opening doors or turning off and on lights. For individuals with problems with unsteadiness on their feet, service dogs provided a "4-legged cane for balance." One participant on the waitlist described how she felt that "a cane makes a person feel and look older, not a pleasant feeling" and how she hoped her service dog would provide the stability and balance support that a cane can provide without the stigma.

Psychosocial Benefits

Beyond the tangible medical and physical assistance that mobility and medical service dogs provide, both individuals on the waitlist and with a service dog often described the psychosocial benefits they expected or have experienced from being placed with a service dog. Almost all of those with a service dog (98%) described the psychosocial benefits they have received from their service dog. In contrast, only 74% of those on the waitlist anticipated psychosocial benefits from their future service dog, instead discussing the physical benefits they anticipated (see *Physical Benefits* section). The *Psychosocial Benefits* theme was grouped into four sub-themes: (1) *The Human-Animal Relationship,* (2) *Emotional Benefits,* (3) *Quality of Life Benefits,* and (4) *Social Benefits*.

Human-Animal Relationship

The Human-Animal Relationship was the most referenced sub-theme of *Psychosocial Benefits,* discussed by 80% of those with a service dog and 48% of those on the waitlist. This sub-theme described the powerful and unique relationship that was both experienced and expected from being paired with a service dog.

The most represented code in *The Human-Animal Relationship* theme described the service dog as being a companion or providing the qualities of companionship. The concept of companionship appeared in 44% of responses from participants with a service dog and a similar 41% of responses from those on the waitlist. In fact, when specifically asked what the most helpful aspect of having a service dog was (Q1), 36% of those with a service dog and 30% of those on the waitlist mentioned companionship in their answers. Another commonly discussed aspect of the service dog-handler relationship was the physical company that the service dog provides. One

participant with a service dog described how “it’s an unnatural feeling when your safety sidekick isn’t attached to your hip. I can’t imagine any part of my life without her.” When describing this phenomenon, individuals described the dog’s actual presence (e.g. “When I feel isolated or cast out, [my service dog] could sit beside me”) and their conceptual presence (e.g. “My service dog is the gift of fur, my companion, my confidant...but most of all he is the one who is always there”). Others also described the physical affection received from the service dog’s presence (e.g. “kisses when you’re sad”, “snuggles”, and “cuddles”).

The use of the words “friendship” and “bond” were exclusively mentioned by those living with a service dog. One participant with a service dog described how “we have more than a relationship, it's a partnership with a powerful bonded friendship.” When asked to share anything else (Q4), one participant with a service dog noted how “my life would be difficult and lonely without my service dog, she is my best friend.”

A total of 19% of both individuals with a service dog and on the waitlist mentioned love in their responses. This included mentions of love *for* the service dog (e.g. “I love [my service dog] and don't want to live without her”), love *from* the service dog (e.g. “[my service dog] just looks at me with complete and the most forgiving love”), or *reciprocated* love (“[my service dog] showers me with love and attention... I can only hope he feels the same from me”). One individual with a service dog also described the service dog as a family member, suggesting a powerful bond both between himself and the service dog, but also with the family.

Emotional Benefits

A commonly described psychosocial benefit was the service dog’s ability to provide emotional comfort and support, mentioned in 55% of responses among those with a service dog and 37% among those on the waitlist. One individual described how their service dog “helps probably more emotionally than physically”, while an individual on the waitlist argued that “more important than the physical help a service dog can apply may be the psychological benefits…people with any kind of 'handicap' need psychological acceptance and companionship.” Other accounts describe the dog being in tune with the participant’s emotions or feelings (e.g. “my service dog can sense my feelings” or “She knows when I'm angry or upset and she does everything she can to calm me down”). A particular emotional aspect of having a service dog that seemed to

be unanticipated from those on the waitlist was the dog's ability to assist with anxiety management, which was mentioned by 16% of those with a service dog but only 4% of those on the waitlist.

Other codes included in *Emotional Benefits* included the service dog instilling a sense of confidence and motivation in the hander. Both individuals on the waitlist and with a service dog described the expected or experienced increases in confidence from being placed with a service dog (e.g. "Having a disability makes you feel vulnerable. Your confidence is gone. Service dogs give you the comfort you need"). Participants also reported how a service dog can decrease loneliness (e.g. "My life would be difficult and lonely without my service dog") and increase feelings of joy and happiness (e.g. "[My service dog] is my joy when I am down", "[My service dog] makes everyone around me happy").

As many service dogs assisted with medical response or alert, another commonly represented code in responses both on the waitlist and among those with a service dog was the "peace of mind" brought by a service dog's presence. Specifically, the feeling of security that a service dog can instill was mentioned by 14% of those with a service dog and 15% of those on the waitlist. For example, an individual with a service dog described how "you always know that there is someone having your back" while an individual on the waitlist described how she hoped her service dog would "give me a sense of security, self-confidence, knowing that I have the added protection."

Quality of Life Benefits

Quality of Life Benefits were discussed by 45% of participants with a service dog and 33% of participants on the waitlist. This sub-theme included codes describing how having a service dog can bring about positive feelings of responsibility, including adding a routine to the day. Codes in this sub-theme also described the freedom and independence provided by having a service dog. One individual with a service dog stated: "I would not have the freedom I have if I did not have my service dog to help watch over me." Another shared how her service dog gave her "freedom to do things without my mom being there." One participant on the waitlist described how "a service dog allows you to live a more independent life," while another hoped that after getting a service dog "maybe I will be able to get out more."

This *Quality of Life* sub-theme was also often represented in answers to "Is there anything else you would like to share to advance the science and understanding of service dogs for

individuals with disabilities and their families?" in which participants described the service dog being "life-changing." For example, one individual with a service dog stated "I can't imagine having my disability and not having my [service dog]. For me, he has given me a new lease on life instead of me being stuck at home."

Others with a service dog also described the impact that their service dog had on their family (e.g. "[my service dog] has not only changed my life but the lives of my children"). Service dogs were also described to decrease family members' stress and worry (e.g. "[my service dog] keeps my family from worrying about me"). One individual with a service dog noted that as a result of his service dog's seizure alert behaviors, "my family hovers less which is nice" while an individual on the waitlist described how he hoped his service dog would provide "relief for family." One participant with a service dog even noted how "since having [my service dog] my husband's blood pressure stays more even."

Social Benefits

Social Benefits involved the service dog's effects on social interactions, relationships, or the public's perception. Social benefits were referenced by 30% of those with a service dog, but only 11% of those on the waitlist. The most represented codes in this sub-theme described positive experiences with community integration, communication with friends or strangers, and positive attention from the public.

Many individuals with a service dog described how their dog positively contributed to their ability to make friends and be social (e.g. "He's made me more social. He's made me more relaxed about talking to other people"). In addition, many responses described how the service dog can positively impact conversations. Several individuals described how service dogs can be "a topic of conversation with anyone" and that "[A service dog] helps because people that are able bodied don't understand the disabled person. The service dog gives a point of common approach." Another individual described how their service dog made them feel "more 'normal' and approachable in public."

Another social benefit experienced by those with a service dog involved the public's perception of them with a service dog. One individual with a neuromuscular disability noted how their service dog "makes the wheelchair disappear" and allows people to see past the disability. Another individual with a service dog noted how "prior to having [my service dog] they saw the

chair first and now they see the dog first." Other social benefits were specific to the service dog's ability to draw positive attention in public. The service dog provider for which participants were recruited omits the traditional "Do Not Pet" patch in place of a "Please Pet Me" patch on their service dog's vests. Thus, recipients noted how "since people are allowed to pet [the service dog], it helps people approach me and talk to me."

3.4.4 Drawbacks

When asked the question "What are (do you think will be) the drawbacks of having a service dog?" (Q3) most individuals both on the waitlist and with a service dog either anticipated or experienced drawbacks. However, 30% of those living with a service dog and 37% on the waitlist responded stating that *no drawbacks* were expected or experienced. For example, one individual with service dog stated "None. There aren't any. You couldn't ask for a better companion to be with you all day long. Nothing better." In addition, two individuals living with a service dog explicitly stated the drawbacks were *outweighed* by the benefits in their answer (e.g. "All of the drawbacks are minor compared to the advantages - it is totally worth it").

Among individuals who did report drawbacks, four sub-themes from responses emerged: (1) *Dog Care,* (2) *Public Education & Access,* (3) *Life Adjustments*, and (4) *Dog Behavior.*

Dog Care Drawbacks

The sub-theme of *Service Dog Care* included responses in which individuals described having to provide for either the general or specific needs of the service dog. Care and responsibility for the service dog was the most commonly discussed drawback, mentioned by 44% of participants with a service dog and 37% of participants on the waitlist.

The codes in this sub-theme largely echoed the needs of caring for any pet dog ("like any dog, [my service dog] needs care and sometimes, I'd rather not.") For example, many individuals discussed how the dog needs walking (e.g. "It's sometimes hard to get the energy to take my service dog on walk"), feeding (e.g. "Making sure [the service dog] is fed"), and taking to the bathroom (e.g. "Having to maintain a regular bathroom routine [for the service dog] while at school"). Others mentioned veterinary care and financial expenses of having a service dog ("I can't think of any big drawbacks. But maybe the financial aspect"). One drawback noted that was specific to those with limited mobility was the inability to clean up after a service dog when they

go to the bathroom in public ("Being in a wheelchair it is hard to clean up so [the service dog's waste] becomes someone else's problem").

One particular breed-specific drawback was the dog's shedding, mentioned by 9% of individuals with a service dog but no individuals on the waitlist. As one participant with a service dog described: "The shedding factor of a Lab is incredible! [My service dog] sheds no matter what I do to groom him, too. A lot of people I visit don't appreciate me bringing him for that reason."

Public Access & Education Drawbacks

Concerns surrounding both public access and public education were prevalent; this sub-theme was mentioned by 44% of those with a service dog, but only 22% of those on the waitlist. In particular, negative attention from people in public was described by 20% of participants with a service dog, but no participants on the waitlist. This included mentions of other people's unwanted behavior or judgment as a result of the service dog's presence (e.g., "by having my [service dog], people think that I am mentally challenged"; "In the beginning I did not want a service dog because epilepsy is an invisible disease. Having a service dog now made it visible"). Others described how having a service dog can result in unwanted attention from others (e.g. "[A drawback is] getting stopped by so many people. It's enjoyable at times but when I am rushed I don't want to be rude but I cut people off"; "Sometimes people will stare"). One individual living with a service dog described how the biggest drawback was being looked over in favor of the service dog ("Lots of people know me, mostly as the guy with the service dog, but I don't know them at all or barely").

Drawbacks regarding public access were discussed by both those with a service dog (16%) and those on the waitlist (15%). An individual on the waitlist said that he expects a drawback will be that his/her service dog "may not be allowed some places" while another anticipated the drawback of "people saying [my service dog and I] cannot go in their stores." Only a couple of individuals both with a service dog (3%) and on the waitlist (7%) described the drawbacks of having a service dog in the context of impacting other people. Specifically, one individual on the waitlist was concerned that "some people are allergic to dogs," while an individual with a service dog noted "there are people in my life that are allergic and that's an issue… I wish [my service dog] was a breed that was hypoallergenic to most people."

While not mentioned by any waitlist participants, 11% of those with a service dog mentioned the lack of public education about service dogs as a drawback. This included the public's behavior in the presence of a service dog (e.g., insisting they need to visit with the dog, stopping the individual to pet the dog; "trying to distract your dog from their job") and the public's lack of education about service dogs (e.g. "a lot of people do not know that service dogs are for people other than blind and deaf. People are not respectful of them because of that." Concerns regarding "fake" service dogs were also only mentioned by participants with a service dog. Specifically, two participants described their negative experiences as a result of other's abuse of public access (e.g. "Fake service dogs cause all sorts of problems where sometimes we are denied entry due to a fake's bad behavior"; "When an untrained dog goes into a public place they ruin it for people who do have a disability and do need their dog with them. You now find yourself being even more discriminated against and turned away because of others").

Lifestyle Adjustment Drawbacks

The sub-theme of *Lifestyle Adjustments* included both the experienced or expected adjustments necessary in order to incorporate a service dog into aspects of one's life. This sub-theme was mentioned by 19% of participants with a service dog, and 26% of participants on the waitlist.

While establishing a close relationship with a service dog was often mentioned as a benefit (see *Human-Animal Relationship)*, the adjustment of having a service dog as a close relationship was also framed as a drawback. For example, separation from the service do*g* was a concern for 5% of participants living with a service dog who framed this as being a drawback (e.g., "On the rare occasion that [she] is not with me I feel like I am driving a car without wearing a seatbelt"). In addition, one participant with a service dog stated that "the only drawback would be having to take the dog everywhere with me." Both individuals on the waitlist (11%) and with a service dog (8%) also mentioned the drawback of having to incorporate the needs of the service dog into their regular daily routine (e.g. "You always have to plan out your days exactly") or maintaining commitment to taking care of the dog (e.g. "Service dogs can be a lot of trouble if you are not fully committed to their love and care"). The topic of death was only minimally mentioned; only one participant, who was on the waitlist, mentioned the fear of the service dog's future death as a drawback.

Another aspect of lifestyle adjustment from having a service dog involved the needs of the service dog changing the logistical experience of leaving home. This involved the more difficult aspects of travelling with the service dog (e.g., "Getting in and out of our car so much could possibly be a hassle"; "[it] takes time, extra care, and special considerations of having to handle [service dogs] when traveling") as well as the restraints that a service dog imposes on the ability to travel freely (e.g., "[The biggest drawback is] vacations because we can't take [the service dog] everywhere we go; "There are some places it just doesn't make sense to go if you have a dog with you").

In addition to routine and travel, other lifestyle adjustments mentioned involved aspects of home life. Concerns about other pets in the home were mentioned solely by individuals on the waitlist, which may have been because individuals on the waitlist were more likely to have a pet dog in the home than those with a service dog. One participant on the waitlist described an anticipated drawback as "three dogs might be a little much" while another stated that "my pet dog (rescue dog) is still very nervous… worried that another dog will upset her." In addition to concerns about existing pets, one individual on the waitlist described adjustments to her home and yard as an anticipated drawback ("having enough land for [the service dog] to run… [needing] excellent fencing to protect dog from road, cars, etc.").

Dog Behavior Drawbacks

The *Service Dog Behavior* sub-theme addressed the drawbacks of the service dog's behavior both in public and in private. Concerns regarding the service dog's behavior were the least common drawbacks reported by the sample, described by 23% of those with a service dog but anticipated by only 7% of those on the waitlist.

Unwanted service dog behaviors included hyperactivity (e.g. "Sometimes [my service dog] jumps on other people and gets a little hyper"; "When people come over … [my service dog] can get a little hyper and takes her a couple minutes to settle down"), or other difficult traits (e.g. "Sometimes [my service dog] is stubborn"). Others with a service dog described their dog's social needs as a drawback (e.g. "[My service dog] often is paying attention to others instead of me"; "[My service dog] has to be petted all day every day"). In addition, several individuals both on the waitlist and with a service dog noted the need for or the experience of training the service dog as

a drawback (e.g. “Training continues. It is a constant work in progress”; “Just because it is already trained, doesn't mean it is trained to your lifestyle”).

Other Concerns

Several other concerns regarding service dogs that were not specifically benefits or drawbacks were described in the final question, “Is there anything else you would like to share to advance the science and understanding of service dogs for individuals with disabilities and their families?” (Q4). A total of 3% of participants with a service dog and 15% of participants on the waitlist described a general need for service dogs in their responses (e.g. “The most pressing matter is the amount of kids that need service dogs don’t get them”). Those on the waitlist specifically expressed concerns regarding acquiring a service dog (e.g. “[The] only problem with . . . service dogs is getting one because the process is difficult”). Three individuals with a service dog also recommended service dogs to others (e.g., “I would recommend a service dog for anyone with a significant disability”), or provided advice for future service dog owners. This included specific advice (e.g., “Don’t give up on your service dog, just give them some time”) as well as acknowledging that all service dog owners are paving the way for future owners (e.g. “Educate, not confront [people in the community] …This will prepare the way for future service dog owners”).

3.5 Discussion

This study assessed the expectations and experiences of being placed with a mobility or medical service dog in a diverse sample of individuals with physical disabilities and chronic conditions. By comparing anticipated experiences (from those on the waitlist to receive a service dog) to actual experiences (from those currently placed with a service dog), a content analysis produced two themes categorizing both *Benefits* and *Drawbacks* of being placed with a mobility or medical service dog. A comparison of response frequency across group revealed several aspects of owning a service dog that were perceived by both groups as well as aspects which were relatively unanticipated by those on the waitlist. In addition, the study’s findings provide an in-depth exploration of benefits and drawbacks to the service dog relationship in the own words of

service dog owners, providing a rich description of expectations and experiences to complement both the design and interpretation of quantitative research in the field.

Findings from this research are novel, as they represent one of the first explorations of the differences in expectations versus experiences among service dog applicants and recipients using a content analysis approach. Notable group differences were observed regarding the perceived benefits of owning a service dog. Specifically, when asked about the most helpful aspect of having a service dog, the majority (89%) of those on the waitlist anticipated benefits that were physical (compared to 70% living with a service dog), while nearly all (98%) of those with a service dog described benefits that were psychosocial (compared to 74% on the waitlist). These differences suggest that service dog applicants most often expect physical benefits to be the most helpful part of having a service dog, while those already paired with a service dog focus on the psychosocial benefits. It is not surprising that waitlist applicants expect a high proportion of physical assistance benefits, given that the anticipated physical, functional, and medical benefits constitute the purpose of seeking out a mobility or medical service dog. However, our findings suggest that the experienced value of a service dog extends *beyond* traditional physical assistance to domains that may be unexpected by many service dog applicants and especially meaningful to those already partnered with a service dog.

3.5.1 Benefits

The most widely represented psychosocial benefit was the human-animal relationship, discussed by 80% of those with a service dog and 48% of the waitlist. While companionship from the service dog was the most highly represented code among both groups, those with a service dog described their relationships with their dogs using the words “friendship” and “love” which reflected the perceived strength of this unique bond. This mirrors findings from several studies that have found the service dog’s companionship to be a central characteristic underlying the perceived benefits from the service dog-owner relationship (Camp, 2001; Fairman & Huebner, 2001; Lynette A Hart, Zasloff, & Benfatto, 1995; Lane et al., 1998). This study expands upon previous knowledge by revealing that the strength and magnitude of the human-animal relationship may not be a specific benefit expected by those on the waitlist to receive a service dog.

The second most discussed psychosocial benefits were emotional benefits, including feelings of confidence, security, and joy. Emotional benefits were discussed by 55% of those with a service dog and 37% of the waitlist. The high prevalence of emotional benefits in this study support findings from previous research indicating that the addition of a service dog into one's life can increase feelings of self-worth and safety while contributing to higher positive affect (Melissa Winkle et al., 2012). For example, a survey of 24 individuals with a mobility or hearing service dog found that 92% of participants indicated they felt safer since obtaining their service dog, 70% reported having higher confidence, and 70% felt less depressed and had better control of their anxiety (Valentine et al., 1993). Further, retrospective studies among individuals with diabetic alert service dogs or seizure response service dogs also suggested owners experienced decreased worry, improvements in mood, and decreased feelings of anxiety (Gonder-Frederick et al., 2013; Kirton et al., 2008). Thus, findings from both the current study and previous research indicate that service dogs may provide significant emotional support to improve self-worth, perceived safety, and positive affect among those with disabilities or chronic conditions.

Improvements to quality of life were an additional psychosocial benefit both experienced (45%) and expected (33%). Quality of life benefits included the service dog's ability to provide increased freedom, independence, and improvements to overall daily functioning. Several studies have described the use of mobility service dogs as a unique assistive technology option to improve functional ability and participation among those with physical limitations. A longitudinal study of 24 long-term manual wheelchair users found that the addition of a mobility service dog was not only associated with decreased pain and exertion, but also was associated with increased reintegration into normal life, increased ability to navigate their environment, and increased occupational performance (Vincent, Gagnon, & Dumont, 2017). Additionally, studies of medical service dogs suggest the service dog's alert or response behaviors can provide feelings of freedom, safety and independence, especially in public or when unaccompanied by a caregiver (Kirton et al., 2008). These improvements to quality of life likely co-occur with the emotional and psychological benefits of improved mood, increased confidence, and higher overall satisfaction with life.

Finally, the last category of psychosocial benefits included those that occur in a social context, described by 30% of service dog owners but only 11% of applicants on the waitlist. Many participants with a service dog specifically cited the benefit of receiving positive attention from

people in public, a phenomenon replicated in other published studies. For example, an observational study found that an individual in a wheelchair with a service dog was smiled at and approached more by strangers when they were with a service dog compared to when they were alone (Lynette A. Hart et al., 1987). Further, studies have found that the presence of a service dog can produce a more positive implicit attitude bias towards individuals with physical disabilities (Coleman et al., 2015). Similarly, a retrospective study of 202 individuals with physical disabilities with service dogs found that 100% of respondents reported that more people approached them in public while 87% reported their social interactions increased (Fairman & Huebner, 2001). Our study builds on these results by suggesting that among those anticipating a future service dog, these social benefits may be unexpected or relatively insignificant in comparison to the anticipated emotional benefits, quality of life benefits, and the human-animal relationship. This finding is similar to that of a 1996 study in which 77% of current hearing dog owners said that their dog had made a difference in social interactions within the community while only 29% of those on the waitlist anticipated this benefit.

3.5.2 Drawbacks

In addition to the benefits expected or experienced, both those with and without a service dog described a range of drawbacks to having a mobility or medical service dog. However, when asked to report on experienced drawbacks, 30% of participants with a service dog stated that there were *no drawbacks* to having a service dog. This finding mirrors that of other service dog studies. Specifically, Rintala et al. found that 39% (11/18) of participants with a mobility service dog did not have drawbacks to report (Lane et al., 1998) while Camp et al. indicated that drawbacks were not often discussed by participants, but rather difficulties were framed as “responsibilities” or “challenges” (Camp, 2001). When asked to report on anticipated drawbacks, 37% of participants on the waitlist similarly reported that they did not expect any drawbacks from their future service dog. This finding suggests that a majority of those on the waitlist do in fact perceive future drawbacks of having a service dog, revealing realistic expectations.

The most common drawback discussed by participants both with a service dog (44%) and without (37%) involved responsibilities surrounding the dog’s care and maintenance. In particular, responses described responsibilities surrounding routine pet-care tasks as well as the impacts of shedding and grooming on owner’s lives. Of the studies that have examined drawbacks of service

dog ownership, most have also described the difficulties surrounding dog maintenance (Camp, 2001; Fairman & Huebner, 2001; Rintala et al., 2002). Davis et al. found that caregivers of children with a service dog reported spending 6.2 hours a week and an average of $1,307 a year caring for the service dog, with 29% and 24% considering this time and cost burdensome, respectively (Davis et al., 2004). In a study of Japanese individuals with physical, hearing, or visual impairments who had chosen not to pursue a service dog as a form of assistive technology in their lives, 50% of participants with orthopedic disabilities cited "They are hard to care for" as a reason for not obtaining one (Yamamoto, Hart, Ohta, Matsumoto, & Ohtani, 2014). While maintaining a service dog's eating, walking, and bathroom schedule may be trivial to healthy adults, for those with impairments these added responsibilities may represent a substantial challenge.

The second most commonly discussed drawback was difficulties with public access and education, experienced by 44% of those with a service dog and 22% of individuals on the waitlist. Many individuals with a service dog specifically described difficulty with experiencing discrimination due to being with a service dog in public as well as a lack of public education on service dog etiquette and access. This mirrors findings from other studies in which a large proportion of service dog owners have described the frustration and difficulties experienced by public access and discrimination (Davis et al., 2004; Fairman & Huebner, 2001). In fact, a survey of 482 service dog owners in the United States found that 68% of participants reported experiencing daily discrimination because of their service dog, which was especially prominent for those with "invisible" disabilities (Mills, 2017). Further, 42% of participants reported that they often received "invasive personal questioning" while accompanied by the service dog, 50% reported choosing not to take their service dogs in public because of unwanted attention, and 77% reported that the legitimacy of their service dog was sometimes questioned (Mills, 2017). While having a service dog in public may result in a variety of social benefits for service dog owners, it seems that the service dog's presence may also contribute to negative experiences in the community. Further, as those on the waitlist rarely mentioned drawbacks in this category, issues with public access and education may be a relatively unexpected aspect of having a service dog.

In addition to the service dog's care and issues with discrimination in public, there were several lifestyle adjustments framed as a drawback by 19% of those with a service dog and anticipated by 26% of those on the waitlist. These adjustments included changes to routines, travelling or separation limitations, and home adjustments. Camp et al. also found most of the

n=10 participants with a service dog interviewed described the patience and frustration involved in the initial "adjustment period" of incorporating the service dog into their routine and life (Camp, 2001).

3.5.3 Limitations

This study is not without its limitations. As this was a cross-sectional study, we were unable to determine the extent to which benefits and drawbacks of having a service dog may potentially change with time. Future research will benefit from pursuing longitudinal designs to understand the trajectory of experiences with a service dog. Another limitation to the interpretation of findings was a potential selection bias in participants. As this was a voluntary study, there is a possibility that those who had relatively positive experiences with their service dog were more likely to participate in the study and share their experiences than others. A final population limitation was that pet dog ownership was unequal across groups, with the waitlist significantly more likely to have a pet dog in the home than those with a service dog. However, this difference was accounted for in a separate analysis of quantitative findings from this study on standardized surveys, and the effect on psychosocial outcomes was negligible (Kerri E. Rodriguez et al., Under Review).

The use of an open-ended format questionnaire to gather qualitative data had both positive and negative aspects. The benefit of this design was that this gave participants an opportunity to describe their thoughts in their own words, allowing us to describe responses using participant-reported themes rather than predetermined themes (as would be the case with a checklist or ranking of benefits and drawbacks). However, we were unable to determine the relative weighting of benefits and drawbacks within and across individuals. Even though we did frame questions using rank-promoting language (i.e., "What is the most helpful aspect of having a service dog?") it is possible that certain benefits may be more or less meaningful to quality of life than others. Additionally, we were unable to understand the relative severity of the drawbacks and how they potentially impact wellbeing. Specifically, because we could not probe participants for a deeper discussion, it is unclear if a stated drawback is viewed as simply a nuisance or has negatively impacted a service dog recipient's psychosocial health or quality of life. Future research would benefit from semi-structured or more in-depth interviews to allow for that kind of understanding.

An important consideration of this research is that we omitted caregiver/parent-proxy reported data to solely capture the views of service dog applicants and recipients themselves. This

limited the sample to those who were older than 13 and possessed the capacity to report on their own behalf, which excluded those who were nonverbal or intellectually impaired. Future research will benefit from including this important population of service dog owners, who may have unique experiences or face different challenges than those who are more independent. For instance, future studies may focus on the benefits and drawbacks of having a service dog from the perspective of children who bring their dogs to school with them or from the perspective of a caregiver for a nonverbal adult child.

A final limitation of the study is that we cannot determine whether the same pattern of expectations and experiences would be generalizable to other types of service dogs (guide, hearing, or psychiatric) and their owners. In this context, it would be beneficial to know if there are certain aspects of service dog ownership that are commonly experienced by all owners (e.g., the human-animal relationship) or if there are aspects that may be particularly salient to one type of service dog owner (e.g. those with an "invisible" disability or those who are severely socially isolated). As the study population in this research was limited to those with seizure disorders, mobility limitations, or diabetes, some of the emergent themes in the qualitative analysis (e.g. medical assistance) are likely a product of our sample and limited to a certain type of service dog. However, some themes (e.g. emotional benefits) may be generalizable to other types of service dogs, emotional support dogs, or companion dogs in general. In addition, the sampled population of service dog owners were recruited from a single service dog provider, so findings may reflect characteristics specific to the provider. For example, the service dog provider Canine Assistants focuses heavily on the human-animal bond during the service dog-owner matching and training process, which may have had an impact on the relative frequency of the perceived human-animal relationship benefits.

3.5.4 Implications and Future Directions

This study's findings have important implications for occupational therapists and rehabilitation professionals. Understanding the positive and negative lifestyle changes experienced by those with a service dog, professionals recommending this practice can gain a better understanding of both the benefits and challenges that clients may expect and experience. As this study directly compared the expectations of those on the waitlist to the real-life experiences of

those with a service dog, findings also provide professionals with information regarding effects of the service dog-owner relationship that may be unanticipated. This may help prepare individuals who are planning to apply for a service dog realize the future challenges and changes to their lives that may occur, thereby potentially facilitating the initial adjustment period.

This research highlights the need to include and measure both the positive and negative aspects of service dog ownership into future studies. Specifically, quantitative studies investigating the potential effects of service dog ownership on psychosocial health and quality of life will benefit from incorporating standardized measures of both the human-animal relationship as well as drawbacks into future research. An example of a standardized measure that captures both the human-animal relationship as well as the daily maintenance and responsibility of caring for the dog is the Monash Dog-Owner Relationship Scale (Dwyer et al., 2006). For caregivers of those with severe impairment who may be responsible for both the handler *and* the service dog's health and wellbeing, it may be useful to adapt a caregiver burden scale for measuring the responsibilities surrounding the service dog's care into their routines. Finally, as public discrimination was commonly reported both among our sample and others (e.g. Mills, 2017) service dog-related discrimination is likely to be of particular importance to consider when measuring psychosocial wellbeing and social functioning in this population.

3.5.5 Conclusion

In conclusion, this study compared the expectations and experiences of both future and current mobility and medical service dog owners to describe the benefits and drawbacks to service dog ownership. Results suggest that in combination with the medical and physical benefits the service dog is trained to provide, those with a service dog experience substantial psychosocial benefits from their service dog's assistance and companionship to a degree that may be unanticipated by future service dog owners. The study's findings provide evidence to suggest that the social, emotional, and quality of life benefits from a service dog's assistance and companionship are an important aspect of the service dog-owner relationship. Further, the drawbacks of having a service dog, specifically those that involve the service dog's behavior and public access and education, are important considerations to prepare those anticipating the addition of a service dog in their lives.

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CHAPTER 4. DEFINING THE PTSD SERVICE DOG INTERVENTION: PERCEIVED IMPORTANCE, USAGE, AND SYMPTOM SPECIFICITY OF PSYCHIATRIC SERVICE DOGS FOR MILITARY VETERANS

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4.1 Abstract

Research suggests that psychiatric service dogs may be an effective complementary treatment option for military veterans with posttraumatic stress disorder (PTSD). Although this practice continues to increase in popularity and research has reached the rigor of clinical trials, the components of the PTSD service dog intervention remain largely undefined. This research aimed to 1) quantify the importance, usage, and PTSD symptom specificity of service dog trained and untrained behaviors, 2) explore how PTSD severity, time since receiving the service dog, and the veteran-dog relationship relate to outcomes, and 3) compare expectations of veterans on the waitlist to experiences of veterans with service dogs. In a cross-sectional design, a total of N=216 post-9/11 military veterans with PTSD were recruited from a national service dog provider, including n = 134 with a service dog and n = 82 on the waitlist. Results showed that the service dog's trained tasks of calming and interrupting anxiety were perceived as the most important for veterans' PTSD, the most frequently used in a typical day, and as helping the most PTSD symptoms. Trained tasks were most helpful to the PTSD symptoms of hypervigilance and intrusion, and least helpful towards the symptoms of amnesia and risk-taking. Although all trained tasks were helpful towards PTSD symptoms, veterans rated the service dog's untrained behaviors on average as more important for their PTSD. After controlling for covariates, there was no relationship between a veteran's PTSD severity and perceived importance or frequency of task use. However, veterans who reported feeling closer to their service dogs reported using trained tasks more often, and veterans who had their service dogs for longer reported using trained tasks less often. Finally, veterans on the waitlist reported higher expectations regarding task use and importance than described by veterans with a service dog. In conclusion, findings describe the core

components of the PTSD service dog intervention by quantifying the use and value of trained and untrained dog behaviors. Overall, this study helps explain the PTSD service dog's clinically-relevant value while contributing to the scientific understanding of this emerging practice.

4.2 Introduction

Of the roughly 2.7 million United States military personnel deployed to Iraq and Afghanistan post-9/11, up to 23% return with diagnostic symptoms of posttraumatic stress disorder (PTSD; Fulton et al., 2015). PTSD is a pervasive mental health condition that can occur after exposure to a traumatic event characterized by avoidance, re-experiencing, negative alterations in cognition and mood, and hyperarousal (American Psychiatric Association, 2013). Several evidence-based treatment options for PTSD exist, including cognitive behavioral therapy, prolonged exposure therapy, and pharmacotherapy (Foa, Keane, Friedman, & Cohen, 2008). However, treatment dropout rates are often high among military veterans, and many veterans will retain their PTSD diagnosis despite treatment completion (Resick et al., 2015; Steenkamp, Litz, Hoge, & Marmar, 2015). To meet the needs of military veterans with pervasive PTSD symptoms, many complementary and alternative treatments and practices have emerged to supplement evidence-based care (McPherson & Schwenka, 2004).

One increasingly popular integrative treatment option for PTSD is the provision of a specially trained psychiatric service dog. Psychiatric service dogs are a form of assistance dog that are specially trained to do work or perform tasks directly related to a psychiatric disability - thereby allowing them legal public access rights (Americans With Disabilities Act, 1990). For example, PTSD service dogs can be trained to detect a veteran's physical signs of anxiety and distress, serving to alert to and interrupt anxiety and panic attacks during the day as well as interrupt nightmares during the night. PTSD service dogs can also be trained for positional commands thought to provide a sense of safety in public, such as standing behind the veteran in public and "watching their back." The resulting companionship and non-judgmental social support that a PTSD service dog provides can also offer emotional and therapeutic value (Krause-Parello & Morales, 2018). PTSD service dogs are referred to as an complementary intervention as this practice is considered a nontraditional approach to supplement evidence-based care and mainstream therapies (O'Haire & Rodriguez, 2018; Scotland-Coogan, Whitworth, & Wharton, 2020). The demand for PTSD service dogs continues to increase, waitlists for PTSD service dogs

are often months or years long (Walther et al., 2017; Walther, Yamamoto, Thigpen, Willits, & Hart, 2019). PTSD service dogs may be popular due to the low perceived stigma surrounding this practice in comparison to other forms of mental health treatment (Kim, Thomas, Wilk, Castro, & Hoge, 2010; Yarborough et al., 2017).

Recent research has provided preliminary evidence of the therapeutic efficacy of PTSD service dogs for military veterans. Cross-sectional studies suggest that compared to receiving usual care while on the waitlist, having a PTSD service dog is associated with lower PTSD symptoms, better quality of life, and better social functioning in addition to more regulated production of the stress hormone cortisol (O'Haire & Rodriguez, 2018; Kerri E Rodriguez, Bryce, Granger, & O'Haire, 2018; Yarborough et al., 2017). Similarly, longitudinal studies have found that after receiving a PTSD service dog, veterans self-report significant improvements to PTSD symptoms in addition to secondary outcomes such as depression, anxiety, and quality of life (Bergen-Cico et al., 2018; Kloep, 2016; Whitworth, Scotland-Coogan, & Wharton, 2019). This emerging literature base is complemented by qualitative reports suggesting that PTSD service dogs can provide significant social and emotional support, reduce stress, and improve veterans' overall quality of life (Krause-Parello & Morales, 2018; Taylor, Edwards, & Pooley, 2013; Yount, Ritchie, Laurent, Chumley, & Olmert, 2013).

Despite recent knowledge gained regarding the psychosocial and physiological effects of PTSD service dogs, the therapeutic components of the intervention remain largely undefined. Various proposed standards for PTSD service dog training agree that dogs must be trained for tasks to mitigate the veterans' PTSD (Assistance Dogs International, 2019). However, these trained tasks not only vary widely across service dog providers, but also according to an individual veteran's needs (Vincent et al., 2019). There is a critical need for an empirical assessment of the perceived clinically-relevant value of specific trained tasks and behaviors for military veterans with PTSD. This information is especially relevant for understanding how these psychiatric service dogs may serve as an complementary treatment option for PTSD. Further, it is unknown how important both untrained and trained behaviors are for managing PTSD symptoms, how often trained tasks are used on a daily basis, and how these outcomes may relate to PTSD symptom severity, time since receiving the service dog, and the human-animal bond. As research in this area reaches the rigor of clinical trials (ClinicalTrials.gov, 2019a, 2019b), such knowledge is crucial to

be able to interpret outcomes, understand potential mechanisms of action, and optimize future therapeutic efficacy.

The purpose of this exploratory, non-hypothesis driven study was to define the PTSD service dog intervention by quantifying its therapeutic components utilizing self-reported data from a population of military veterans both with a service dog and on the waitlist to receive one. Specifically, this research aimed to (1) quantify the importance of both trained and untrained service dog behaviors towards veterans' PTSD (2) describe the frequency of use and PTSD symptom specificity of trained service dog tasks, (3) determine how PTSD symptom severity, the veteran-service dog relationship, and time since the service dog was placed may relate to importance and usage outcomes, and (4) compare the expectations of those on the waitlist to the everyday experiences of veterans with service dogs.

4.3 Materials and Methods

4.3.1 Participants

Using a cross-sectional design, participants both with a service dog and on the waitlist to receive a service dog were recruited to participate in an online survey. Participants were recruited between January and May of 2016 from the database of the U.S. service dog provider K9s For Warriors (Ponte Vedra Beach, FL). K9s For Warriors is an Assistance Dogs International (ADI)-accredited, non-profit organization that provides service dogs free of charge to post-9/11 military veterans in almost all 50 U.S. states. Participants consisted of those who applied for and had been approved to receive a PTSD service dog from K9s For Warriors, which utilizes the following inclusion criteria for placements: Verified honorable discharge in the U.S. armed forces, verification of a service-connected disability, verified diagnosis of PTSD from a clinician referral letter or met the clinical cutoff of 50 on the PTSD Checklist (PCL-IV;Weathers, Litz, Herman, Huska, & Keane, 1993), passed a background check verifying no conviction of any crime against animals or felony convictions, had no current substance abuse, was independently mobile, and had no more than two pet dogs living in the home (per the policies of the service dog provider).

A total of 217 military veterans with PTSD participated in the survey (response rate of 51%), including 134 placed with a service dog and 83 on the waitlist to receive one. Participants *on the waitlist* had been approved to receive a service dog from the provider (i.e., had completed

the application and passed screening from the organization) but had not yet received a service dog at the time of participation in the research. The exact length of time on the waitlist was unknown for each participant, but both previous research with this population (O'Haire & Rodriguez, 2018) and reports from the service dog provider indicate that veterans spend an average of 18 months on the waitlist.

Participants *with a service dog* had received a service dog from the provider between 1 month to 7.17 years prior to participating in the research (M = 1.80, SD = 1.67, Median = 1.33 years). Service dog placement occurred onsite at K9s For Warriors campus during a 3-week class. During this time, groups of 6 to 10 veterans received daily instruction to learn how to interact with, care for, and continue training their service dogs at home. Service dogs were primarily sourced from shelters and selected based on their age, temperament, and physical size. Specifically, dogs are screened for physical soundness and health, and selected for friendly temperaments, lack of any aggression or fear, and overall trainability. At full maturity, dogs must be at least 24 inches tall and weigh at least 50 pounds to serve as a potential bracing object for veterans needing assistance with balance. Breeds were predominantly Labrador Retrievers or Labrador Mixes. Dogs were trained for a minimum of 120 hours before placement on basic obedience (e.g., sit, stay, down, recall) and specific tasks to mitigate PTSD symptoms (see Table 1 for the list of tasks trained by the organization). Before final placement, veteran-service dog pairs were required to pass a public access certification test to demonstrate appropriate control and service dog behavior in public settings.

Apart from the service dog intervention, neither the service dog provider nor the researchers encouraged or discouraged any treatments or intervention services for participants' PTSD. Thus, all participants received unrestricted access to usual care for their PTSD symptoms.

4.3.2 Procedure

The study protocol was approved by the Purdue University Human Research Protection Program Institutional Review Board (IRB Protocol 1607017967). Because there were no interactions between researchers and service dogs, a waiver was obtained by the Purdue University Institutional Animal Care and Use Committee (IACUC). To recruit participants, researchers obtained contact information including veterans' names and email addresses from the service dog provider. Potential participants were recruited via a personalized email which included information

about the study and a link to complete an online survey regarding their experiences and perceptions about PTSD service dogs (dog-specific outcomes including service dog training, temperament, and personality have been published in a separate manuscript; LaFollette, Rodriguez, Ogata, & O'Haire, 2019). Participants were advised that their individual answers would be kept confidential and would not be shared with the service dog provider. Voluntary informed consent was obtained electronically by asking participants to confirm that they understood the research study and details regarding their participation before clicking "next" on the survey's landing page. Upon completion of the survey, participants chose between receiving $20 in cash (42%) or $20 Amazon gift card (58%) as compensation for their time.

4.3.3 Measures

Demographics

The online survey contained demographic questions including age, gender identity, marital status, and current pet dog ownership. Participants also consented for researchers to access their records with the service dog provider, which shared service dog placement information (month and year) for those already placed with a service dog.

PTSD Symptoms

PTSD symptom severity was assessed with the PTSD Checklist (PCL-5) for the Diagnostic and Statistical Manual of Mental Disorders (DSM-5; Blevins, Weathers, Davis, Witte, & Domino, 2015). The PCL-5 is a 20-item questionnaire assessing current PTSD symptom severity across four subscales corresponding with the DSM-5 symptom criteria of PTSD: Intrusion, Avoidance, Negative alterations in cognition and mood, and Alterations in arousal and reactivity. The PCL-5 format used omitted the Criterion A component as participants were already screened for having a service-connected PTSD diagnosis. Rather, current symptom severity was assessed by asking participants to rate their symptomology in relation to a general "stressful experience". Participants were asked to rate how often each PTSD symptom has affected them in the past month on a scale of 0 ("Not at all") to 4 ("Extremely"). The scale ranges from 0 to 80, with higher scores indicating greater PTSD symptom severity. Cronbach's α in the current sample was 0.95 overall with subscale α's of 0.91 (B), 0.84 (C), 0.88 (D), and 0.86 (E). A total of 31 participants (14%) did not fill out the PCL-5 measure and thus were excluded from analyses that related PTSD symptom

severity to outcomes. A total of 11 participants (5%) had missing values, but completed more than 75% of the PCL-5 (n = 8 missing one question, n = 2 missing two questions, and n = 1 missing three questions), allowing for subscale-level mean imputation of missing values.

Veteran-Service Dog Closeness

Veterans with a service dog completed the Inclusion of Other in Self (IOS) scale as a measure of their relationship with the service dog. The IOS is a single item, 7-option pictorial scale with demonstrated validity and reliability to measure interpersonal closeness (Aron, Aron, & Smollan, 1992). The IOS has been previously used as a measure of the human-animal bond (LaFollette et al., 2019; McConnell et al., 2011). The pictorial scale consists of seven diagrams, each with a set of two circles that range from not overlapping (score of 1) to completely overlapping (score of 7). One circle was labeled "you" and the other labeled "service dog." Participants were asked to "Choose the option that best describes the relationship between you and your service dog."

Importance of Trained and Untrained Service Dog Behaviors

Participants completed a questionnaire quantifying the perceived importance of a list of trained tasks and untrained service dog behaviors (**Table 4.1**). The questionnaire was developed with advice from service dog providers and experts in the field of human-animal interaction.

Seven trained tasks were assessed in this study based off tasks trained from the service dog provider (**Table 4.1**). These included the dog's ability to both interrupt and alert to anxiety or distress (including waking from nightmares), as well as positional commands to be used in public such as *block* and *cover*. The *block* command was split into two different variations: block to help provide personal space in public, and block to guard or protect the veteran from others in public. While the physical behavior of the service dog is identical in both versions, the distinction in wording was intentionally chosen to identify differences in veterans' perceived purpose of the behavior.

Ten untrained behaviors and characteristics were assessed based on qualitative reports from veterans with PTSD service dogs (Krause-Parello & Morales, 2018; Taylor et al., 2013; Yount et al., 2013). These included the service dog's companionship, non-judgmental support, source of love, calming presence, source of happiness, source of independence, help leaving the house, help connecting to family members, instilling a routine, and help with social interactions.

For each of the seven trained tasks and ten untrained behaviors, participants were asked on a scale of 1 ("Not at all important") to 5 ("Extremely Important") how helpful the behavior has been for their PTSD (or how helpful the behavior is *expected to be*, for those on the waitlist). A short narrative description accompanied each task or behavior/characteristic to aid in objectivity in interpretation (**Table 4.1**). An overall importance score was calculated for both trained tasks and untrained behaviors by averaging items. Cronbach's α in the current sample was 0.84 (trained task importance) and 0.87 (untrained behavior importance).

Table 4.1 Service dog trained behaviors and untrained behaviors or characteristics as described to participants in the survey

Trained Behaviors	
Interrupt/Alert to Anxiety	The dog lets the veteran know when they are feeling anxious and interrupts with a nose bump, placing head in lap, or some other behavior
Calm/Comfort Anxiety	The dog performs a calming behavior such as making physical contact (laying on top of handler, placing head in lap, gently leaning against the body) when the veteran feels distress or anxiety
Block (Create Space)	The dog positions itself horizontally in front of the veteran to create personal space
Block (Guard/Protect)	The dog positions itself horizontally in front of veteran to guard/protect
Cover (Watch Back)	Dog positions itself directly behind the veteran to "watch" the veteran's back
Social Greeting	The dog helps greet people in public by sitting/offering a paw
Wake Up from Nightmare	The dog recognizes that the veteran is having a nightmare and gently wakes them up
Untrained Behaviors or Characteristics	
Companionship	Dog is a "battle buddy", best friend, and companion
Non-judgmental	Dog does not judge person for PTSD
Love	Dog gives person something to love, and to feel loved in return
Calming	The dog's physical presence is calming and comforting
Happiness	Dog makes person smile and brings joy to their life
Independence	Dog is source of empowerment for veteran to do things on their own
Leave House	Dog enables veteran to leave house and feel at ease in public
Connecting to Family	Dog helps connect veteran to their family
Routine	Dog adds structure, routine, and responsibility to veteran's life
Social Help	Dog helps the veteran make friends and have comfortable social interactions

Frequency of Trained Task Use

For each of the seven trained tasks, participants were asked how often they currently used each task in a typical day (or how often they *expected to use* each task in a typical day, for those on the waitlist). As this was a free response question, most participants provided numerical frequency values, but text entries were possible. Text entries were coded into numeric responses by the research team (e.g., "Never" or "Once a day" were coded to 0 and 1, respectively, while ranges such as "4-5 times" were coded to 4.5). However, for 20 data points from n = 4 participants with a service dog and six data points from n = 2 participants from the waitlist, text entries were unable to be coded into a specific numeric value and thus were dropped from analysis (e.g. "all the time" or "only when I'm in public").

PTSD Symptom Specificity of Trained Tasks

Among only participants with a PTSD service dog, participants were given a list of the 20 symptoms from the PCL-5 and asked to indicate the trained tasks that have helped address each symptom using a check all that apply format. Participants were also given the option to indicate "Not Applicable" for any PTSD symptom.

4.3.4 Analysis Strategy

Analyses were conducted using Statistical Package for the Social Sciences (SPSS 24.0). To compare demographic characteristics by group, independent *t*-tests were conducted for the continuous variable of age and chi-squared tests were conducted for the categorical variables of sex, marital status, and pet dog ownership.

Importance of Trained and Untrained Service Dog Behaviors

Prior to analyses, importance values were examined for their distribution which determined a high degree of skewness. Importance values were log-transformed, which corrected the skew to a normal distribution. To compare expected and experienced importance of behaviors, a series of linear regressions were conducted which predicted log-transformed importance from the binary variables of having a service dog or not (yes or no) as well as participant sex (male or female), relationship status (single or married/cohabitating), if there was a pet dog in the home (yes or no), and PTSD severity (total PCL-5 score). Age was also considered as an independent variable, but

did not have any significant effects in models (p's > 0.10). Thus, age was excluded from further models to conserve power. Further, to reduce the number of statistical comparisons made, only the average untrained behavior importance score was compared across groups (rather than item-level comparisons). Within-group t-tests compared trained task importance to untrained behavior importance.

Linear regressions were conducted to determine the effect of PTSD severity, veteran-service dog relationship, and time since the service dog was placed on log-transformed perceived importance of behaviors. Independent variables included the demographic covariates above and PTSD severity (total PCL-5 score), as well as veteran-service dog closeness (IOS score) and time since service dog placement (in number of months) for those with a service dog. Cohen's *d* effect sizes were calculated based on the means, standard deviations, and sample sizes of each group using the cutoffs of 0.2 for a small effect, 0.5 for a medium effect, and 0.8 for a large effect (Cohen, 1988).

Frequency of Trained Task Use

The distribution of frequency values also had a high degree of skewness with several extreme outliers. To account for the fact that these outliers could lead to significant results that might not be representative, data were winsorized such that extreme values were replaced with the trimmed cutoff of three standard deviations from the mean. Using this approach, a total of 24 extreme values from 10 participants were replaced. After winsorizing, residuals did not follow normality assumptions. Winsorized values were then log-transformed, which resulted in normal residuals in subsequent linear regression models.

PTSD Symptom Specificity of Trained Tasks

For each participant, two scores were calculated. First, the number of tasks that were reported to help each PTSD symptom were summed such that a score of 0 indicated that the participant did not perceive any tasks to help the PTSD symptom (and/or they had indicated "Not Applicable"), and a score of 7 indicated that the participant perceived all seven trained tasks as helping the PTSD symptom. An average of this score was taken across all participants to calculate the average number of trained tasks that helped each PTSD symptom, with a possible score range from 0-7. Second, the number of PTSD symptoms that were helped by each trained task were summed such

that a score of 0 indicated the participant did not perceive the trained task to help any of the listed PTSD symptoms, and a score of 20 indicated the participant perceived the trained task to help all 20 PTSD symptoms. An average of this score was taken across all participants to calculate the mean number of PTSD symptoms helped by each trained task, with a possible score range from 0-20. A total of n = 10 participants who completed less than half of the PTSD symptom specificity survey were excluded from these summary scores in order to prevent skewed values.

4.4 Results

4.4.1 Demographics

Participants with a service dog (n = 134) and on the waitlist (n = 83) did not significantly differ in age (waitlist M = 39.63, SD = 9.06 years old; service dog M = 39.99, SD = 8.07 years old; $t = 0.30$, $p = 0.764$; age missing for n = 3 individuals with a service dog and n = 1 on the waitlist). In addition, groups did not differ by relationship status (waitlist 67% married or cohabitating, service dog 63%; $X^2 = 0.23$, $p = 0.631$; relationship status missing for n = 2 individuals on the waitlist), or whether they had a pet dog in the home or not (waitlist 45%, service dog 50%; $X^2 = 0.60$, $p = 0.437$). However, groups did significantly differ in sex; participants on the waitlist were more likely to be female than those with a service dog (waitlist 66% male, service dog 81% male; $X^2 = 6.59$, $p = 0.010$). Groups significantly differed in PTSD symptom severity, with those on the waitlist reporting more severe PTSD symptoms than those with a service dog (waitlist PCL-5 M = 58.97, SD = 12.96, service dog M = 44.34, SD = 17.13; $t = -6.62$, $p < 0.001$; Jensen, Rodriguez, & O'Haire, 2020).

4.4.2 Importance of Trained Tasks and Frequency of Task Use

Table 4.2 displays descriptive statistics of perceived importance and frequency of use of service dog trained tasks. Overall, participants with a service dog reported using a trained task an average of 3.16 (SD = 2.54) times a day (**Error! Reference source not found.**). Veterans with a service dog rated *calm/comfort to anxiety* as both the most important task and the most frequently used task. Similarly, *cover* and *interrupt/alert to anxiety* were rated as the second and third most important and most frequently used tasks, respectively. *Block to create space* and *block to*

guard/protect were rated nearly identically for both importance and frequency. Veterans rated the service dog's *social greeting* task as the least important behavior for their PTSD and the second least frequently used task. Perceived importance of the *social greeting* task had the largest variance among veterans with a service dog, indicating the most individual variability in responses. The least frequently used service dog task from veterans was *wake up from nightmare*. It is notable that even the lowest-rated tasks were still perceived on average as "moderately" important for veterans' PTSD. Overall, waitlist expectations of importance and frequency of use of trained tasks tended to be higher than what was experienced among veterans with service dogs (see *Expectations vs. Experiences*).

Table 4.2 Group comparisons of the expected and experienced importance of trained tasks for PTSD symptoms and frequency of trained task use per day

Task Importance	Service Dog (n = 134)		Waitlist (n = 83)		Group Difference		
	M	SD	M	SD	β	*p*	*d*
Total	**3.70**	**0.82**	**4.21**	**0.68**	-0.22	0.005**	0.68
Calm/Comfort Anxiety	4.23	0.97	4.43	0.74	-0.07	0.388	0.23
Interrupt/Alert to Anxiety	3.98	0.97	4.36	0.79	-0.06	0.447	0.43
Cover (Watch Back)	3.95	1.13	4.39	0.92	-0.13	0.125	0.43
Block (Create Space)	3.65	1.14	4.35	0.83	-0.25	0.002**	0.70
Block (Guard/Protect)	3.63	1.19	4.34	0.85	-0.24	0.002**	0.69
Wake Up from Nightmare	3.31	1.33	4.06	1.11	-0.18	0.025*	0.61
Social Greeting	3.18	1.51	3.54	1.15	-0.21	0.013*	0.27
Task Frequency	Service Dog (n = 97)		Waitlist (n = 63)		Group Difference		
	M	SD	M	SD	β	*p*	*d*
Total	**3.16**	**2.54**	**5.23**	**4.08**	-0.21	0.019*	0.61
Calm/Comfort Anxiety	5.05	4.60	6.48	4.84	-0.75	0.407	0.30
Cover (Watch Back)	4.08	4.90	6.43	6.75	-0.25	0.010*	0.40
Interrupt/Alert to Anxiety	3.43	2.61	5.92	4.36	-0.24	0.008**	0.69
Block (Guard/Protect)	2.61	4.02	5.09	5.61	-0.25	0.009**	0.51
Block (Create Space)	2.59	4.32	5.80	6.98	-0.33	0.001**	0.55
Social Greeting	2.34	2.69	3.82	3.52	-0.14	0.214	0.47
Wake Up from Nightmare	1.36	1.51	2.47	2.22	-0.05	0.621	0.58

Note: M, Mean; SD, Standard deviation; β, standardized regression coefficient controlling for participant sex, relationship status, presence of pet dog in the home, and PTSD severity; *d*, Cohen's d effect size; *, $p < 0.05$; **, $p < 0.01$; ***, $p < 0.001$.

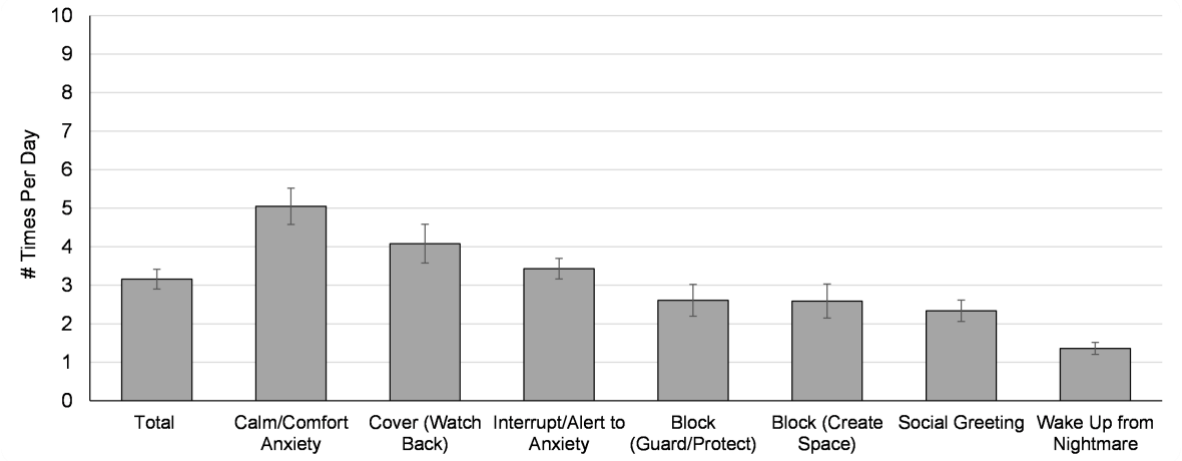

Figure 4-1 Mean frequency of task use in "a typical day" reported by n = 94 veterans with a service dog

Note: Values ordered from highest to lowest values. Error bars represent the standard error of the mean.

4.4.3 Importance of Untrained Behaviors

Overall, veterans with a service dog rated the importance of untrained behaviors higher than the importance of trained tasks ($M_{trained}$ = 3.70 of 5, $M_{untrained}$ = 4.42; t = -8.50, $p < 0.001$, d = 1.04). Table **4.3** contains descriptive statistics regarding veterans' perceived importance of untrained service dog behaviors and characteristics. Veterans with a service dog rated all ten untrained behaviors on average as "quite a bit" to "extremely" important for their PTSD symptoms. The most important untrained behavior for helping PTSD symptoms was the dog's ability to give the veteran something to love and to feel loved in return. The least important untrained behaviors for PTSD were the service dog's ability to connect them to their family and provide social help in public, but most participants on average indicated these behaviors were still "quite a bit" important for their PTSD. However, connecting to family and social help also had large standard deviations indicating that responses for these characteristics were quite varied. Expected importance of untrained behaviors did not significantly differ from what was experienced by those with a service dog (see 3.6, *Expectations vs. Experiences*).

Table 4.3 Means and standard deviations of the expected and experienced importance for PTSD symptoms of untrained service dog behaviors

Untrained Behavior/Characteristics Importance	Service Dog (n = 134)		Waitlist (n = 83)		Group Difference		
	M	SD	M	SD	β	*p*	*d*
Total	**4.42**	**0.54**	**4.41**	**0.56**	0.05	0.534	0.02
Love	4.79	0.52	4.70	0.66			
Companionship	4.75	0.53	4.67	0.57			
Calming	4.67	0.67	4.66	0.65			
Happiness	4.64	0.60	4.55	0.79			
Non-judgmental	4.51	1.13	4.61	0.87			
Routine	4.42	0.75	4.20	0.93			
Independence	4.29	0.85	4.42	0.80			
Leave House	4.29	0.88	4.40	0.90			
Social Help	3.95	1.06	3.96	1.10			
Connecting to Family	3.92	1.17	3.90	1.11			

Note: M, Mean; SD, Standard deviation; β, standardized regression coefficient controlling for participant sex, relationship status, presence of pet dog in the home, and PTSD severity; d, Cohen's d effect size; *, $p < 0.05$; **, $p < 0.01$; ***, $p < 0.001$.

4.4.4 PTSD Symptom Specificity of Trained Tasks

Table **4.4** contains descriptive statistics regarding the perceived helpfulness of each trained task for individual PTSD symptoms as reported by veterans with a service dog. For each trained task, veterans were asked to indicate which PTSD symptoms they were helpful for (if any). Across the seven trained tasks, there was considerable variability in the number of PTSD symptoms helped. However, the most widely relevant service dog task for veterans' PTSD symptoms was *calm/comfort to anxiety*, with veterans reporting this task to help an average of 12.73 of the 20 PTSD symptoms. This task was perceived as applicable to symptoms across all four symptom clusters. The second most widely relevant task was *interrupt/alert anxiety*, helping an average of 6.80 of the 20 PTSD symptoms. Most veterans perceived this task as being helpful to several intrusion symptoms as well as symptoms regarding alterations in arousal and reactivity. The task that veterans reported to help the least amount of PTSD symptoms on average was *social greeting*, helping an average of 1.14 PTSD symptoms. *Wake from nightmares* was also reported to help only 1.76 PTSD symptoms on average a majority of veterans reporting this task to help with intrusive dreams.

On average, the PTSD symptom helped the most by the service dog's trained tasks was hypervigilance, with veterans indicating an average of 2.74 trained tasks (of seven) were helpful

towards addressing this symptom. Further, 50% or more of veterans reported that four tasks (*interrupt/alert to anxiety*, *calm/comfort to anxiety*, *block to guard/protect*, and/or *cover/watch back*) helped their hypervigilance. Other PTSD symptoms helped by more than two tasks on average included intrusive memories of the traumatic event (M = 2.38 tasks), feeling jumpy or easily startled (2.28), feeling distressed when reminded of the traumatic event (2.16), and having strong physical reactions (e.g., heart pounding, sweating) when reminded of the traumatic event (2.12). On the contrary, the PTSD symptoms that were least helped by the service dog's trained tasks included trouble remembering the traumatic event (M = 0.56 of 7 tasks) and engaging in reckless behavior (M = 0.68 tasks). When asked if the service dog's trained tasks helped these two symptoms, 65% and 61% of veterans, respectively, indicated the service dog's training was "not applicable" to these symptoms.

Table 4.4 Means, standard deviations, and population percentages of the PTSD symptom specificity of trained behaviors.

DSM-V Symptom Cluster	PTSD Symptom (PCL-5)	M (SD) Tasks Helped	Calm/ Comfort Anxiety	Interrupt/ Alert to Anxiety	Block (Guard/ Protect)	Block (Create Space)	Cover (Watch Back)	Wake Up From Nightmare	Social Greeting	Not Applicable
Intrusion	Memories	2.38 (1.53)	84%	60%	16%	13%	27%	34%	12%	5%
	Dreams	1.68 (1.19)	57%	40%	5%	2%	5%	56%	1%	18%
	Flashbacks	2.00 (1.40)	75%	60%	16%	16%	15%	12%	4%	12%
	Cued distress	2.16 (1.46)	86%	56%	22%	22%	16%	8%	5%	5%
	Cued physical reactions	2.12 (1.35)	85%	54%	21%	22%	15%	11%	3%	5%
Avoidance	Avoiding internal reminders	1.71 (1.51)	70%	41%	17%	14%	15%	9%	6%	22%
	Avoiding external reminders	1.86 (1.84)	59%	32%	29%	35%	21%	4%	8%	24%
Negative Alterations in Cognition and Mood	Amnesia	0.56 (1.05)	27%	10%	6%	5%	5%	3%	1%	65%
	Negative beliefs	1.42 (1.46)	68%	20%	16%	8%	15%	5%	11%	23%
	Blame	1.07 (1.18)	56%	21%	7%	7%	7%	4%	4%	32%
	Negative feelings	1.48 (1.30)	74%	34%	13%	7%	13%	2%	3%	19%
	Loss of interest	1.36 (1.64)	51%	22%	18%	14%	14%	1%	15%	22%
	Detachment	1.50 (1.59)	65%	18%	17%	16%	13%	0%	22%	17%
	Numbing	1.15 (1.11)	68%	21%	6%	8%	2%	1%	9%	19%
Alterations to Arousal and Reactivity	Irritability/ aggression	1.92 (1.37)	74%	62%	16%	25%	10%	1%	4%	9%
	Reckless behavior	0.68 (1.13)	24%	21%	8%	7%	5%	1%	1%	61%
	Hypervigilance	2.74 (1.76)	76%	50%	54%	37%	50%	1%	7%	10%
	Startle	2.28 (1.70)	76%	35%	38%	33%	43%	1%	3%	13%
	Concentration	1.48 (0.97)	52%	25%	7%	13%	8%	0%	2%	33%
	Sleep	1.30 (1.17)	63%	14%	13%	3%	9%	28%	0%	20%
M (SD) Symptoms Helped			12.73 (4.98)	6.80 (4.68)	3.37 (3.68)	3.05 (3.56)	3.03 (3.24)	1.76 (2.14)	1.14 (1.90)	4.22 (4.11)

Note: Percentages represent the proportion of n = 120 veterans with a service dog who indicated that a given task helped each PTSD symptom, with darker colors indicating higher proportions. Average tasks helped represents the mean number of tasks (of 7) indicated to help each PTSD symptom by the overall sample. Average symptoms helped represents the mean number of PTSD symptoms (of 20) helped by each trained task for the overall sample. PTSD symptoms are ordered based on the PTSD checklist for DSM-5 (PCL-5), while trained tasks are ordered right to left based on the highest to lowest number of average PTSD symptoms helped.

4.4.5 Effect of PTSD Severity, Veteran-Service Dog Closeness, and Time since Service Dog Placement

Table 5 displays analyses examining the relationships between PTSD severity, veteran-service dog closeness, and time since service dog placement with importance and frequency outcomes. Among veterans with a service dog, there was no effect of PTSD symptom severity on trained task importance, untrained behavior importance, or frequency of task use. Specifically, veterans' PTSD symptom severity did not predict how often they used trained tasks in a given day, nor how important they rated trained and untrained behaviors for their PTSD. Among veterans with a service dog, veteran-service dog closeness was a stronger predictor of perceived importance and reported frequency of PTSD service dog behaviors (Table 5). Specifically, higher perceived veteran-service dog closeness was associated with higher perceived importance of both trained and untrained behaviors for the veteran's PTSD. Veterans who reported higher closeness with their service dogs also reported using the service dog's trained behaviors more often. There was no significant relationship between time since the service dog was placed and perceived trained task importance or untrained behavior importance. However, time since placement was a significant predictor of frequency of task use such that the longer the veteran had the service dog, the less frequently they reported using trained tasks on a daily basis.

Among veterans on the waitlist, PTSD symptom severity was a significant predictor of expected importance of trained tasks, but not untrained behaviors (Table 5). That is, veterans on the waitlist with more severe PTSD expected their future service dogs' trained tasks as being more important for their PTSD than veterans with less severe PTSD symptoms. In addition, PTSD severity was a significant predictor of expected task frequency, such that veterans on the waitlist with more severe PTSD symptoms expected to use the service dog's trained task more often on a daily basis in the future.

Table 4.5 Relationship of PTSD severity, veteran-service dog closeness, and time since placement with importance of untrained behaviors and trained tasks for PTSD symptoms and frequency of task use among veterans with service dogs or on the waitlist.

	Service Dog (n = 111)						Waitlist (n = 71)	
	PTSD severity		Veteran-service dog closeness		Time since placement		PTSD severity	
	β	*p*	β	*p*	β	*p*	β	*p*
Untrained Behavior Importance	-0.13	0.157	0.40	<0.001 ***	-0.03	0.776	0.09	0.437
Trained Task Importance	-0.04	0.666	0.35	<0.001 ***	0.03	0.790	0.49	<0.001 ***
Task Frequency	0.15	0.137	0.41	<0.001 ***	-0.36	0.001 **	0.41	0.001 **

Note: Data displayed includes standardized regression coefficients (β) and *p* values controlling for participant sex, relationship status, and presence of pet dog in home;
*, $p < 0.05$; **, $p < 0.01$; ***, $p < 0.001$

4.4.6 Expectations vs. Experiences

Overall, waitlist expectations of importance and frequency of use of trained tasks was significantly higher on average than what was experienced among veterans with service dogs. Specifically, after controlling for participant sex, relationship status, presence of a pet dog in the home, and PTSD severity, waitlist participants expected both overall task importance and four of the seven specific trained tasks to be more important for helping their PTSD symptoms than what was experienced by those with a service dog (Table 2). Tasks in which expected importance was not higher than experienced were *calm/comfort anxiety*, *interrupt/alert to anxiety*, and *cover*. Regarding frequency of use, participants on the waitlist again expected to use trained service dog tasks more frequently per day than those with a service dog reported. Specifically, veterans on the waitlist expected to use four of seven trained tasks (*cover, interrupt/alert to anxiety, block to guard/protect, and block to create space)* more frequently than what was reported by those with a service dog (Table 2). Similar to veterans with a service dog, those on the waitlist expected to use *calm/comfort to anxiety* the most often per day, followed by *cover (watch back)*.

Expected importance of untrained behaviors did not significantly differ from what was experienced by those with a service dog (Table 3). However, both groups reported near-ceiling importance for all ten untrained behaviors and characteristics. Aligning with experiences from those with a service dog, veterans on the waitlist perceived the service dog's ability to give the

veteran something to love and to feel loved in return as the most important untrained service dog characteristic. Similarly, veterans on the waitlist reported the service dog's ability to connect them to their family and provide social help in public as the least important untrained behaviors for PTSD. Overall, veterans on the waitlist rated the expected importance of untrained behaviors significantly higher than trained tasks ($M_{untrained}$ = 4.41, $M_{trained}$ = 4.21; t = 2.07, p = 0.040, d = 0.32).

Among the waitlist, PTSD symptom severity was a significant predictor of expected trained task importance and frequency of task use, but this relationship was not found for veterans with a service dog (Table 5). However, among both groups there was no relationship between PTSD severity and perceptions of the importance of untrained behaviors.

4.5 Discussion

4.5.1 General

The overall aim of this research was to both document and quantify the therapeutic use of PTSD service dogs to define the intervention while comparing relative expectations of those on the waitlist to everyday experiences of those with a service dog. The specific objectives of this research were to (1) quantify the importance of trained and untrained service dog behaviors towards alleviating PTSD symptoms, (2) quantify how often trained tasks are used while describing their PTSD symptom specificity (2) determine how PTSD symptom severity, the veteran-service dog relationship, and time since the service dog was placed may relate to importance and frequency outcomes, and (3) compare the expectations of those on the waitlist to the everyday experiences of veterans with service dogs. Results from this study offer valuable knowledge towards understanding the specific components and therapeutic value of PTSD service dogs, the PTSD symptoms that are helped most by the service dog's trained tasks, and quantifying the PTSD service dog intervention among a large and representative sample of military veterans both with a service dog and on the waitlist to receive one.

4.5.2 Trained Tasks

The first objective served to quantify critical components of the PTSD service dog intervention by describing the perceived importance and frequency of use of the service dog's

trained tasks. Although there was a moderate degree of individual variance observed, results suggest that all seven trained tasks were, in some capacity, valuable aspects of the PTSD service dog intervention from the perspective of this population. Among those with a service dog, all seven tasks were rated on average as "moderately" to "quite a bit" important for veterans' PTSD. Trained service dog tasks were used on average 3.16 times per day, with individual tasks ranging from an average of 1.36 to 5.05 times per day. While some trained tasks were broader in their helpfulness towards PTSD symptoms than others, veterans with service dogs reported that all seven trained tasks helped at least one PTSD symptom on average. Results provide critically necessary quantification of the perceived importance, use, and PTSD symptom specificity of psychiatric service dogs' trained tasks.

The trained tasks of *calm/comfort to anxiety* and *interrupt/alert to anxiety* were among the most centrally valued trained tasks for veterans' PTSD. These tasks were not only the most important for veterans' PTSD symptoms, but were also among the most frequently used tasks and rated to help the most number of individual PTSD symptoms. For example, *calm/comfort to anxiety* was reported as the most important task for PTSD (4.23 out of 5), the most frequently used task (5.05 times per day), and the task that helped the most number of specific PTSD symptoms (12.73 out of 20 symptoms on the PTSD Checklist). Similarly, *interrupt/alert to anxiety* was perceived as the second most important task (3.98 out of 5), the third most frequently used task (3.43 times a day) and helped the second most number of specific PTSD symptoms (6.80 out of 20 symptoms). These findings mirror qualitative reports suggesting that these anxiety-reducing service dog behaviors are valued by veterans for reducing hypervigilance and coping with re-experiencing episodes (Bergen-Cico et al., 2018; Crowe, Sanchez, Howard, Western, & Barger, 2018; Krause-Parello & Morales, 2018; Vincent, Belleville, Gagnon, Auger, et al., 2017; Yarborough et al., 2017). For example, in a 2017 qualitative study of the benefits of psychiatric service dogs, veterans described how the "nudging" behavior from their service dogs during a flashback episode served to help their PTSD by interrupting the distress, "grounding" the veteran, and reminding the veteran to stay in the present (Yarborough, Stumbo, Yarborough, Owen-Smith, & Green, 2018). Previous research with non-PTSD populations has also found that simply having a dog present when experiencing distress reduces both subjective stress (Lass-Hennemann, Peyk, Streb, Holz, & Michael, 2014) and objective, physiological biomarkers of stress (Polheber & Matchock, 2013). Overall, findings from this research indicate that the service dog's ability to

respond to the veteran's distress and serve as a calming presence during anxiety episodes are key mechanistic components of the PTSD service dog intervention.

The *cover* task was the second most frequently used task (4.1 times a day) and was reported to help the PTSD symptoms of hypervigilance and feeling "jumpy" or easily startled. This "watch my back" task is thought to replicate aspects of military comradery in which soldiers will guard each other's blind spots during combat. Previous qualitative reports have described the value of the *cover* task for reducing hypervigilance in public; veterans describe how their service dogs help "share the burden" of being continuously on alert or aware of approaching people (Yarborough et al., 2018). Interestingly, use of this task had the most variability among participants. Because *cover* is largely encouraged to be used when the veteran is hypervigilant of approaching people (such as in public), the observed variation in the frequency of use may be due to the range of experiences and needs from this population. For example, veterans who frequently engage in public activities may also use the cover task more frequently than a veteran who leaves their house less often. Future research may benefit from examining how veterans use tasks differently in different settings during the trajectory of their recovery and reintegration into society over time.

The *social greeting* task helped an average of 1.14 of 20 PTSD symptoms, thus was less broadly applicable to PTSD symptoms than other trained tasks. However, the task was still rated as "moderately" important on average for participants' PTSD. Similar to *cover*, the *social greeting* task is trained to especially assist veterans while in public when interacting with other people. Thus, veterans that go out in public more may both use this task more frequently and perceive greater benefit from the task towards alleviating PTSD symptoms such as detachment from others. Research has shown that both pet dogs and service dogs can be useful as a "social bridge" to facilitate social interaction with strangers (e.g., Eddy, Hart, & Boltz, 1988; McNicholas & Collis, 2000). Additionally, research has found that veterans with PTSD service dogs report less social isolation and more social participation than veterans on the waitlist for a service dog receiving treatment as usual (Bergen-Cico et al., 2018; O'Haire & Rodriguez, 2018; Whitworth et al., 2019). In this context, the *social greeting* task may serve as a key component of this observed improvement in social interactions.

The *wake up from nightmare* task, in which the dog recognizes signs of physical distress in the veteran at night and wakes them from sleep, was also more specific in the PTSD symptoms that were helped. Although this task did not have the breadth of addressing many PTSD symptoms,

it had more specificity in targeting PTSD symptoms such as intrusive memories, nightmares, and sleep disturbances. This finding aligns with qualitative reports describing how veterans have benefited from their service dog's ability to interrupt nightmares and improve sleep quality (Krause-Parello & Morales, 2018; Yarborough et al., 2018). In the current study, 57% of veterans reported that this task helped them with their trauma-related nightmares. It is unknown whether the remaining veterans may have had minimal nightmare symptomology or may have had service dogs that did not actively engage in nightmare-awakening behavior. Regardless, for those veterans that benefit from this trained task, the service dog's interrupting behavior during nightmares appears to be an important aspect of the PTSD service dog intervention.

Interestingly, neither veterans with a service dog nor on the waitlist rated the two different versions of *block – block to create personal space* and *block to guard/protect* – differently in terms of importance, frequency, or value for PTSD symptoms. The *block* task has specifically been subject to controversy; mental health professionals have argued that using block may encourage the veteran to maintain fear and avoidance behaviors in public, which is contradictory to the goals of traditional exposure treatment for PTSD (M. L. Kloep, Hunter, & Kertz, 2017). While our research did not specifically quantify this potential relationship, results do suggest that military veterans perceived both versions of *block* to be "moderately" to "quite a bit" important for their PTSD, on average. A second criticism of the *block* task is that its perceived use to guard or protect the veteran from others may perpetuate and reinforce negative views about their environment. While slightly more veterans with a service dog reported *block to guard or protect* as addressing their hypervigilance than *block to create personal space*, frequency of use of either version of the task was not significantly related to the veteran's current PTSD symptomology. The two versions of *block* may not have been rated differently due to participants not perceiving the nuances of the differential survey wording. For example, some veterans may have perceived *block to guard and protect* as inherently allowing for personal space. In a 2018 qualitative study, veterans described how their service dogs' stature and presence created a physical barrier between them and others in public to both prevent individuals from coming too close *and* creating a sense of security (Lessard et al., 2018). Future research will be necessary to elucidate the underlying perceptions of veterans who regularly use the *block* task and how it relates to their avoidance symptomology and views regarding their social environment.

4.5.3 PTSD Symptom Specificity

Among veterans with a service dog, trained tasks addressed almost every PTSD symptom from the DSM-5. On average, intrusion symptoms were helped by the most number of tasks. That is, veterans reported that their service dogs helped mitigate intrusive memories or flashbacks of the traumatic experience as well as internal and physical distress from the memories. These symptoms were mainly addressed by the trained tasks of *calm/comfort to anxiety* and *interrupt/alert to anxiety*. In this context, the service dog's calming presence and interrupting behaviors (e.g., licking, pawing) can serve to anchor the veteran in the present, thereby distracting them from the flashback while providing a calming sense of relief from the internal and/or external distress.

The two PTSD symptoms that were not helped for a majority of veterans with service dogs were amnesia (i.e., having trouble remembering parts of the traumatic experience) and engaging in risky or reckless behavior. This finding is to be expected since research has suggested that service dogs are not a standalone "cure" for PTSD. Rather, PTSD service dogs are an complementary treatment to address symptoms as a supplement to evidence-based treatment (O'Haire & Rodriguez, 2018). Thus, it is unrealistic to expect a service dog to address all aspects of PTSD symptomology. In a 2017 longitudinal study, veterans' PTSD symptomology significantly decreased with clinically meaningful change after 3 months with a PTSD service dog, but only 12 of the 17 PCL symptoms showed significant improvement on an item-level (Vincent, Belleville, Gagnon, Dumont, et al., 2017). Both this research as well as current findings provide specificity regarding the PTSD symptoms that are both helped and not helped by service dogs. This information is not only critical to guide clinician's understanding of how these service dogs may benefit PTSD symptomology, but is also important knowledge for service dog providers when educating potential and current clients on how a service dog may help PTSD.

4.5.4 Untrained Behaviors

Overall, the service dogs' untrained behaviors were considered more important than trained tasks for veterans' PTSD. Specifically, among both those with and without a service dog, eight of the ten behaviors or characteristics were rated "quite a bit" important for their PTSD (on a scale from "not at all" to "extremely"). These included aspects of the service dog that can also be shared

by a pet dog or an emotional support dog such as the dog's ability to provide companionship, non-judgmental support, love, a calming presence, happiness, and a sense of routine. In a 2013 survey of 30 military veterans with PTSD who benefited from their pet dogs, veterans similarly reported feeling calmer, less lonely, and less depressed from their dog's companionship (Stern et al., 2013). However, although most veterans reported that their pet dogs tried to "cheer me up when I'm feeling bad," there was no significant impact of the pet dog on the PTSD symptoms of intrusive memories, flashbacks, or nightmares (Stern et al., 2013). Overall, results from both the Stern et al. study and the current research suggest that untrained aspects of canine companionship, inherent to most pet dogs, may be therapeutic for the mental and social health of military veterans with PTSD. However, in addition to the helpfulness of the service dog's specific training towards interrupting and calming anxiety and assisting the veteran in public, this research found that characteristics specific to service dogs (e.g., providing a sense of independence, allowing the veteran to leave the house, and feeling at ease in public) were rated just as highly as the other untrained behaviors such as providing love and companionship. Future research is necessary to fully disentangle how the service's untrained and trained behaviors may dually contribute to the therapeutic components of the PTSD service dog intervention. Considering the costs and long waitlists associated with preparing and placing trained service dogs, further research is warranted to determine the potential value of pet dogs and emotional support dogs for this population as an alternative.

4.5.5 Effects of PTSD Severity, Veteran-Service Dog Closeness, and Time since Placement

Surprisingly, results showed that PTSD severity was not an important significant predictor of task importance or frequency of use among those with a service dog. Specifically, the severity of a veteran's PTSD did not have a significant relationship with how important the veteran perceived his or her service dog's trained or untrained behaviors, nor how often he or she used most trained tasks on a daily basis. These null findings may be partially due to the wide variety of experiences from those with a service dog. For example, one might assume that veterans with more severe PTSD both use trained tasks more frequently and view those tasks as more important. However, some veterans with severe PTSD may infrequently leave their house or engage with strangers resulting in less use of tasks that are most suited to being in public, such as the *cover* or *block* tasks. On the other hand, one might assume that veterans with sub-clinical PTSD may use their service dog's trained tasks less often due to decreased need. However, veterans who are

actively reintegrating into society may be using their service dog's tasks more often to help mitigate symptoms (e.g., in a school or workplace environment). Thus, these individual variances may have diluted any clear relationship on a population level.

Veteran-service dog closeness was a significant predictor of both perceived importance and frequency of use of trained tasks. The closer a veteran perceived their service dog to themselves on the IOS scale, the more they viewed their service dog's tasks as important for their PTSD and the more frequently they used the tasks. Veteran-service dog closeness was also positively related to the importance of untrained service dog behaviors. These findings confirm the important moderating relationship that the veteran-service dog bond has in explaining PTSD service dog use and benefits. However, the causational direction of this finding is unable to be determined. Specifically, it remains unclear whether obtaining the benefits of a service dog's trained or untrained behaviors leads to higher perceived closeness, or if veterans with a closer relationship with their dogs perceive their service dog to be more therapeutic for their PTSD. However, it is likely that some of the service dog's trained tasks such as waking from nightmares or alerting to rising anxiety or distress require a certain degree of closeness between the veteran and service dog to precede frequency. Indeed, qualitative reports have suggested that as the bond grows stronger between the veteran and service dog, the dog becomes more likely to become sensitive to the veteran's 'triggers' and emotional state in order to alert to the veteran's anxiety, intervene during a flashback, and/or wake him or her from nightmares .

Finally, time since placement of the service dog was a significant predictor of frequency of trained task use. Specifically, veterans who have had their service dogs for longer reported using trained service dog tasks less often than veterans who have had their service dogs for shorter periods. This finding partially supports a popular stance of the PTSD service dog community that reliance on a PTSD service dog decreases over time as the veteran builds healthy coping skills, reintegrates into society, and decreases avoidance behaviors in public. However, our analyses did not take into consideration engagement with other PTSD treatments over time, which may be an important moderating factor of task use. Future, longitudinal research is necessary to fully understand how the use of trained tasks may vary over time and across individual.

4.5.6 Expectations vs Experiences

Overall, results suggest that veterans on the waitlist reported higher expectations than what was experienced by those already with a service dog. Specifically, veterans on the waitlist to receive a service dog expected the service dog's trained tasks to be more important for their PTSD and used more frequently on a daily basis than what was reported by veterans with a service dog. Veterans on the waitlist with more severe PTSD symptoms also expected service dogs' trained tasks to be more important for their PTSD and to use these tasks more often compared to veterans on the waitlist with less severe PTSD. These findings may be explained partly by veterans' feelings of hope and excitement regarding their future PTSD service dog, which may not necessarily be a bad thing. In cognitive-behavioral interventions for PTSD and other types of anxiety disorders, this positive motivational state of hope and optimism may actually play a role in treatment success by mediating clinical improvement (Gilman, Schumm, & Chard, 2012; Snyder et al., 2000).

On the other hand, there is value in education regarding what to expect from a PTSD service dog. While this research did not directly assess veterans' expectations regarding potentially negative aspects of the service dog intervention, qualitative research with this population has indicated discrepancies between expectations and actual experiences in terms of drawbacks of having a service dog are important. For example, veterans who recently received a service dog report difficulty in coping with the added stressors of maintaining the dog's training, integrating the dog into their family, and receiving unwanted attention in public (Yarborough et al., 2018). In addition, one crucial expectation is that sometimes improvements in PTSD symptoms and quality of life may not be immediate, and the initial transition period of integrating the PTSD service dog into the veteran's life may create additional stress, anxiety, and fatigue (Yarborough et al., 2018). In a 2019 survey of PTSD service dog providers, difficulties including discrepancies in the veteran's and program's expectations as well as problems with maintaining at-home training were both reported to lead to dropouts (Vincent et al., 2019). In fact, research supports that conducting interventions with patients regarding what to expect from a given treatment can have meaningful effects on improving dropout, satisfaction, and even treatment success (Noble, Douglas, & Newman, 2001). Regardless of the specific goals and motives that a veteran has for applying for a PTSD service dog, it is important for service dog providers, mental health professionals, and occupational therapists involved in treatment decisions to instill accurate expectations regarding the therapeutic value and potential drawbacks of a PTSD service dog.

4.5.7 Limitations

This research is not without its limitations. First, the study population was recruited from a single, national service dog provider. We do not know if our findings would be replicated if we had surveyed populations that had received dogs from other PTSD service dog providers. Not only do different providers have varying training philosophies and models (e.g., programs in which the veteran is entirely hands-on in training their service dog), but not all providers train for the same service dog tasks (Vincent et al., 2019). Therefore, future research and replication are necessary to disentangle provider-specific variation in PTSD service dog task use and efficacy. Additionally, the population was limited to military veterans who had experienced service-related trauma. Thus, findings may not generalize to other populations of trauma survivors. Second, a participation bias may have been present such that veterans with a service dog who chose to participate in this research may have had comparatively more positive experiences with their service dogs than those who declined to participate. Veterans who had experienced negative outcomes from obtaining a service dog were also likely not in our participant pool as these individuals often return their service dogs to the provider. As the psychiatric service dog field grows, researchers should begin to quantify both when and why a PTSD service dog may not be efficacious for PTSD symptoms for some individuals. Finally, this research did not aim to quantify past history of stressful life events and specific sources of trauma, but rather assessed currently symptomology via the PCL-5 in relation to a general stressful event. This may have resulted in a mismatch in symptom identification to other current or past sources of trauma. This study also did not quantify other treatments and interventions that veteran participants were engaging in for their PTSD apart from a service dog. However, both trauma type/history and engagement with other PTSD treatments (e.g. medications, psychotherapy) may have important influence on experiences and perceived value of PTSD service dogs. Future research will benefit from examining how these individual differences may explain potential variance in how veterans are incorporating their PTSD service dogs into their lives.

One population limitation is that groups were not equal on all demographic variables; more females were on the waitlist to receive a service dog than already placed with a service dog. The service dog provider schedules separate placement classes for males and females. Thus, this observed difference is likely due to sampling at a time before a large female-only class had occurred. We attempted to control for this limitation by controlling for sex in all models.

Participants' race and ethnicity were also not collected, nor was time spent on the waitlist, which may have explained outcome variance. Another limitation of this research is that it relies on self-reported accounts, so recall or expectancy biases may have been present. However, most of the constructs in this study were subjective experiences in nature, such as the perceived importance of the service dog's behaviors and perceived closeness with the service dog. Thus, self-reported data was critical to the research question. A final limitation is that we did not exclude veterans who had recently received their service dogs from participation. This decision was made to both maximize sample size and variability in exploring the effects of time since service dog placement on outcomes. Many service dog providers suggest that most veterans require an initial adjustment period of up to 6 months to develop a bond with the service dog and integrate the dog into their routines and lives. Therefore, some variation observed in importance, frequency, and value of trained tasks may have been partially due to the inclusion of veterans who may have still been in this adjustment period. Future longitudinal research will be necessary to determine how the use and perceived value of PTSD service dogs may evolve over the initial time following placement.

4.6 Conclusions

In conclusion, these results provide valuable quantification of the critical components of the PTSD service dog intervention while describing the everyday experiences and expectations surrounding PTSD service dog's behaviors. This information is critical for advancing our understanding of how and why PTSD service dogs are beneficial for improving PTSD symptomology and quality of life.

The first two objectives of this research documented how important certain service dog behaviors are for a veteran's PTSD symptoms while quantifying how often trained service dog tasks are used on a daily basis. Findings determined that military veterans with a service dog viewed the dog's calming and interrupting behaviors when experiencing anxiety as the most important trained tasks for their PTSD, among the most frequently used tasks in a typical day, and the tasks that helped the most number of PTSD symptoms. However, all seven trained service dog tasks were rated as at least "moderately" important for PTSD, used on average at least once per day, and helped almost all of 20 PTSD symptoms except amnesia and reckless behavior. Further, results suggest that the untrained qualities of a PTSD service dog are essential to their therapeutic value; veterans viewed most untrained behaviors and characteristics as "extremely" important for

their PTSD, including the dog's source of love and companionship. Findings provide a much-needed quantification of the clinically-relevant value of PTSD service dogs beyond purely qualitative, free-response research.

The second objective of this research aimed to understand how individual differences may contribute to outcomes and change over time. Findings suggest that veteran's PTSD symptoms did not predict either their perceptions of the importance of their service dog's behaviors or the use of the service dog's trained tasks in a typical day. However, veterans who reported feeling closer to their service dogs tended to report using trained tasks more often, and veterans who had their service dogs for longer reported using trained tasks less often. Those reporting more veteran-service dog closeness also viewed the service dog's trained tasks as more important for their PTSD. Not only are these findings critical within the context of interpreting outcomes in future longitudinal, controlled trials, but they also shed light on the substantial contribution of the human-animal bond in the PTSD service dog intervention.

As a final objective, this research compared expectations of veterans on the waitlist to receive a service dog to the everyday experiences of veterans with a service dog. Findings suggest that, on average, individuals on the waitlist not only expected to use their service dogs more often than what was experienced, but also expected trained tasks to be more important for their PTSD symptoms. Veterans' PTSD severity also had a significant positive relationship with how important they expected the service dog's trained tasks to be for their symptoms, in addition to how frequently they expected to use these tasks daily. These findings specifically help to enable providers, practitioners, and veterans to recognize what to expect from service dogs as a complementary treatment for PTSD.

Overall, this study's findings contribute to emerging knowledge on psychiatric service dogs as a potential complementary treatment option for military veterans with PTSD. This study documented how often trained service dog tasks are used, how important each task is for managing PTSD symptoms, and how these outcomes may relate to PTSD symptom severity, the human-animal bond, and time since receiving the service dog. This research provides critical information to not only interpret research outcomes, but also to optimize future therapeutic efficacy of the PTSD service dog intervention.

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CHAPTER 5. PRELIMINARY EFFICACY OF SERVICE DOGS AS A COMPLEMENTARY TREATMENT FOR POSTTRAUMATIC STRESS DISORDER IN MILITARY MEMBERS AND VETERANS

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5.1 Abstract

Objective: Psychiatric service dogs are an emerging complementary treatment for military members and veterans with posttraumatic stress disorder (PTSD). Yet despite anecdotal accounts of their value, there is a lack of empirical research on their efficacy. The current proof-of-concept study assessed the effects of this practice.

Method: A non-randomized efficacy trial was conducted with 141 post-9/11 military members and veterans with PTSD to compare usual care alone (n = 66) versus usual care plus a trained service dog (n = 75). The primary outcome was longitudinal change on the PTSD Checklist, including data points from a cross-sectional assessment and a longitudinal record review. Secondary outcomes included cross-sectional differences in depression, quality of life, and social and work functioning.

Results: Mixed model analyses revealed clinically significant reductions in PTSD symptoms from baseline following the receipt of a service dog, but not while receiving usual care alone. Though clinically meaningful, average reductions were not below the diagnostic cutoff on the PTSD Checklist. Regression analyses revealed significant differences with medium to large effect sizes among those with service dogs compared to those on the waitlist, including lower depression, higher quality of life, and higher social functioning. There were no differences in employment status but there was lower absenteeism due to health among those who were employed.

Conclusions: The addition of trained service dogs to usual care may confer clinically meaningful improvements in PTSD symptomology for military members and veterans with PTSD, though does not appear to be associated with a loss of diagnosis.

5.2 Introduction

Posttraumatic stress disorder (PTSD) is a trauma and stressor-related disorder that adversely affects the mental health and quality of life of a substantial number of United States military members and veterans (American Psychiatric Association, 2013; Kang, Natelson, Mahan, Lee, & Murphy, 2003; Kulka et al., 1990). The traumatic event of experiencing combat violence associated with military deployment is particularly associated with a risk of developing PTSD, enough so that the recognition of the disorder by modern psychiatry in 1980 was largely brought about as result of the mental health experiences of military members returning from the Korean and Vietnam Wars (Trimble, 1985). An estimated 6-14% of all Operation Iraqi Freedom (OIF) and Operation Enduring Freedom (OEF) military veterans returning from deployments to Iraq or Afghanistan are affected by PTSD (Hoge et al., 2004; Tanielian & Jaycox, 2008). Further, PTSD in this population is linked to negative comorbidities such as major depression (Grieger et al., 2006), alcohol and substance abuse (Jacobson et al., 2008), and suicidal behavior (Kemp & Bossarte, 2013).

The demand remains high for effective PTSD treatment options for military personnel. Current evidence-based treatments for PTSD are effective for many individuals; however, dropout and nonresponse rates can be up to 50% (Hoge et al., 2014; Mott et al., 2014; Schottenbauer, Glass, Arnkoff, Tendick, & Gray, 2008). These high dropout and nonresponse rates may be explained by barriers to receiving mental health care specific to the military population. Such barriers can range from conflicts with work, school, or family commitments to social stigmas and stereotypes surrounding treatment (Ouimette et al., 2011; Pietrzak, Johnson, Goldstein, Malley, & Southwick, 2015). Further, common symptoms of PTSD and depression such as denial, avoidance, and helplessness can exacerbate the problem (Sayer et al., 2009). It is therefore imperative to discover and evaluate alternative and complementary therapies (Bomyea & Lang, 2012; Cukor, Spitalnick, Difede, Rizzo, & Rothbaum, 2009). In particular, there is a need to evaluate complementary treatment options for PTSD that encourage engagement and retention while directly or indirectly addressing the comorbidities of the diagnosis (Hoge et al., 2014; Ouimette et al., 2011; Pietrzak et al., 2015).

One of these emerging treatment options is the placement of a specially trained PTSD service dog. Psychiatric service dogs are distinguished from emotional support, therapy, or companion dogs by specifically being trained to perform a variety of commands relevant to the psychiatric

needs of the individual and thus are legally allowed public access under the Americans with Disabilities Act (ADA; Kruger & Serpell, 2010; Tedeschi, Fine, & Helgeson, 2010). These service dogs are thought to mitigate PTSD symptomology by instilling a sense of confidence, safety, and independence in the veteran on a day-to-day basis. Specific tasks can range from responding to and distracting a veteran from panic or emotional distress, "watching" their back in public, and waking them up from nightmares. PTSD service dogs may also alleviate anxious arousal/hypervigilance, avoidance, and feelings of isolation and detachment from others (Taylor, Edwards, & Pooley, 2013; Yeager & Irwin, 2012; Yount, Ritchie, Laurent, Chumley, & Olmert, 2013). As a result of the dog's presence, individuals also report increased social confidence enabling them to leave their house, interact with friends and strangers, and reintegrate into society (Newton, 2014; Rubenstein, Debboun, & Burton, 2012; Stern et al., 2013; Yount et al., 2013).

Beyond anecdotal and largely retrospective reports, recent systematic reviews of the literature on Animal-Assisted Intervention (AAI) for PTSD reveal that there is a notable absence of peer-reviewed, empirical studies of the efficacy of service dogs for alleviating PTSD symptoms (Krause-Parello, Sarni, & Padden, 2016; O'Haire, Guérin, & Kirkham, 2015). Therefore, there is a critical need to evaluate proof-of-concept of the therapeutic efficacy of psychiatric service dogs for individuals with PTSD as this practice increases in its media attention and receives national financial and political attention from governmental organizations such as the U.S. Department of Veterans Affairs (Saunders et al., 2017). There is a further need for increased public awareness of the role and evidence-based outcomes of service dogs for PTSD.

The objective of this research was to empirically evaluate the effects of service dogs on standardized assessments of PTSD symptomology, depression, quality of life, and social and employment functioning in military members and veterans diagnosed with PTSD. To achieve this objective, we compared two groups: (1) individuals receiving usual care while on the waitlist to receive a service dog and (2) individuals receiving usual care plus the addition of a service dog. Our hypothesis was that participants with PTSD who have been placed with a service dog will show decreased PTSD symptom severity, decreased depression, increased quality of life, and greater overall social functioning compared to those receiving usual care while on the waitlist to receive a PTSD service dog.

5.3 Methods

5.3.1 Participants

Participants were recruited between November 2015 and February 2016 from a national sample of 304 individuals who applied and were approved to receive a trained PTSD service dog from an accredited service dog provider, K9s For Warriors. Inclusion criteria consisted of: (1) military service after September 11, 2001, (2) a clinician referral letter verifying a diagnosis of PTSD or meeting the clinical cutoff of 50 on the validated PTSD Checklist (PCL) (3) honorable discharge or current honorable service, (4) no substance abuse, (5) no conviction of any crime against animals, and (6) no more than two pet dogs currently in the home. A lack of prior history with substance and/or animal abuse were self-reported and confirmed by the organization via a background check. All participants had applied for and been approved to receive a service dog from K9s For Warriors. Approximately half of the sample was on the waitlist to receive a service dog and the other half had already received a service dog.

Usual care

Both participants on the waitlist and those with a service dog had unrestricted access to usual care during the course of the study. Unrestricted access indicates that no constraints were made on participant treatment usage. Participants were not directed towards any specific services, and were allowed to continue to receive intervention services and seek advice from medical professionals as they normally would. No statements were made to participants about their usual care, including continuing or altering treatment services. The frequency of PTSD treatment sessions and perceived improvements were recorded.

Waitlist group

Participants in the waitlist group had previously submitted an application to the service dog provider, K9s For Warriors. They had been on the waitlist between 2 months to 2.4 years (M = 0.64, SD = 0.36 years). Their application had been approved and they were currently waiting until their scheduled date to receive a service dog. Receipt of a service dog occurs in order of application.

Service dog group

Participants in the service dog group had been previously provided a PTSD service dog from K9s For Warriors. They had been paired with a service dog for between 1 month to 4 years (M = 1.64, SD = 1.07 years). The service dogs (predominantly Labrador Retrievers, Golden Retrievers, and Mixes) were primarily rescued from animal shelters and were selected based on a suite of characteristics ranging from physical size to temperamental demeanor. Participants placed with a service dog attended a three-week training class on site at K9s For Warriors headquarters in which they learned how to live with, care for, and maintain training with their future service dog before being sent home. Training classes consist of 6-8 recipients on average, in which all individuals live in dormitories on site and attend daily, scheduled activities to learn how to work with their service dogs both in public and private settings. Trained commands for each service dog ranged from basic obedience including sit, stay, down, and heel as well as a variety of commands specifically trained to mitigate PTSD symptoms. Examples of these trained tasks include alerting to anxiety or agitation to interrupt or prevent a panic attack, waking from nightmares, leaning against or standing in front of a veteran in social spaces to provide comfort and create personal space, retrieving and reminding to take medication, and allowing the veteran to physically brace on the dog for stabilization.

5.3.2 Procedure

The study protocol was approved by the Purdue University Human Research Protection Program Institutional Review Board (IRB Protocol 1504015973). No interactions occurred between the research team and the dogs during the course of the study; therefore a waiver was obtained from the Institutional Animal Care and Use Committee (IACUC).

The study consisted of both cross-sectional and longitudinal assessments. Cross-sectional assessments compared a single time point across the waitlist and service dog groups at the time of study, and thus directly compared current differences between those with and without a service dog. Longitudinal assessments consisted of previously collected PTSD assessments on file with the service dog provider, in addition to a current PTSD assessment as part of the study. The aim of the longitudinal assessments was to evaluate the trajectory of PTSD symptomology across five time points: (1) baseline (initial application to the service dog provider), (2) during the waitlist period, (3) immediately prior to service dog acquisition, (4) 3-weeks after service dog acquisition

and (5) at follow-up once the service dog is in the home. The time points collected for each group are presented in Table 3.

For time points in the current study, all current or active recipients from the K9s For Warriors database were sent an initial study packet in the mail, which included information about the study protocol, participation materials, and $20 cash as remuneration for time spent reviewing materials. The mailing response rate was 46% (n = 141 of 304). Following voluntary informed consent, participants completed a battery of standardized, self-report assessments online (94%) or through the mail (6%). They also consented to allow research personnel to access their PTSD assessments on file with the service dog provider for longitudinal assessments. Upon completion of the study protocol, participants received an additional $20 in remuneration.

5.3.3 Measures

Usual Care

Participants' usual care treatment was assessed with a subset of questions from the *American Legion Survey of Effectiveness of PTSD Treatments* (Greenberg, 2014). The questions asked if the participant currently received treatment for PTSD, TBI or MST as well as the frequency of treatment sessions and perceived level of improvement since receiving care on a scale of 1 to 10 (1=got worse, 5=no change, and 10=significantly better).

Posttraumatic Stress Disorder

The primary outcome measure of PTSD severity was assessed both cross-sectionally and longitudinally using the *PTSD Checklist (PCL)*, a widely used 17-item scale based on the three DSM-IV symptom clusters of re-experiencing (subscale B) avoidance (subscale C) and arousal (subscale D) (Weathers, Litz, Herman, Huska, & Keane, 1993). A total score above 50 on a scale of 17 to 85 indicates a positive screening for PTSD for military personnel with a higher score indicating greater overall symptom severity (Forbes, Creamer, & Biddle, 2001). In addition, a change of 10 points is considered clinically meaningful. Cronbach's α's in the current sample were 0.85, 0.92, 0.92, 0.93 and 0.92 for the five assessment points, respectively.

Depression

Due to the multifaceted nature of depression, two outcome measures were enlisted to capture the breadth of self-reported depression characteristics. The *Patient Health Questionnaire (PHQ-9)* a 9-item tool for assessing depression and is commonly used for screening and diagnosis ($\alpha = 0.89$) (Kroenke, Spitzer, & Williams, 2003). Cronbach's α for the current sample was 0.95, indicating high reliability.

The Patient Reported Outcomes Measurement Information System (PROMIS) is a set of highly reliable, precise measures of physical, mental, and social well-being (Cella et al., 2010). The *PROMIS Depression* adult short-form 8-item scale was used with a higher score indicating greater depression. Cronbach's α for the current sample was 0.84 indicating high reliability.

Quality of Life

The *Veteran's RAND 12 Item Health Survey* (VR-12) is a health-related quality of life survey summarized into two scores, a physical component summary and a mental component summary (Iqbal et al., 2007). Higher scores indicate better overall health quality of life in either the mental or physical domain.

The *Satisfaction with Life Scale (SWLS)* is a 5-item instrument designed to measure judgments of satisfaction with one's life (Diener, Emmons, Larsen, & Griffin, 1985). A higher score on the SWLS indicates higher life satisfaction. Cronbach's α for the current sample was 0.85 indicating high reliability.

The *Bradburn Scale of Psychological Wellbeing (BSPW)* is a 5-item scale that assesses positive wellbeing (Bradburn, 1969). A higher score on the BSPW indicates higher positive well-being. Cronbach's α for the current sample was 0.54 indicating moderate reliability.

The *Connor Davidson Resilience Scale (CDRS)* is a 25-item scale that measures resilience, or the capacity to change and cope with adversity (Connor & Davidson, 2003). A higher score on the CDRS indicates greater resilience. Cronbach's α for the current sample was 0.92 indicating high reliability.

Social & Work Functioning

Three PROMIS scales were used to measure overall social functioning. The *PROMIS Ability to Participate in Social Activities* adult short form is an 8-item scale with higher scores

indicating greater social participation. The *PROMIS Social Isolation* adult short form is an 8-item scale with higher scores indicating greater social isolation. The *PROMIS Companionship* adult short form is a 6-item scale with higher scores indicating a greater perceived level of companionship. Cronbach's α's for the current sample were 0.93, 0.91, and 0.93 for the three scales, respectively.

The *Work Productivity and Activity Impairment Questionnaire: General Health V2.0 (WPAI)* is a 6-item questionnaire that assesses the effect of an individual's health problems on their ability to work and perform regular activities (Reilly, Zbrozek, & Dukes, 1993). It measures absenteeism and impairment at work as well as overall activity impairment as a result of one's health.

5.3.4 Data Analysis

Data analyses were performed in two phases. First, demographic, military, and clinical characteristics of participants were compared using independent samples t-tests for continuous variables and chi-squared tests for categorical variables. Second, to examine differences in outcome measures based on condition (control vs service dog), we conducted a series of linear mixed effects models. Longitudinal data included participants followed during the waitlist period only (n = 66) as well as participants followed during both the waitlist and service dog periods (n = 75). For data with multiple time points per participant (i.e. PCL), we used hierarchical linear modeling (Raudenbush & Bryk, 2002) to examine differences in outcomes over time (within-subjects). For data with a single time point per participant (all other outcome measures), we compared the waitlist group to the service dog group using linear regression (Seber & Lee, 2012) to examine differences in outcome as a function of condition (between-subjects). In all models, sociodemographic variables (i.e. age, sex, marital status) were included as additional control covariates. Effect sizes are reported using Cohen's d, with 0.20, 0.50, and 0.80 indicating small, medium, and large effect sizes, respectively (Cohen, 1992).

5.4 Results

5.4.1 Demographic characteristics

A total of 141 participants with PTSD completed the study, including 66 receiving usual care while on the waitlist and 75 receiving usual care while paired with a service dog. Demographic and military characteristics are displayed in Table **5.1**. The sample was predominantly male (n = 110, 78.0%) with an average age of 37.1 years (S.D. = 8.3). Most participants had a significant other, spouse, or partner (n = 111, 78.7%) with an average of 3.1 people living in the household, including the participant (S.D. = 1.6). A subset of the sample (n = 55, 39.0%) required mobility aids. Approximately one-third of the sample had completed a college degree or higher (n = 47, 33.3%). The most common military branch was the Army (n = 93, 66.0%), with deployments to both Iraq (n = 90, 63.8%) and Afghanistan (n = 60, 42.6%) and the highest proportion of participants in the E4-E5 grade (n = 74, 52.5%). There were no significant differences between groups (service dog vs. control) on any demographic variable, except for marital status. A higher proportion of participants were married in the service dog group, compared to the control group [X_2 (1, N = 141) = 8.23, p = .004], therefore marital status was included as a control variable in all models. At baseline (time of application to the service dog provider), there were no significant differences in PTSD Checklist scores (p = 0.732), indicating that both groups were similar in initial PTSD symptom severity.

Table 5.1 Demographic and clinical characteristics of participants across groups

Variable	Group			Group difference		
	Waitlist (n = 66)	Service Dog (n = 75)	Total (N = 141)	*t*	X_2	*p*
Age, M (SD), y	37.3 (8.1)	37.0 (8.5)	37.1 (8.3)	0.206		0.837
Gender, n (%) Male	50 (75.8)	60 (80.0)	110 (78.0)		0.368	0.544
Marital Status, n (%) Single	21 (31.8)	9 (12.0)	30 (21.3)		8.232	0.004[b]
People in household, M (SD) [a]	3.0 (1.5)	3.2 (1.8)	3.1 (1.6)	-0.663		0.508
Using a Mobility Aid, n (%)	27 (40.9)	28 (37.3)	55 (39.0)		0.189	0.664
Traumatic Brain Injury (TBI) comorbidity n (%)	13 (19.7)	13 (17.3)	26 (18.4)		0.130	0.718
Education, n (%)					2.259	0.688
High School or GED	4 (6.1)	8 (10.7)	12 (8.5)			
Some College	37 (56.1)	45 (60.0)	82 (58.2)			
Bachelor's Degree	16 (24.2)	13 (17.3)	29 (20.6)			
Master's Degree	8 (12.1)	7 (9.3)	15 (10.6)			
Advanced Graduate Work or PhD	1 (1.5)	2 (2.7)	3 (2.1)			
Military Branch, n (%)					0.700	0.873
Air Force	6 (9.1)	8 (10.7)	14 (9.9)			
Army	45 (68.2)	48 (64.0)	93 (66.0)			
Marines	8 (12.1)	8 (10.7)	16 (11.3)			
Navy	7 (10.6)	11 (14.7)	18 (12.8)			
Military Grade, n (%)					4.289	0.368
E1 – E3	3 (4.5)	6 (8.0)	9 (6.4)			
E4 – E5	35 (53.0)	39 (52.0)	74 (52.5)			
E6 – E7	17 (25.8)	20 (26.7)	37 (26.2)			
E8 – E9	3 (4.5)	6 (8.0)	9 (6.4)			
Officer	8 (12.1)	3 (4.0)	11 (7.8)			
Unknown	0 (0.0)	1 (1.3)	1 (0.7)			
Deployment, n (%)						
Iraq	43 (65.2)	47 (62.7)	90 (63.8)	0.759	0.094	0.759
Afghanistan	27 (40.9)	33 (44.0)	60 (42.6)	0.711	0.137	0.711
PTSD Checklist, M (SD), Baseline [c]	70.2 (8.7)	69.4 (8.8)	69.7 (8.7)	0.344		0.732
Re-experiencing, M (SD)	20.3 (3.5)	19.6 (3.3)	19.8 (3.7)	0.729		0.469
Avoidance Subscale, M (SD)	28.0 (3.9)	28.5 (3.9)	28.3 (3.9)	-0.493		0.624
Arousal Subscale, M (SD)	22.0 (3.4)	21.3 (3.2)	21.6 (3.3)	0.752		0.455

Note: M, mean; S.D., standard deviation; y, years; n, partial sample size; N, total sample size; %, percentage of participants; PTSD, posttraumatic stress disorder

[a] Including the veteran

[b] Marital status was included as a control variable in all models

[c] Baseline score at time of initial application to service dog provider

5.4.2 Usual care

The American Legion Treatment Survey was used to ascertain usual care treatment participation across groups, which are displayed in Table **5.2**. These include non-service dog PTSD treatments. There were no significant differences between groups in the number of participants currently receiving treatment (p = 0.940, d = 0.07) nor in how frequently they received treatment sessions per year (p = .482, d = 0.05), indicating that both groups were roughly equivalent in their dosage of usual care services. However, compared to the waitlist group, participants with service dogs reported a higher overall level of perceived improvement from their treatment with a medium effect size (p = .007, d = 0.55), indicating that those with service dogs perceive greater improvement from the same dosage of usual care treatment services.

Table 5.2 Usual care PTSD treatment participation across groups

	Group		Group difference		
Measure	Waitlist (n = 66)	Service Dog (n = 75)	β	*t*	*d*
Receiving PTSD treatment, n (%)	53 (80.3)	58 (77.3)	0.04	0.08	0.07
Treatment sessions per year, M (S.D.)	39.0 (38.7)	41.9 (78.0)	7.87	0.71	0.05
Perceived level of improvement since receiving care, M (S.D.)	5.0 (1.9)	6.0 (1.7)	0.98**	2.76	0.55

Note: PTSD, posttraumatic stress disorder; M, mean; S.D., standard deviation; β, standardized regression coefficient (reference category: service dog), *d*, Cohen's *d* effect size; CI, confidence interval;
**, $p < .01$
[a] Among those currently receiving treatment. Rated on a scale from 1 to 10: 1 (got worse), 5 (no change), 10 (significantly better)

5.4.3 Service dog outcomes

The longitudinal assessment compared PTSD symptomology within individuals, including up to three time points while on the waitlist and up to two time points with a service dog Table **5.3**. Results of longitudinal PCL scores are reported in Table 4. Compared to baseline (initial application to the service dog provider), there were no significant differences on the PCL at any point during the waitlist period (during waitlist: p = .202, end of waitlist: p = .504); however, there were significant reductions on the PCL at both points during the service dog period with large effect sizes (after 3 weeks: $p < .001$, d = -2.11, follow-up: $p < .001$, d = -1.03). Estimated reductions

from baseline were between 11.54 and 21.36 points on average, which is larger than the standard cutoff of 10 points indicating a clinically meaningful change in PTSD symptomology.

Table 5.3 Longitudinal assessment time points.

Time Point	n	Waitlist (n = 66)	Service Dog (n = 75)
Waitlist			
(1) Baseline (initial application for service dog)	60	X	X
(2) During waitlist	66	**X**	
(3) Before dog placement	33		X
Service Dog			
(4) 3-weeks after dog placement	35		X
(5) Follow-up	74		**X**

Note: Bolded **X** indicates cross-sectional comparison. All other time points were collected from records on file from the service dog provider.

Table 5.4 Longitudinal comparison of PTSD Checklist scores over time within participants.

Condition	*n*	Total PCL			Re-experiencing (subscale B)			Avoidance (subscale C)			Arousal (subscale D)		
		M (S.D.)	*b*	*d*	*M* (S.D.)	*b*	*d*	*M* (S.D.)	*b*	*d*	*M* (S.D.)	*b*	*d*
Waitlist													
Baseline (application for service dog)	60	69.7 (8.7)	-		19.8 (3.4)	-		28.3 (3.9)	-		21.6 (3.3)	-	
During waitlist [a]	66	66.3 (11.7)	-2.60	-0.32	18.4 (4.6)	-1.19	-0.35	27.1 (5.0)	-0.10	-0.27	20.9 (3.4)	-0.43	-0.34
Before service dog placement [b]	33	70.7 (10.7)	1.65	0.11	19.7 (3.6)	0.01	-0.03	29.3 (4.8)	1.26	0.23	21.7 (3.4)	0.39	0.04
Service Dog													
3-weeks after service dog placement [b]	35	47.9 (11.7)	-21.36 ***	-2.11	14.6 (4.1)	-5.17 ***	-1.38	18.2 (5.0)	-9.94 ***	-2.25	15.1 (4.3)	-6.25 ***	-1.43
Follow-up [a]	74	58.2 (13.1)	-11.54 ***	-1.03	16.5 (4.3)	-3.28 ***	-0.85	23.2 (6.2)	-5.17 ***	-0.98	18.5 (4.3)	-3.08 ***	-0.90

Note: PTSD, posttraumatic stress disorder; n, sample size; M, mean; S.D., standard deviation; *b*, unstandardized coefficient (reference category: baseline);
d, effect size, *, $p < .05$; **, $p < .01$; ***, $p < .001$
[a] Data from cross-sectional between group comparison at a single time point.
[b] Training consisted of a 3-week period on site at the service dog provider.

The cross-sectional, single time point assessment compared functioning between individuals receiving usual care while on the waitlist (control) to those receiving usual care in addition to a service dog (treatment). Results of linear regression models are reported in **Table 5.5**. Compared to the control group, participants with a service dog demonstrated significantly lower scores for PTSD symptomology with a medium effect size on the PCL ($p < .001$, $d = -0.66$). There was no significant correlation between baseline PCL score and change over time (to the cross-sectional survey time point) in the service dog group ($r = -.193$, $p = .238$), indicating that initial PTSD symptom severity was not associated with service dog outcomes on the PCL.

Participants with service dogs exhibited significantly lower depression symptomology with a large effect size on the PROMIS Depression ($p < .001$, $d = -0.91$) and a medium effect size on the PHQ-9 ($p < .001$, $d = -0.74$). Quality of life was higher among those with service dogs, with medium to large effect sizes on the VR-12 Mental ($p < .001$, $d = 0.66$), BSPW ($p < .001$, $d = 0.81$), SWLS ($p = .003$, $d = 0.59$), and CDRS ($p < .001$, $d = 0.55$). No significant differences were reported on the VR-12 Physical ($p = .908$, $d = -0.03$). Compared to the control group, participants with a service dog reported significantly higher social functioning with medium effect sizes, including a greater ability to participate in social activities (PROMIS Social Activities: $p < .001$, $d = 0.70$), lower social isolation (PROMIS Social Isolation: $p < .001$, $d = -0.63$), and higher perceived companionship (PROMIS Companionship: $p = .043$, $d = 0.52$). There were no significant differences in the proportion of individuals who were employed between groups (WPAI: $p = .451$, $d = -0.20$); however, for those who were working, individuals with service dogs reported a lower proportion of work missed due to health with a large effect size ($p = .019$, $d = -0.89$) and a lower rate of activity impairment with a small effect size ($p = .049$, $d = -0.27$), but no significant differences in their level of impairment while at work overall ($p = .051$, $d = -0.69$) or due to health ($p = .453$, $d = -0.29$).

Table 5.5 Comparison of outcomes between groups at a cross-sectional time point.

Measure	Group		Group difference		
	Waitlist (n = 66) M (S.D.)	Service Dog (n = 75) M (S.D.)	β	*t*	*d*
Depression					
PROMIS Depression SF 8a	28.9 (7.4)	22.3 (7.2)	-7.07***	-5.68	-0.91
PHQ-9	17.9 (5.3)	14.0 (5.4)	-4.33***	-4.62	-0.73
Quality of Life					
VR-12 Mental Health	24.4 (9.7)	30.9 (10.1)	6.84***	3.87	0.66
VR-12 Physical Health	37.1 (12.3)	36.8 (10.9)	-0.24	-0.12	-0.02
BSPW	-2.7 (2.0)	-0.9 (2.5)	1.86***	4.72	0.81
SWLS	15.0 (5.9)	18.8 (7.9)	3.58**	3.00	0.55
CDRS	18.5 (7.3)	22.8 (8.5)	4.89***	3.67	0.54
Social					
PROMIS Ability to Participate in Social Activities SF-8A	16.2 (5.7)	20.8 (6.9)	5.11***	4.83	0.73
PROMIS Social Isolation SF-8A	30.6 (6.3)	26.7 (6.8)	-4.41***	-3.95	-0.60
PROMIS Companionship SF-6A	19.0 (5.4)	22.1 (6.5)	2.00*	2.05	0.52
Work					
WPAI – Employed, n (%)	18 (24.7%)	22 (33.3%)	0.30	0.76	-0.19
WPAI – Absenteeism [a]	27.6 (35.2)	5.0 (8.4)	-22.77*	-2.46	-0.89
WPAI – Impairment at Work (Health) [a]	52.7 (30.9)	44.4 (25.0)	-7.33	-0.76	-0.29
WPAI – Impairment at Work (Overall) [a]	64.4 (29.7)	44.8 (27.4)	-19.99†	-2.03	-0.69
WPAI – Activity Impairment [a]	62.6 (27.7)	56.3 (26.9)	-9.43*	-1.99	-0.23

M, mean; S.D., standard deviation; β, standardized regression coefficient (reference category: service dog), *d*, Cohen's *d* effect size; CI, confidence interval; †, $p < .10$; *, $p < .05$; **, $p < .01$; ***, $p < .001$; PCL, PTSD Checklist; PROMIS, Patient-Reported Outcomes Measurement Information System; SF, short form; PHQ-9, Patient Health Questionnaire 9; VR-12 Mental Health, Veteran's Rand 12 item Health Survey- Mental Health Component; VR-12 Physical Health, Veteran's Rand 12 item Health Survey- Physical Health Component; BSPW, Bradburn Scale of Psychological Wellbeing; SWLS, Satisfaction with Life Scale; CDRS, Connor-Davidson Resilience Scale; WPAI, Work Productivity and Activity Impairment Questionnaire: General Health Problem V2.0

[a] Among veterans who are employed

5.5 Discussion

The purpose of this study was to examine the preliminary efficacy of trained service dogs for military members and veterans with PTSD, compared to a usual care waitlisted control group. The results indicated that compared to usual care alone, the provision of trained service dogs was associated with clinically significant reductions in PTSD symptoms on the PTSD Checklist. However, average scores were not lower than the diagnostic cutoff of 50 on the PTSD Checklist, indicating that in their current form, service dogs do not appear to be associated with a loss of diagnosis. This research presents proof-of-concept that in combination with usual care, service dogs may reduce perceived PTSD symptoms among military members and veterans. These findings offer support for initial efficacy, but require further research to evaluate their integration with evidence-based treatments.

Changes in PTSD symptomology may be due to the emerging body of evidence suggesting that the presence of animals influences socio-emotional functioning in non-military PTSD populations (Bert et al., 2016; Hart, 2006; Wells, 2009). These findings map roughly onto the diagnostic criterion for PTSD related to negative alterations in cognition and mood. Studies have demonstrated that the presence of a dog can reduce feelings of social estrangement (Allen & Blascovich, 1996; Rintala, Sachs-Ericsson, & Hart, 2002; Wood, Giles-Corti, & Bulsara, 2005), motivate social participation (Barak, Savorai, Mavashev, & Beni, 2001; Fairman & Huebner, 2001; Taylor et al., 2013), produce positive emotions (Collins et al., 2006) and reduce negative emotions (Souter & Miller, 2007). It is possible that these effects are elicited by the addition of a service dog for individuals with PTSD, and that they either indirectly or directly influence pathways to reductions PTSD symptomology. Indeed, secondary outcomes revealed that relative to usual care alone, individuals with a service dog exhibited significant differences with medium to large effect sizes in some of these domains. Specifically, those with service dogs showed differences with respect to depression (lower symptomology), quality of life (increased mental, but not physical, quality of life, increased psychological wellbeing, life satisfaction, and resilience), social functioning (increased ability to participate in social activities, lower social isolation, greater feelings of companionship), and some differences with respect to work functioning (no differences in employment level or impairment at work, but lower absenteeism and activity impairment due to health).

Historically, service dogs have been partnered with individuals with physical or ambulatory disabilities by assisting with mobility tasks (Winkle, Crowe, & Hendrix, 2012). The provision of service dogs to address psychosocial needs has emerged in recent years (Tedeschi et al., 2010). The efficacy of service dogs for participants with PTSD in this sample appears to be tailored to mental health, rather than physical health outcomes. For example, on the VR-12 quality of life measure, individuals with a service dog scored significantly higher on the mental health component of the measure, but the physical health component did not differ between groups. Similarly, on the WPAI work productivity measure, the overall health impairment at work component was significantly lower among those with service dogs, but the physical impairment at work component was not different between groups. These characteristics suggest that compared to usual care alone, trained service dogs for PTSD are related to primarily psychosocial differences rather than purely physical differences.

Concern has been expressed that some individuals may seek animal-assisted interventions in place of evidence-based treatments, putting them at risk of not receiving effective services (Anestis, Anestis, Zawilinski, Hopkins, & Lilienfeld, 2014). The results of this study contradict this assertion; they suggest that participants with service dogs are receiving similar levels of PTSD treatment (usual care) to those on the waitlist (>75% in both groups). Thus in the current sample, participants did not employ service dogs to substitute treatment as usual, but instead added service dogs to complement treatment as usual. The only difference was that participants with service dogs perceived a higher level of improvement (20% higher on average) from the same dosage of usual care treatment. Though significantly higher than the waitlist group, the service dog group perceived only slightly more than “no change” from their usual care treatments. It is unclear why participants with service dogs would perceive more improvement from the same level of treatment; however, it may be due to co-occurring increased feelings of resilience and ability to participate in social activities, which could create a more engaging space for the implementation of evidence-based practices.

The findings from this preliminary study also suggest that the outcomes from service dogs are comparable to those of evidence-based practices for PTSD. The results indicate that on average, the provision of a service dog in combination with treatment as usual contributed to a clinically significant reduction in PTSD symptoms, but not below a conservative diagnostic cutoff of 50 on the self-reported PCL. These findings mirror a review of randomized clinical trials of evidence-

based treatments for PTSD, where mean post-treatment scores also remained at or above the clinical cutoff for PTSD (e.g. (Monson et al., 2006; Steenkamp, Litz, Hoge, & Marmar, 2015). Within-group treatment effect sizes from this research are also similar to frequently studied psychotherapies for military PTSD (Steenkamp et al., 2015; Watts et al., 2013). For example, pre-post effect sizes for cognitive processing therapy (CPT) and prolonged exposure (PE; Cohen's d range = 0.78-1.10) are comparable to service dogs in the current study at the follow-up time point in the longitudinal PCL analysis (Cohen's d = 1.03; Steenkamp et al., 2015).

5.5.1 Limitations

Outcomes from the current study should be interpreted with consideration of some important limitations. First, the control condition was usual care, which can include participants receiving no treatment at all. It is unknown what types of treatments participants were receiving; thus although they received the same number of sessions per year, the types of sessions may have varied across groups. The control condition also does not account for the potential effects of non-specific treatment factors such as attention or novelty. This limitation is particularly salient with respect to the first three weeks of the treatment period, which include training on site at the service dog provider with a small cohort of fellow service dog recipients. The active components and effects of this unique time period are a critical area for further investigation as the in-person training session may act as a form of treatment in itself with or without the service dog component being present (Yount et al., 2013). However, following the introduction of the service dog into the home, there are minimal non-specific treatment effects related to attention from a therapist or treatment group, given that the only component of the intervention is the dog itself.

The goal of this study was to conduct an ecologically valid preliminary efficacy study to determine the effects of a service dog compared to unrestricted access to usual care, which included evidence-based treatments. Based on the current results, further studies can be developed to enlist an active comparison that accounts for these limitations as well as possible placebo effects (Furukawa et al., 2014). The specific roles and usage of trained dog commands should also be investigated to empirically define the treatment and evaluate fidelity and best practices.

Second, allocation to treatment group was not randomized. Results may have been due to natural maturational changes over time, rather than the service dog. Given the multi-year long waitlists associated with service dogs for PTSD, it was not possible for ethical reasons to change

order on the waitlist to randomize for this study. Third, the sample was self-selected as a group of individuals who had a demonstrated interest in obtaining a service dog. Recruitment consisted of contacting individuals who had already applied for or received a service dog. Thus, the results should be interpreted as generalizable only to those who are amenable to service dogs. At a minimum, our findings provide initial support that service dogs do not seem to have aversive outcomes for those who are motivated to get them.

Finally, the results include standardized self-report, which may be subject to expectancy biases (Cook, 2010). It is possible that baseline measurements were inflated at the time of applying to the service dog provider to justify the need for a service dog. Inflation of symptoms represents an interesting shift from the documented denial and minimization among many military personnel, who underrate their PTSD symptoms to avoid a diagnosis (Davidson & Connor, 1999). If military personnel are willing to exaggerate symptoms to receive a diagnosis and be paired with a service dog, this may evidence the perceived value of the service dog despite the associated stigma. To address biases in self-reported symptomology, the incorporation of a validated diagnosis of PTSD from a private or community health provider was enlisted to authenticate baseline PCL values; however, a more objective measure of PTSD severity such as the clinician-administered PTSD scale (CAPS; Blake et al., 1995) would have been beneficial.

Future studies should enlist physiological and blinded assessments to obtain additional objective indicators of change over time and between groups rather than relying on standardized self-report alone. Individual differences in evidence-based treatment receptivity and concurrent diagnoses should also be explored. Further studies should incorporate a comprehensive intake to define usage of different types of usual care. This will enable evaluation of how the provision of a service dog may change participation in usual care. It will also foster evaluation of the best ways to incorporate service dogs as an adjunct to evidence-based treatment.

5.5.2 Conclusions

This pragmatic, longitudinal effectiveness trial provides initial evidence that compared to usual care alone, military members and veterans with trained service dogs show lower PTSD symptomology, reduced depression, and increased social participation. Individual differences influencing short term and long-term efficacy remain to be tested. Ongoing research is needed to

determine the most effective ways to incorporate service dogs into evidence-based usual care as well as how to enhance service dog best practices to achieve maximal clinical change.

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CHAPTER 6. THE EFFECT OF A SERVICE DOG ON SALIVARY CORTISOL AWAKENING RESPONSE IN A MILITARY POPULATION WITH POSTTRAUMATIC STRESS DISORDER (PTSD)

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6.1 Abstract

Recent studies suggest a therapeutic effect of psychiatric service dogs for military veterans with posttraumatic stress disorder (PTSD), but are limited by self-report biases. The current study assessed the effect of PTSD service dogs on the salivary cortisol awakening response (CAR) and arousal-related functioning in a population of military veterans with PTSD. Participants included 73 post-9/11 military veterans with PTSD including 45 with a service dog and 28 on the waitlist to receive one. Saliva samples were collected on two consecutive weekday mornings at awakening and 30 minutes later to quantify the cortisol awakening response (CAR) and its area under the curve (AUCi) in addition to standardized survey measures of anxiety, anger, sleep quality and disturbance, and alcohol abuse. There was a significant main effect of having a service dog on both the CAR and the AUCi, with individuals with a service dog exhibiting a higher CAR and AUCi compared to those on the waitlist. Results also revealed that those with a service dog reported significantly lower anxiety, anger, and sleep disturbance as well as less alcohol abuse compared to those on the waitlist, with medium to large effect sizes. Although those with a service dog reported significantly less PTSD symptom severity, CAR was not significantly associated with PTSD symptoms within or across group. In conclusion, results indicate that the placement of a PTSD service dog may have a significant positive influence on both physiological and psychosocial indicators of wellbeing in military veterans with PTSD. Although clinical significance cannot be confirmed, a higher CAR/AUCi among those with a service dog corresponded with higher psychosocial functioning and lower PTSD severity. Future within-subject, longitudinal research will be necessary to determine potential clinical significance and impact of individual differences.

6.2 Introduction

Approximately 5-20% of US military veterans returning from post-9/11 deployments have posttraumatic stress disorder (PTSD; Ramchand et al., 2010). PTSD is an anxiety and stress-related disorder characterized by persistent and intense symptoms related to intrusion, avoidance, negative alterations in cognition and mood, and alterations in arousal and reactivity (American Psychiatric Association, 2013). PTSD is often associated with high rates of comorbidity with substance use, depression, and suicidal ideation (Brady, Killeen, Brewerton, & Lucerini, 2000; Brown & Wolfe, 1994; Jakupcak et al., 2009).

Within the military population, PTSD can often be difficult to treat. A recent meta-analysis of nine randomized clinical trials of psychotherapy, a common treatment for PTSD, found that up to 72% of military patients maintained their pre-treatment PTSD diagnoses (Steenkamp, Litz, Hoge, & Marmar, 2015). In addition, military members infrequently take advantage of mental health services (Hoge et al., 2014). Among those who do seek professional help, dropout rates during PTSD treatment can be as high as 50% (Schottenbauer, Glass, Arnkoff, Tendick, & Gray, 2008). Therefore, there is a critical need for alternative and complementary treatments for PTSD that maintain efficacy while encouraging treatment retention in military patient populations (Bomyea & Lang, 2012).

One complementary treatment is the placement of specially trained PTSD service dogs. PTSD service dogs are specifically trained to perform tasks that are thought to mitigate symptoms of PTSD. For example, the dog may position itself behind the individual to "watch their back" and alert to approaching strangers (a task intended to decrease hypervigilance in crowds). PTSD service dogs can also be trained to be attentive to an individual's behavior and provide a redirection of attention during an episode of re-experiencing or distress. Qualitative evidence suggests that PTSD service dogs can confer unique benefits to military veterans that address PTSD symptomology, especially hyperarousal (Crowe, Sánchez, Howard, Western, & Barger, 2017; Olmert, Nordstrom, Peters, St Laurent, & Yount, 2015; Taylor, Edwards, & Pooley, 2013; Yount, Olmert, & Lee, 2012). Beyond anecdotal reports, quantitative studies have documented significant effects of PTSD service dogs on self-reports of PTSD symptoms, depression, quality of life, emotional health, and interpersonal relationships (Kloep, Hunter, & Kertz, 2017; O'Haire & Rodriguez, 2018; Vincent et al., 2017; Yarborough et al., 2017). While these findings offer promising preliminary evidence of the therapeutic efficacy of PTSD service dogs, there remains a

need for empirical, objective research to advance our understanding of the potential mechanisms of the effects of PTSD service dogs, particularly with respect to hyperarousal and stress (Krause-Parello, Sarni, & Padden, 2016; O'Haire, Guérin, & Kirkham, 2015).

Stress in humans can be measured via the hormone cortisol, a product of the hypothalamic-pituitary-adrenocortical (HPA) axis (Stratakis & Chrousos, 1995). Cortisol concentrations can be assayed from saliva samples upon awakening and shortly thereafter to estimate the cortisol awakening response (CAR; J. C. Pruessner et al., 1997). In healthy individuals without PTSD, the CAR is characterized by a 50-75% increase of cortisol (J. Pruessner et al., 1997). Studies consistently link individual differences in the magnitude of this increase to both acute and chronic stress (Chida & Steptoe, 2009).

In contrast to healthy individuals, individuals with PTSD tend to experience hyperarousal-induced dysregulation of HPA activity leading to atypical cortisol profiles (Yehuda, Teicher, Trestman, Levengood, & Siever, 1996). In particular, cortisol output can often attenuate over time among individuals with PTSD; this is thought to be induced by the continuous “fight or flight” response which may create a negative feedback within the HPA axis (A. Clow, Hucklebridge, Stalder, Evans, & Thorn, 2010). Recent meta-analyses investigating the relationship between PTSD and cortisol output have found that PTSD is significantly associated with lower morning cortisol output (Boggero, Hostinar, Haak, Murphy, & Segerstrom, 2017; Morris, Compas, & Garber, 2012). Studies have also examined how cortisol activity and reactivity may change as a result of PTSD treatment (Ryan, Booth, Spathis, Mollart, & Clow, 2016). Of the three studies that have quantified pre and post-treatment CAR, two found evidence of a decreased CAR as a result of PTSD treatment (Bergen-Cico, Possemato, & Pigeon, 2014; Rapcencu, Gorter, Kennis, van Rooij, & Geuze, 2017) while one found no significant difference in the CAR among treatment and controls (Pacella, Feeny, Zoellner, & Delahanty, 2014).

There is evidence that the HPA-axis and cortisol activity are sensitive to human-canine interaction. For example, when positively interacting with pet dogs, healthy adults secrete significantly less cortisol (Odendaal & Meintjes, 2003), and the presence of a dog during a stressful situation leads to significantly less salivary cortisol output than the presence of a friendly human or a toy dog (Beetz et al., 2011; Polheber & Matchock, 2013). However, to our knowledge, only one study to date has directly examined the effect of human-canine interaction on the CAR. A study of 42 children with autism found that a service dog in the home was related to a decreased

CAR compared to when the service dog was briefly removed from the home (Viau et al., 2010). In this regard, the effects of the service dog's presence and companionship may be an important contextual state-related factor contributing to variance in HPA-axis activity and the CAR (Law, Hucklebridge, Thorn, Evans, & Clow, 2013).

Although several self-report and anecdotal accounts have suggested that PTSD service dogs can reduce hyperarousal, to the best of our knowledge no studies have quantified the effect of service dogs on cortisol secretion or the CAR in the context of PTSD (Krause-Parello et al., 2016; O'Haire et al., 2015). In this exploratory study, we attempt to fill this gap. The main goal was to investigate the effect of a service dog on the CAR among military veterans with PTSD; secondary outcomes included subjective functioning of anxiety, sleep quality, anger, and alcohol use. Although previous findings are mixed regarding the relationship between PTSD treatment outcomes and HPA axis activity, we hypothesized that compared to a waitlist control group, participants placed with a PTSD service dog while receiving treatment as usual would exhibit a significantly altered CAR profile as well as higher functioning in the areas of anger, anxiety, sleep quality, and alcohol abuse. Additionally, we explored the relationship between individual CAR profiles and PTSD severity and symptoms.

6.3 Methods

6.3.1 Participants

Participants were recruited between November 2015 and February 2016 from a national sample of 304 military members and veterans who applied for and were approved to receive a PTSD service dog from the organization K9s For Warriors. Inclusion criteria for organizational approval consisted of: (1) military service after September 11, 2001, (2) a community diagnosis of PTSD or meeting the clinical cutoff of 50 on the validated PTSD Checklist (PCL) (3) honorable discharge or current honorable service, (4) no current or past substance abuse, (5) no conviction of any crime against animals, and (6) no more than two pet dogs currently in the home.

Waitlist Group

Participants on the waitlist had been accepted by the organization, but had not yet received a service dog. Waitlist participants had been on the waitlist anywhere from 2.5 months to 1.59

years (M = 0.64 years, SD = 0.33) and were awaiting a scheduled date to receive a service dog while receiving their usual care. The service dog provider does not suggest nor discourage engagement with any specific treatments for PTSD outside of the placement of a service dog, thus, both those placed with a service dog and those on the waitlist to receive a service dog had unrestricted access to usual care determined by individual preference.

Service Dog Group

Participants in the service dog group had been placed with PTSD service dogs from the organization anywhere from 1 month to 4 years (M = 1.71 years, SD = 1.12). Participants had attended a three-week team training program in which they were taught by K9s For Warriors personnel how to interact with, care for, and maintain ongoing training with their service dog with a group of 6-10 recipients of the same sex. Service dogs were primarily acquired from animal shelters and selected and screened for physical and temperamental characteristics (e.g. 24 inches at the shoulder, no past or current aggression). All service dogs were trained for a minimum of 120 hours over at least 6 months for basic obedience and a variety of commands specifically trained to mitigate veterans' PTSD symptoms. Examples of tasks include "cover" (positioning backwards to alert the warrior of approaching people and provide comfort in public), "block" (standing sideways in front of the warrior to assist with creating personal space), and alerting to agitation or anxiety to prevent or distract from rising panic.

6.3.2 Procedure

The study protocol was approved by the Purdue University Human Research Protection Program Institutional Review Board (IRB Protocol 1504015973). No interactions occurred between researchers and service dogs during the study, therefore a waiver was obtained from the Institutional Animal Care and Use Committee (IACUC).

Individuals from the K9s For Warriors database (either on the waitlist or already placed with a dog) were sent a study packet in the mail which included detailed study information, consent forms, and $20 cash as compensation for reviewing the materials. Participants could earn an additional $20 for participating in a self-report survey and completing saliva collections following voluntary informed consent.

6.3.3 Saliva Collection and Determination of Cortisol

Participants collected four passive drool, whole saliva samples on two consecutive weekdays both at awakening (S1) and 30 minutes after awakening (S1+30; J. C. Pruessner et al., 1997). All participants were provided with detailed print material and an instructional video on how to collect samples. Participants were advised to collect their first sample immediately upon awakening and to not eat, drink anything other than water, or brush their teeth 30-minutes prior to sampling (Stalder et al., 2016).

An SMS texting software (EZ Texting, Callfire Inc.) aided in collection compliance; participants registered their time zone and wake times from their personal cell phone, allowing the software to send personalized reminders on collection days. As a marker of compliance and a timestamp for collection, the participant was required to reply to these reminder texts. If the participant did not text in, he/she was sent a reminder to complete the sample collection. In the rare cases in which sampling was disrupted or if a participant accidentally ate or drank, the participant's sampling day was rescheduled and new saliva collection materials were sent in the mail.

After successful completion of sampling, participants were instructed to store their samples in their home freezers before overnighting their samples back to the research team in a pre-paid shipping envelope. Samples were kept frozen at -80$_{o}$ C until assay, and assayed in duplicate for salivary cortisol using a commercially available enzyme immunoassay without modification to the manufacturers recommended protocol (Salimetrics, Carlsbad, CA, USA). The test volume was 25 µl, lower limit of sensitivity was 0.007 µg/dL, and intra- and inter-assay coefficients of variation were less than 10 and 15%, respectively. Duplicate values were averaged to represent the cortisol levels used in all statistical analyses and are reported in ug/dL. Cortisol samples showed substantial deviation from normality and outliers greater than three standard deviations from the group mean were winsorized. After winsorizing the outliers, all cortisol variables were within an acceptable range (Tabachnick, Fidell, & Osterlind, 2001).

The cortisol awakening response (CAR) was computed based on the absolute difference between S1 and S1+30 (J. C. Pruessner et al., 1997). As a second measure of the CAR, the area under the curve with respect to increase (AUCi) was calculated (the distance of both samples from zero; Chida & Steptoe, 2009). As the peak cortisol awakening response occurs within a narrow time window (20-45 minutes after awakening; Chida & Steptoe, 2009; A. Clow et al., 2010),

samples were excluded from CAR and AUCi analyses if the time between samples fell outside of 20-45 minutes after awakening. In addition, we conservatively excluded samples in which the time between samples was unknown (Stalder et al., 2016).

6.3.4 Survey Assessments

Participants completed a questionnaire consisting of basic demographic questions (employment and relationship status) and a series of standardized self-report measures of mental health and wellbeing. By consenting to participate in the survey, veterans also allowed the research team to access their initial application to the service dog provider. Application demographic variables included date of birth, sex, BMI, diagnosis, use of mobility aids, and either the date of service dog placement or date of being approved for those on the waitlist.

PTSD Symptoms

Verification of clinician-reported PTSD diagnosis was assessed using the PTSD Checklist (PCL), a 17-item scale based on the DSM-IV diagnosis (Weathers et al. 1993). The three symptom cluster subscales are re-experiencing (subscale B), avoidance (subscale C), and arousal (subscale D) with higher scores indicating greater overall symptom severity (Forbes, Creamer, & Biddle, 2001). A clinical cutoff of 50 on a scale of 17 to 85 indicates the presence of a PTSD diagnosis (Forbes et al., 2001). Cronbach's α's in the current sample was 0.92 for the total score and 0.96, 0.93, and 0.93 for the three subscales, respectively.

Medication Use

A medication questionnaire asked the participant to list all current medication names and their uses (either daily or as needed). Following Granger and colleagues (Granger, Hibel, Fortunato, & Kapelewski, 2009), medications were coded for their potential to impact salivary cortisol synthesis or secretion. Using this method, a total score of the number of medications influencing cortisol was created for each participant.

Physical Health

The Physical Component Score (PCS) of the VR-12 was used to assess general physical health. The six PCS items correspond to general health perceptions, physical functioning, role limitations due to physical problems, and bodily pain.

Patient-Reported Outcome Measurement Information System (PROMIS)

PROMIS is a system of highly reliable, precise measures of patient-reported health status for physical, mental, and social well-being (Cella et al., 2010). The PROMIS adult short forms of Anxiety (8A), Anger (5A), Alcohol Use (7A), and Sleep Disturbance (8A) were used with higher scores indicating greater severity. Reliability was high for all subscales (Cronbach's α ranged from 0.90 - 0.95).

Sleep Quality

The Pittsburgh Sleep Quality Index (PSQI) is a 19-item scale of self-reported sleep quality over the past one month (Carpenter & Andrykowski, 1998). Scoring is based on seven components of (1) subjective sleep quality, (2) sleep latency, (3) sleep duration, (4) habitual sleep efficiency, (5) sleep disturbance, (6) use of sleep medication, and (7) daytime dysfunction. The summary score is a continuous variable with lower scores indicating better overall sleep quality.

6.3.5 Data Analysis Strategy

Data cleaning, descriptive statistics, and correlations among all study variables were conducted prior to all analyses. Next, possible group differences in demographic characteristics were examined. To examine possible differences in CAR profile between those with and without a service dog, we examined a two-level mixed model controlling for demographic and physical health variables. Mixed-effects modeling, also known as hierarchical or multi-level modeling, was selected to account for both within- and between-participant variation (Raudenbush & Bryk, 2002). This technique is also recommended by the CAR expert consensus guidelines (Stalder et al., 2016) to handle the continuous dynamics of time, missing values, heteroscedasticity, and autocorrelations in the error structure of cortisol data.

In the mixed model, the levels represent repeated measures over time (Level 1) nested within individuals (Level 2); thus, day and individual were included as random factors. The

primary outcome of interest was having a service dog, included as a fixed factor. Additional fixed factors were included as covariates to address relevant state and trait covariates as recommended by the CAR expert consensus guidelines (Stalder et al., 2016). These fixed factors included demographic variables (age, sex), physical health (VR-12 PCS, use of a mobility aid, BMI), medication and substance use (total number of medications taken that may influence cortisol, PROMIS Alcohol Use), sleep quality (PROMIS Sleep Disturbance), salivary cortisol at awakening, and time of awakening.

6.4 Results

6.4.1 Preliminary Analyses

Prior to analyses, all data were screened. A total of 85 participants provided saliva samples, including 52 with a service dog and 33 on the waitlist to receive a service dog (participation rate of 27.96%). A total of 10 participants failed to use the text messaging system; due to unknown sampling times, these participants were conservatively excluded from analyses. Two participants that provided saliva samples had sample quantities insufficient for assay on both days, and were also excluded from analyses. On one of the two days of sampling, an additional three participants had sample quantities insufficient while 10 participants were noncompliant (sample times outside of the 20-45 minute CAR window); for these participants, mean values reflect only one sample day rather than two.

The final sample analyzed included 73 participants, including 45 with a service dog and 28 on the waitlist. Descriptive statistics were examined for all variables of interest by group (Table **6.1**). Participants were an average of 37.08 years old (SD = 7.81), mostly male (79.72%), and predominantly married or cohabitating with a partner (83.73%). Participants did not statistically differ in whether they were currently receiving PTSD treatment nor the frequency in which they attended treatment (p's > 0.15). There were significant group differences in PTSD symptom severity, which is expected from the service dog intervention. However, on average, participants across both groups had symptom severity above the clinical cutoff of 50 on the PCL (waitlist group M = 69.00, SD = 11.13; service dog group M = 57.38, SD = 13.40). Participants' S1 and S1+30 samples were significantly correlated across days, providing support for the decision to create average values across the two days (S1 r (69) = 0.30, $p < 0.01$; S1+30 r (69) = 0.34, $p < 0.01$).

Table 6.1 Demographic and clinical characteristics of participants across groups.

	Group		Group difference	
	Waitlist (n = 28)	Service Dog (n = 45)	*t* or χ^2	*p*
Age, M (S.D.), years	37.29 (7.26)	36.87 (8.36)	-0.22	0.82
Gender, n (%) male	21 (75.00)	38 (84.40)	0.99	0.32
Relationship status, n (%) married/cohabitating	22 (78.60)	40 (88.90)	1.44	0.23
Employed, n (%)	11 (39.30)	9 (20.90)	2.82	0.09
BMI, M (S.D.)	29.57 (5.81)	30.13 (4.41)	0.46	0.65
Using a mobility aid, n (%)	13 (46.43)	15 (33.33)	1.25	0.26
Education, n (%)			5.96	0.20
High School or GED	2 (7.10)	7 (15.60)		
Some College	13 (46.40)	28 (62.20)		
Bachelor's Degree	7 (25.00)	5 (11.11)		
Master's Degree	6 (21.42)	5 (11.11)		
Military branch, n (%)			1.32	0.73
Air Force	3 (10.70)	6 (13.30)		
Army	15 (53.60)	26 (57.80)		
Marines	5 (17.90)	4 (8.90)		
Navy	5 (17.90)	9 (20.00)		
Traumatic Brain Injury (TBI) comorbidity n (%)	8 (28.57)	9 (20.00)	0.71	0.40
Receiving PTSD treatment, n (%)	23 (82.14)	35 (77.78)	1.96	0.38
Treatment sessions per year, M (S.D.) [a]	39.85 (34.61)	27.68 (33.53)	-1.45	0.15

Note: M, Mean; S.D., Standard deviation; BMI, Body mass index; PTSD, Posttraumatic stress disorder.

[a] Among those receiving PTSD treatment.

6.4.2 Effect of PTSD Service Dog on Survey Assessments

Descriptive statistics of self-report survey measures for both those with a service dog and on the waitlist are displayed in Table **6.2**. As hypothesized, those with a service dog reported significantly less anxiety, anger, and sleep disturbance than those on the waitlist (PROMIS Anxiety t (68) = -3.98, $p < 0.001$, $d = 0.96$; PROMIS Anger t (68) = -2.95, $p < 0.01$, $d = 0.73$; PROMIS Sleep Disturbance t (69) = -2.71, $p < 0.01$, $d = 0.67$). There was no significant group difference in sleep quality, although scores trended in the hypothesized direction (PSQI t (67) = -1.74, $p = 0.09$, $d = 0.43$). Although there was no significant group difference in the proportion of individuals who self-reported having consumed alcohol in the past 30 days (46.7% of those with a service dog, and 50.0% of those on the waitlist), those with a service dog who were current users of alcohol reported fewer symptoms of alcohol abuse than those on the waitlist (PROMIS Alcohol t (33) = -2.38, $p < 0.05$, $d = 0.87$). Among those with a service dog, sleep disturbance was significantly positively correlated with time since receiving the dog (r (45) = 0.37, $p < 0.05$); among those on the waitlist, both anger (r (28) = 0.33, $p < 0.01$) and anxiety (r (28) = 0.26, $p < 0.05$) were significantly positively correlated with time since being approved for the waitlist.

Table 6.2 Comparison of behavior measures between groups.

	Group		Group difference		
Measure	Waitlist (n = 28) M (S.D.)	Service Dog (n = 45) M (S.D.)	*t*	*p*	*d*
PTSD Checklist (PCL)	69.00 (11.13)	57.38 (13.40)	-3.80	<0.001	0.94
Re-experiencing (B) Subscale	19.36 (4.34)	16.19 (4.23)	-3.04	<0.01	0.75
Avoidance (C) Subscale	27.54 (5.12)	22.55 (6.47)	-3.42	<0.001	0.84
Arousal (D) Subscale	22.11 (3.05)	18.64 (4.27)	-3.96	<0.001	0.94
Pittsburgh Sleep Quality Index	16.26 (3.54)	14.76 (3.45)	-1.74	0.09	0.43
PROMIS Alcohol Use 7A	53.14 (8.91)	39.88 (19.51)	-2.38	0.02	0.87
PROMIS Anxiety 8A	71.31 (7.28)	64.50 (6.83)	-3.98	<0.001	0.96
PROMIS Anger 5A	73.24 (8.49)	66.54 (9.81)	-2.95	<0.01	0.73
PROMIS Sleep Disturbance 8A	66.31 (7.62)	60.65 (9.19)	-2.71	<0.01	0.67

Note: M, mean; S.D., standard deviation; *t*, t statistic, *d*, Cohen's d effect size; PCL, Posttraumatic stress disorder checklist; PROMIS, Patient Reported Outcome Measurement Information System.
[a] All PROMIS instrument scores are represented at normalized t-score metrics in which the general population mean is 50 with a standard deviation of 10.

6.4.3 Effect of PTSD Service Dog on CAR

Table **6.3** contains model output describing the effect of having a service dog on cortisol via the CAR and AUCi. As hypothesized, there was a significant main effect of having a service dog on the salivary cortisol awakening response via both the AUCi (ß = -1.13, $p < 0.05$) and the CAR (ß = -0.08, $p < 0.05$). Specifically, after controlling for several covariates that may influence cortisol output, including both state (e.g. medication and alcohol use, sleep quality, cortisol at awakening, and time of awakening) and trait variables (e.g. age, sex, physical health attributes, BMI), individuals with a service dog exhibited both a higher CAR and a higher AUCi compared to those without a service dog while on the waitlist (Table **6.3**; Figure **6-1**). In addition to having a service dog, both age and S1 were significant predictors of AUCi and CAR while sex was a significant predictor of AUCi, but not CAR. A post-hoc analysis of S1 revealed that there was no significant effect of having a service dog on waking cortisol (ß = -0.04, $p = 0.18$), and no covariates were significant predictors of S1 (all p's > 0.18). Among participants with and without a service dog, neither time since receiving the service dog nor time since being approved for the waitlist were significant correlates with AUCi (*r's* < 0.15) or CAR (*r's* < 0.17; Table **6.4**).

Table 6.3 Summary of mixed model analysis of AUCi and CAR.

	AUCi			CAR		
Variable	B	*p*	95% CI	B	*p*	95% CI
Intercept	6.36	0.02	(0.87, 11.85)	0.40	0.03	(0.05, 0.76)
Service Dog	-1.13	0.03	(-2.15, -0.12)	-0.08	0.02	(-0.15, -0.02)
Age	-0.08	0.01	(-0.15, -0.02)	0.00	0.02	(-0.01, 0.00)
Sex (Reference: Female)	0.99	0.12	(-0.27, 2.24)	0.06	0.12	(-0.02, 0.14)
Use of Mobility Aid (Reference: No)	-0.68	0.21	(-1.74, 0.38)	-0.05	0.18	(-0.11, 0.02)
BMI	-2.78	0.33	(-8.42, 2.87)	-0.18	0.31	(-0.55, 0.18)
VR-12 PCS	0.03	0.22	(-0.02, 0.07)	0.00	0.25	(0.00, 0.00)
PROMIS Alcohol Use	0.05	0.09	(-0.01, 0.11)	0.00	0.11	(0.00, 0.01)
PROMIS Sleep Disturbance	0.04	0.32	(-0.04, 0.11)	0.00	0.29	(0.00, 0.01)
Medication	0.21	0.17	(-0.09, 0.50)	0.01	0.23	(-0.01, 0.03)
Waking Cortisol (S1)	-5.25	<0.001	(-8.02, -2.47)	-0.34	<0.001	(-0.52, -0.17)
Wake Time	0.00	0.33	(0.00, 0.00)	0.00	0.33	(0.00, 0.00)

Note: AUCi, Area under the curve with respect to increase; CAR, Cortisol awakening response in µg/dL; B, regression coefficient; CI, confidence interval; BMI, Body Mass Index; VR-12 PCS, Veteran's Rand 12 item Health Survey-Physical Health Component Score; PROMIS, Patient-Reported Outcome Measurement Information System; Waking cortisol (S1), cortisol at awakening in µg/dL.

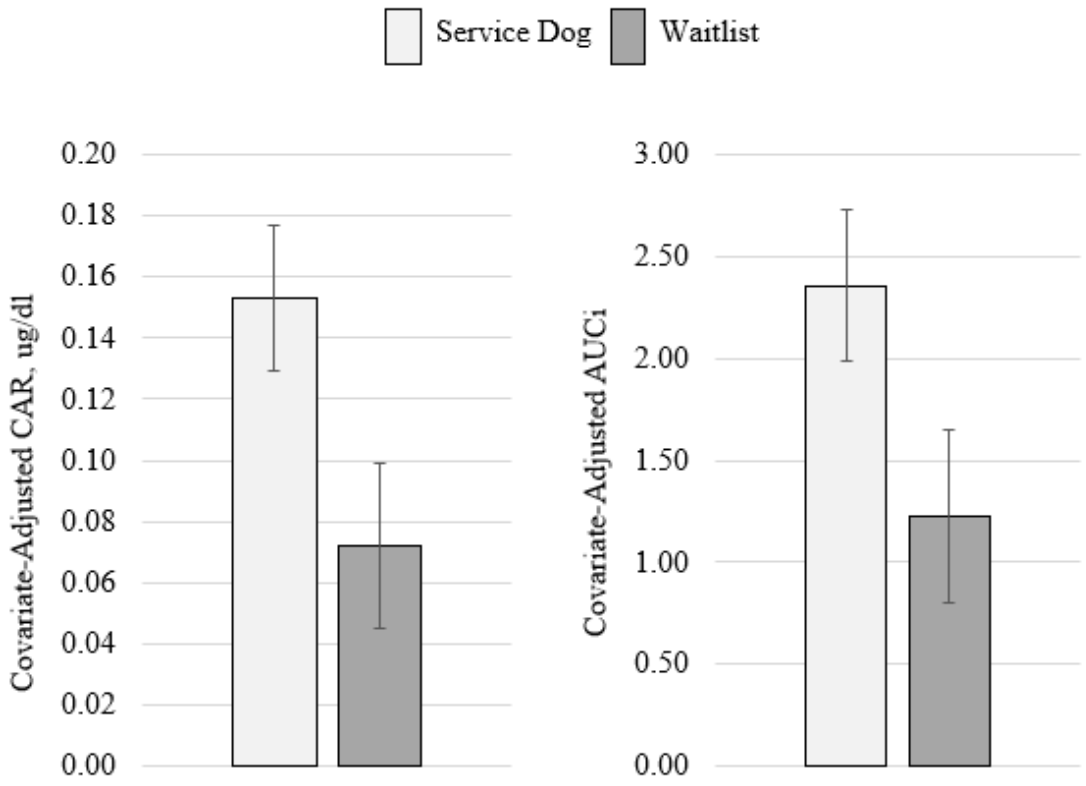

Figure 6-1. Graphic display of CAR and AUCi by group.

Note: Covariate-adjusted CAR and AUCi are displayed as least square means (LSM) from mixed model output, controlling for age, sex, use of a mobility aid, body mass index (BMI), physical health (VR-12 PCS), alcohol use, sleep disturbance, cortisol-influencing medication, waking cortisol value, and wake time.
CAR, Cortisol awakening response in µg/dL; AUCi, Area under the curve with respect to increase.

6.4.4 Correlational Analyses with PTSD Severity

Correlations between outcome variables and PTSD symptom severity for both those with a service dog and on the waitlist are displayed in Table **6.4**. Among those with a service dog, PTSD symptomology as measured through the PCL was not significantly correlated with CAR or with AUCi, but was significantly positively correlated with anxiety, anger, and sleep disturbance (Table 4). Among those on the waitlist, PTSD symptomology was again not significantly correlated with CAR or with AUCi and was similarly positively correlated with anxiety, anger, and sleep disturbance as well as sleep quality. Among both groups neither CAR nor AUCi were significantly correlated with any behavioral outcomes or with S1 (Table **6.4**).

Further analyses indicated that none of the three PCL subscales (re-experiencing, avoidance, and arousal) among those with and without a service dog were significantly correlated with AUCi (all *p's* > 0.20) or CAR (all *p's* > 0.18). Correlations between PTSD symptom severity and cortisol outcomes were even less after conducting partial correlation analyses controlling for age, gender, medication use, and physical health (all *p's* > 0.24).

Table 6.4 Pearson's r bivariate correlation matrix among study variables.

	1	2	3	4	5	6	7	8	9	10
1 AUCi		**1.00 *****	**-0.23**	**-0.13**	**0.01**	**0.12**	**-0.10**	**-0.12**	**-0.06**	**0.15**
2 CAR	1.00 ***		**-0.24**	**-0.15**	**0.01**	**0.09**	**-0.11**	**-0.13**	**-0.08**	**0.17**
3 S1	-0.24	-0.24		**-0.14**	**0.07**	**0.2**	**0.11**	**0.29**	**0.11**	**-0.25**
4 PTSD Checklist	-0.05	-0.04	-0.01		**0.51 ****	**-0.09**	**0.64 *****	**0.38 ***	**0.42 ***	**-0.09**
5 PSQI	-0.13	-0.13	-0.04	0.29		**0.24**	**0.34**	**0.36**	**0.64 *****	**0.01**
6 Alcohol Use [a, b]	0.14	0.14	0.00	0.24	0.11		**0.00**	**0.34**	**0.25**	**-0.05**
7 Anxiety [a]	-0.09	-0.09	-0.21	0.60 ***	0.05	0.17		**0.3**	**0.22**	**-0.27**
8 Anger [a]	-0.11	-0.10	0.02	0.59 ***	0.13	0.36 *	0.53 ***		**0.58 ****	**0.00**
9 Sleep Disturbance [a]	0.18	0.19	-0.16	0.49 **	0.63 ***	0.27	0.07	0.17		**-0.03**
10 Time [c]	-0.06	-0.04	0.17	0.31 *	0.11	0.10	0.15	0.09	0.35 *	

Note: Correlations for those with a service dog are displayed below the diagonal, while correlations for those on the waitlist are displayed above the diagonal in bolded text; S.D., Standard deviation; AUCi, Average of area under the curve with respect to increase; CAR, Average of cortisol awakening response; S1; Average of awakening cortisol; PTSD, Posttraumatic Stress Disorder as quantified through the PTSD Checklist (PCL); PSQI, Pittsburgh Sleep Quality Index;
***, p < 0.001, **, p < 0.01, *, p < 0.05.

[a] Patient Reported Outcome Measurement Information System (PROMIS) short forms Alcohol Use 7A, Anxiety 8A, Anger 5A, and Sleep Disturbance 8A.

[b] Alcohol Use questionnaire only filled out by those who indicated that they had consumed alcohol in the past 30 days, which consisted of n = 21 (46.7%) with a service dog and n = 14 (50.0%) on the waitlist.

[c] For participants with a service dog, this continuous variable represents time elapsed since receiving a service dog; For participants on the waitlist, this variable represents time since applying and being placed on the waitlist to receive a service dog.

6.5 Discussion

The purpose of this study was to examine the potential physiological and arousal-modulating effects of the placement of a specially trained PTSD service dog on a population of military members and veterans with PTSD compared to a usual care, waitlisted control group. To our knowledge, this research represents the first study in this context to examine stress and arousal using an objective, physiological measure. Results indicated that after controlling for demographic and physical health covariates, having a PTSD service dog was significantly associated with a higher morning cortisol awakening response, supporting the main hypothesis. Compared to those on the waitlist, participants with a service dog also self-reported significantly lower anxiety, anger, sleep disturbance, and alcohol abuse supporting the secondary hypothesis. Findings suggest that in combination with usual care, service dogs may confer therapeutic psychological and physiological effects on military veterans with PTSD.

6.5.1 CAR and AUCi Findings

After controlling for several state and trait variables known to influence HPA-axis activity, participants with a service dog exhibited a significantly higher CAR and AUCi compared to a waitlisted control group. While the presence of a service dog was not a significant predictor of waking cortisol values, having a service dog was specifically associated with a *larger* magnitude of the awakening response. While it has been debated whether a smaller or larger CAR is indicative of a healthier state, especially in individuals with histories of traumatic exposure and/or psychosocial dysfunction (Chida & Steptoe, 2009), the results from this study provide support that, in this specific population, a higher CAR may be indicative of better health and wellbeing. Specifically, both results from this study and additional data show that those with a service dog had significantly lower PTSD symptomology than those on the waitlist in addition to greater psychosocial well-being, less depressive symptoms, higher social functioning, and better overall quality of life (O'Haire & Rodriguez, 2018).

The result of a significantly higher CAR among the treatment group in this study mirror that of studies that have examined the effects of PTSD treatment on cortisol outcomes other than the CAR. Specifically, results are supported by findings of a 2007 study in which individuals with PTSD receiving a form of cognitive behavioral therapy (CBT) had increased post-treatment A.M.

basal cortisol (Olff 2007). Similarly, a 2014 study reported increased 24-hour urinary cortisol output among treatment responders to CBT (Yehuda et al 2014). In this regard, successful treatment of PTSD symptoms via a service dog or psychotherapies may correspond with increases in HPA-activity and thus, in circulating cortisol. However, among the studies published to date that have examined the CAR in particular as an outcome variable in PTSD treatment studies, the results of this study contribute to mixed findings likely due to methodological and population differences. Specifically, Pacella et al. (2014) found no pre- and post-treatment difference in CAR or AUCi among civilians with PTSD receiving prolonged exposure therapy or antidepressant medication; however, participants experienced a range of traumatic events ranging from sexual to childhood assault (M = 8.21 traumatic incidents per person) and saliva was only collected for a single day introducing a likelihood for low validity (Angela Clow, Thorn, Evans, & Hucklebridge, 2004). Bergen-Cico et al. (2014) found that veterans with PTSD who completed a mindfulness-based treatment had a reduced CAR and AUCi compared to baseline, but results were limited by small sample size (n = 9). Future research is necessary to better understand how cortisol biomarkers respond to PTSD treatment in military veteran and civilian populations.

6.5.2 Survey Assessment Findings

Participants with a service dog reported significantly better psychosocial functioning than those on the waitlist including exhibiting lower anger, anxiety, and alcohol abuse symptoms, all of which are common symptoms and comorbidities of a PTSD diagnosis. These findings are consistent with the emerging literature providing evidence of a significant effect of the placement of a service dog on standardized measures of PTSD and psychosocial functioning (e.g. Kloep et al., 2017; Vincent et al., 2017; Yarborough et al., 2017). As individuals with a service dog reported less severe PTSD symptomology than those on the waitlist, it is logical that group differences would also be observed in these symptom areas with medium to large effect sizes (PROMIS Anger, $d = 0.73$; PROMIS Anxiety, $d = 0.96$; PROMIS Alcohol Use, $d = 0.87$, PTSD Checklist, $d = 0.94$). Sleep quality and sleep disturbance, other areas commonly affected by PTSD, had small to medium effect sizes across group (PSQI sleep quality, $d = 0.44$; PROMIS sleep disturbance, $d = 0.67$). Although sleep quality via the PSQI was not significantly different across group in this study, recent findings have shown a significant improvement in PSQI scores ($d = 0.82$) among military veterans with a PTSD who have had a service dog for 3 months, compared to before they

received the service dog (Vincent et al., 2017). Because our study design surveyed individuals with a service dog for varying amounts of time, it is possible that this variation may have contributed to the discrepancy in effect sizes across studies.

Our findings also indicated a significant positive correlation with sleep disturbance and time since receiving a service dog (r = 0.35; but not overall sleep quality, r = 0.11). In addition, there was a significant positive correlation with overall PTSD symptoms and time since receiving a service dog (r = 0.31). Thus, although those with a service dog had significantly lower levels of sleep disturbance (d = 0.67) and PTSD symptoms (d = 0.94) on average compared to those on the waitlist, there may be drift in symptomology over time that is unexplained by current findings. While these correlations were small in magnitude, they warrant future research and replication using objective measures of sleep (e.g. actigraphy) and a longitudinal design.

6.5.3 PTSD and the CAR

While results did indicate a significant main effect of having a service dog on the CAR, there was no significant relationship between the CAR profile and PTSD symptomology (despite a large effect size difference in PTSD severity among those with a service dog compared to those on the waitlist). This unsupported relationship between the CAR and PTSD symptoms among our sample suggests that the potential physiological stress-buffering effects from the service dog on the CAR were *independent* of the service dog's subjective effect on PTSD symptomology. Further, this result also suggests that perceived hyperarousal symptoms (the subscale of the PTSD checklist that exhibited the greatest group difference) may be similarly independent of the PTSD service dog's psychophysiological effect on arousal via the HPA axis. While this is an interesting preliminary finding, further research will require a within-subject longitudinal design to investigate the potential interaction effects between individual differences in the CAR and PTSD symptomology following the placement of a service dog.

6.5.4 Limitations

Outcomes from this preliminary, cross-sectional study should be interpreted with several important limitations. First, the use of a cross-sectional design means that causation and directionality cannot be determined. Although findings suggest a higher CAR and AUCi in those

with a service dog compared to those on the waitlist, it is unknown how these physiological measures may change over time and how observed variance in the CAR/AUCi may be attributable to individual differences. For example, Pacella et al. (2014) found that PTSD treatment responders had a higher AUCi at baseline than non-responders (d = 1.12). Future, within-subject studies are needed to determine how pre-treatment CAR (i.e. having a decreasing, flat, or increasing CAR) and waking cortisol as well as latent, trait-specific effects on HPA activity may predispose an individual to experiencing either decreases or increases in morning cortisol output following pairing with a PTSD service dog.

Another limitation of the study was the use of a simplified sampling design assessing only two samples across two days to minimize participant burden instead a more time-intensive design (i.e. 15, 30, and 45 minutes after awakening across 2+ days). Although the assessment of CAR with two awakening samples is a common approach, some reliability in the measurement of the CAR may have been lost (Angela Clow et al., 2004). Specifically, many individuals in the sample may not have exhibited a peak in cortisol secretion right at 30 minutes, preventing us from obtaining precise measurement of the CAR across individuals. In addition, while our mixed model analyses did control for covariates suggested by expert guidelines (Stalder et al., 2016), there may be unaccounted for confounds that could have impacted the CAR. In particular, the presence of other pets in the home, especially pet dogs, may be a key confounding factor that will be useful to examine in future, longitudinal research.

An additional limitation of the study is that both the waitlisted control group as well as the treatment group were receiving unrestricted access to PTSD treatment as usual, current treatments at time of surveying were unknown. Although the distribution of those receiving treatment and number of sessions per year were not statistically different across groups, there is a possibility that those on the waitlist may have been engaging in different types of treatment for PTSD than those with a service dog. However, our goal was to conduct an ecologically valid and preliminary assessment of the potential physiological differences across those with and without a service dog. Future, more resource-intensive studies will benefit from carefully distinguishing the effects of the placement of a PTSD service dog from other evidence-based treatments individuals may be receiving. Additionally, because allocation to the treatment group was not randomized, it remains unclear if the observed differences in HPA axis activity among those with a PTSD service dog were simply due to the passage of time during treatment. While it was not possible to randomize

treatment in this preliminary study, this is a future direction to be addressed in a large-scale, clinical trial.

A final limitation is the systematic biases that may have been present in our sample. Participants had volunteered for the treatment and were thus amenable to being placed with a service dog, therefore our findings may not generalize to the average military veteran with PTSD. Additionally, consent bias may have been present such that individuals who participated in the study may not have been representative of the true sample.

6.5.5 Future Research

While the findings from this research suggest that the HPA axis may be sensitive to the effects of a PTSD service dog, precise mechanisms for these effects remain speculative and will be an important future direction of research. While anecdotal and qualitative reports consistently state that one of the most helpful and therapeutic aspects of a PTSD service dog is their calming and stress-reducing abilities (Crowe et al., 2017; Taylor et al., 2013; Yount, Ritchie, Laurent, Chumley, & Olmert, 2013) and studies on the therapeutic efficacy of service dogs for PTSD continue to find evidence of reduced self-reported hyperarousal symptoms (Kloep et al., 2017; O'Haire & Rodriguez, 2018; Vincent et al., 2017; Yarborough et al., 2017), it remains unclear how changes in PTSD symptoms and hyperarousal relate to changes in the HPA-activity. Specifically, this study was not able to determine if changes to the CAR are psychophysiological in nature (increasing as a result of these positive psychological benefits experienced by the PTSD service dog's presence) or potentially either preceding or even moderating these perceived outcomes. Despite growing knowledge in the study of animal-assisted intervention for trauma including PTSD (O'Haire et al., 2015), future research will benefit from incorporating physiological measurement using longitudinal designs to address this gap in the knowledge base.

Future research may also help in determining the specific aspects of the HPA-axis that a service dog may impact by collecting more cortisol samples throughout the day. For example if only the CAR, rather than diurnal secretion of cortisol, differs across group this may indicate that the therapeutic effects of the PTSD service dog are CAR-specific rather than applying to the HPA-axis more generally. It may also be helpful to measure the CAR across more days (including weekend days) as a measure of state variation and CAR flexibility, which can also be predictive of individual differences in psychosocial wellbeing (Law et al., 2013; Mikolajczak et al., 2010).

In addition, as Elder et al. (2016) points out, both waking cortisol levels and the magnitude of the CAR are potentially sensitive to daily variation; measuring the CAR across 3-4 days instead of two days would greatly aid in the interpretation of results (Elder, Ellis, Barclay, & Wetherell, 2016).

Finally, future research will benefit from examining canine-specific traits, training, and relationship factors that may impact the physiological activity of their handlers. In particular, specific trained commands (e.g. calming and distracting from anxiety or intrusive thoughts), behavioral profiles (e.g. non-reactive temperaments), or relationship factors (owner-dog attachment) may be key moderators of psychophysiological activity (Schöberl, Beetz, Solomon, Gee, & Kotrschal, 2015). In addition, examining the co-regulation or attunement between the cortisol outputs of both a military veteran participant *and* their service dog may be beneficial for examining the dyadic factors underlying physiological change (Haubenhofer & Kirchengast, 2007).

6.5.6 Conclusion

In conclusion, this novel and preliminary study quantified the therapeutic effects of PTSD service dogs using both subjective measurement and objective, physiological measurement of stress and arousal. Results provide initial evidence that, compared to usual care alone, military members and veterans placed with PTSD service dogs exhibit lower PTSD symptomology, better psychosocial wellbeing, and higher morning cortisol output quantified via the CAR and AUCi. However, PTSD severity and cortisol outcomes were not significantly related, suggesting that the psychosocial and physiological effects of a service dog may be independent from each other. Future longitudinal research will contribute to a more precise understanding in how within-subject change in cortisol activity is related to psychosocial functioning and hyperarousal symptoms in military veterans with PTSD. If replicated with a longitudinal design, the findings from this study could have clinical implications suggesting that the CAR is an effective biomarker for capturing psychophysiological change following receipt of a service dog.

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APPENDIX A. CHAPTER 1 SUPPLEMENTAL FILES

Table A.1. Search terms/search strategy.

PubMed Search Strategy [a]
(“Service animal”[Title/Abstract] OR “service animals”[Title/Abstract] OR “Service dog”[Title/Abstract] OR “Service dogs”[Title/Abstract] OR “Assistance animal”[Title/Abstract] OR “Assistance animals”[Title/Abstract] OR “Assistance dog”[Title/Abstract] OR “Assistance dogs”[Title/Abstract] OR “Guide dog”[Title/Abstract] OR “Guide dogs”[Title/Abstract] OR “Dog guide”[Title/Abstract] OR “Dog guides”[Title/Abstract] OR “Mobility dog”[Title/Abstract] OR “Mobility dogs”[Title/Abstract] OR “Seizure dog”[Title/Abstract] OR “Seizure dogs”[Title/Abstract] OR “Seizure alert dog”[Title/Abstract] OR “Seizure alert dogs”[Title/Abstract] OR “Seizure response dog”[Title/Abstract] OR “Seizure response dogs”[Title/Abstract] OR “Epilepsy alert dog”[Title/Abstract] OR “Epilepsy alert dogs”[Title/Abstract] OR “Diabetes alert dog”[Title/Abstract] OR “Diabetes alert dogs”[Title/Abstract] OR “Diabetic alert dog”[Title/Abstract] OR “Diabetic alert dogs”[Title/Abstract] OR “Diabetic response dog”[Title/Abstract] OR “Diabetic response dogs”[Title/Abstract] OR “Hearing dog”[Title/Abstract] OR “Hearing dogs”[Title/Abstract] OR “Signal dog”[Title/Abstract] OR “Signal dogs”[Title/Abstract] OR “Medical response dog”[Title/Abstract] OR “Medical response dogs”[Title/Abstract] OR “Seeing eye dog”[Title/Abstract] OR “Seeing eye dogs”[Title/Abstract])

[a] The search strategy was adapted to the other databases, including mapping terms to each database’s thesaurus or prescribed vocabulary, as appropriate.

Table A.2. Summary of methodological rating scores by each of the N=27 individual studies, separated by study design (longitudinal or cross-sectional).

Study Design	First Author (Year)	Study #	Objective	Hypothesis	Demographics	Disabilities	Equal groups	Inclusion/exclusion	Ethical approval	Service dog characteristics	Control	Variability estimates	Statistical values	Effect sizes	Precise probability values	Service dog time	Limitations	Total	%
Longitudinal	Allen (1996)	1	1	0	1	1	1	1	0	0	1	1	0	0	1	-	1	9/14	64%
	Collins (2004)	2	1	1	1	1	1	1	1	0	1	1	0	0	0	-	1	10/14	71%
	Donovan (1994)	3	1	1	1	1	1	0	1	0	1	0	0	0	0	-	1	8/14	57%
	Gilbey (2003) #1	4	1	1	1	0	-	0	0	0	0	0	1	0	1	-	1	6/13	46%
	Guest (2006)	5	1	0	1	1	-	0	0	0	0	0	0	0	0	-	0	3/13	23%
	Hubert (2013)	6	1	0	1	1	-	1	1	0	0	1	0	0	1	-	1	8/13	62%
	Lundqvist (2018)	7	1	0	1	1	-	1	1	1	0	1	0	1	1	-	1	10/13	77%
	Rabschutz (2006)	8	1	0	1	1	-	0	1	1	0	1	0	0	0	-	1	7/13	54%
	Rintala (2008) #1	9	1	1	1	1	1	1	0	0	1	1	1	0	1	-	1	11/14	79%
	Rintala (2008) #2	10	1	1	1	1	0	1	0	0	1	1	1	0	1	-	1	10/14	71%
	Spence (2015)	11	1	0	1	1	0	0	1	1	1	0	0	0	0	-	0	6/14	43%
	Vincent (2017)	12	1	1	1	1	-	0	1	1	0	1	0	0	1	-	1	9/13	69%
Cross-sectional	Collins (2006)	13	1	1	1	1	1	1	0	0	1	1	0	0	0	1	1	10/15	67%
	Craft (2007)	14	1	1	1	0	0	1	0	0	1	1	1	0	1	0	1	9/15	60%
	Crudden (2017)	15	1	0	0	1	1	1	1	0	1	1	1	1	0	0	1	10/15	67%
	Davis (2017)	16	1	1	1	1	0	1	1	0	1	1	1	1	1	0	1	12/15	80%

	Gilbey (2003) #2	17	1	1	1	0	1	0	0	0	1	1	1	0	1	0	1	9/15	60%
	Hacket (1994)	18	1	0	1	1	1	1	1	0	1	0	1	0	1	1	1	11/15	73%
	Hall (2017) #1	19	1	1	0	1	1	1	1	0	1	1	1	1	1	0	1	12/15	80%
	Hall (2017) #2	20	1	1	0	1	1	1	1	0	1	1	1	1	1	0	1	12/15	80%
	Matsunaka (2008)	21	1	1	1	0	0	0	1	0	1	1	0	0	0	0	0	6/15	40%
	Milan (2007)	22	1	1	1	1	1	1	1	0	1	1	0	0	0	0	1	10/15	67%
	Refson (1999)	23	1	0	1	0	1	1	0	0	1	0	0	0	1	1	0	7/15	47%
	Rodriguez (2018)	24	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	15/15	100%
	Rushing (1994)	25	1	1	1	1	1	0	0	0	1	1	0	0	0	0	1	8/15	53%
	Shintani (2010)	26	1	0	1	1	1	1	0	0	1	1	0	0	0	0	0	7/15	47%
	Yarmolkevich (2017)	27	1	1	0	1	0	0	1	0	1	1	1	0	0	0	1	8/15	53%
	Total Yes		**27**	**17**	**23**	**22**	**15**	**17**	**16**	**5**	**21**	**21**	**12**	**6**	**15**	**4**	**22**		
	Total No		**0**	**10**	**4**	**5**	**6**	**10**	**11**	**22**	**6**	**6**	**15**	**21**	**12**	**11**	**5**		
	Total N/A		**0**	**0**	**0**	**0**	**6**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**12**	**0**		

PUBLICATIONS

1. **Rodriguez, K. E.,** Greer, J., Yatcilla, J., Beck, A. & O'Haire, M. E. (*Submitted for Publication).* The psychosocial effects of service dogs on individuals with physical disabilities: A systematic literature review.
2. **Rodriguez, K. E.,** Anderson, L., Ott, C & O'Haire, M. E. (*Submitted for Publication*). The effect of a service dog on medication regimens among military members and veterans with posttraumatic stress disorder.
3. Nieforth, L., **Rodriguez K. E.,** & O'Haire, M. E. (*Submitted for Publication)*. Expectations versus experiences of PTSD service dogs for military veterans.
4. Jensen, C.L., Bibbo, J., **Rodriguez, K. E.,** & O'Haire, M. E. (*Submitted for Publication).* Effects of facility dogs on job-related health and wellness of children's hospital staff.
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6. McCall, C. E., **Rodriguez, K. E.,** MacDermid Wadsworth, S. M., Meis, L. A., & O'Haire, M. E. (*In Press*). "A part of our family"? Effects of psychiatric service dogs on quality of life and relationship functioning in military-connected couples. *Military Behavioral Health.*
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