ASSISTANCE DOGS FOR PEOPLE WITH DISABILITIES

EDITED BY: Emily Patterson-Kane, Lynette Arnason Hart and Mariko Yamamoto
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ASSISTANCE DOGS FOR PEOPLE WITH DISABILITIES

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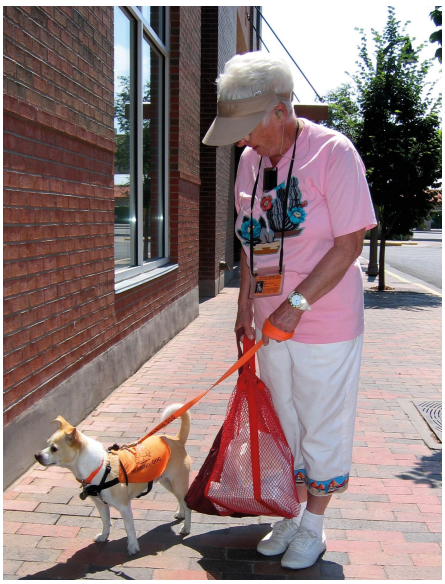

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Table of Contents

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EDITORIAL
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Editorial: Assistance Dogs for People With Disabilities

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Keywords: dog training, emotional support animals, psychiatric service dogs, service dogs, veterinary care

Editorial on the Research Topic

Assistance Dogs for People With Disabilities

The use of assistance dogs has a long and honorable history. Guide dogs have been held in high regard since the 1930s and since the 1980s, assistance dogs have rapidly expanded to fill new roles, particularly in the U.S. (1). Alongside these burgeoning possibilities for canine assistance, the social and regulatory environment for these dogs has become increasingly complex and some areas of confusion and social conflict have emerged (2). The nomenclature used in describing these dogs adds confusion: at the worldwide agency Assistance Dogs International (ADI), the inclusive term used is *assistance dogs* for guide, hearing and service (all other assisting roles, including for autism or psychiatric disabilities) dogs (3). In contrast, the U.S. American Disabilities Act uses the inclusive term *service dogs* (4).

Veterinarians and social scientists have special responsibilities to work together to support people with disabilities and their assistance dogs. This requires a seamless integration of animal and human medicine that includes a full range of service providers. This "One Health" world is more often aspirational than actual, and scientists and professionals are critical to bridging this gap.

Many highly capable agencies support people with disabilities, provide and support service animals, and advocate for them. However, it is researchers, veterinarians, and human health providers that make the connections between domains that are needed to allow the assistance-dog handlers to carry out their everyday activities with the ease and access that is their right.

This Research Topic aims to showcase some of the work being done to find a constructive way forward, expanding the effective and responsible employment of assistance dogs while managing the associated risks and conflicts. This includes supporting research into efficacy and best practices, promoting wider access to and for assistance dogs, and developing the support systems for handlers and their dogs.

IMPROVING PLACEMENTS AND ACCESS TO ASSISTANCE DOGS

It has become almost a cliché to say that more research is needed, but this is an area where research is critically important as the use of assistance dogs grows, vulnerable individuals are affected, and public confusion is rife. The article by Fausak discusses how to conduct literature searches for existing research in this multidisciplinary domain. From this base it becomes apparent that there are many areas where further research would help unblock the paths to progress.

One important goal is to objectively determine the benefits of assistance dogs in relation to different populations of handlers. Wilson et al. demonstrate a method for assessing diabetic alert dogs and understanding the factors that contribute to their levels of performance. Bray et al. show how dogs' performance can be assessed and predicted at a programmatic level to improve

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the success of assistance dog training and placement. Yamamoto and Hart describe some of the challenges for the growing number of people who are self-training their assistance dogs. Effective outreach is needed for handlers who choose to self-train their dogs so they can benefit from best practices and objective data about their dog's performance.

As these methods to validate and refine assistance dog training and placement evolve, it becomes apparent that there are also geographic obstacles to access. Walther et al. show how large areas within North America and Canada are not easily served by providers of appropriately trained service dogs. Also concerned with handlers' access to well-trained dogs, Takayanagi and Yamamoto describe strategies for increasing the availability of assistance dogs to people with disabilities in Japan.

The social mandate for assistance dogs is sometimes tenuous; media reports continue to reflect confusion about rights of access, and report handlers being denied access to public venues. In the United States, both pets and emotional support animals have important roles. In addition, the role of the assistance animal needs to be appreciated as distinct in terms of the dog's function and the handler's rights of access.

The role of psychiatric service dogs continues to be under-appreciated and subject to unjustified regulatory restriction. Lloyd et al. demonstrate the important roles of psychiatric service dogs for people with mental health disorders and LaFollette et al. examine the effects of different training methods with service dogs assisting veterans with PTSD.

OPTIMIZING THE WORKING PARTNERSHIP OF HANDLER AND DOG

The special bond between a handler and dog must be celebrated and supported with a planned awareness that this relationship will ultimately come to an end. Ongoing research is helping us understand how to navigate these difficult transitions in a way that supports handlers continuing to appreciate the support of the animals in appropriate and beneficial roles.

Veterinarians and paraprofessionals have an important role in providing care to assistance dogs throughout their lives. This includes veterinarians developing the ability to provide routine preventative and wellness care that addresses special needs of clients as discussed by Grigg and Hart. The veterinary team is particularly vital when managing a dog's retirement or end-of-life care as addressed in papers by Ng and Fine, and Villalobos.

Members of medical and veterinary medical professions have an important duty to facilitate the role of assistance dogs in the lives of people with disabilities. This includes both a basic level of care that should be expected of the medical and veterinary practitioners involved, and the work of specialists who assist in identifying, developing, and providing assistance dogs to handlers. This duty has many difficult aspects, including protecting the welfare of animals and people, and communicating calmly and consistently with the general public.

CONCLUSION

As the benefits of assistance dogs in relation to a spectrum of disabilities become more apparent, sound research for assessing the efficacy and determining best practices will become ever more important to protect vulnerable individuals and the interests of the community. It is vital that responsible members of the medical and veterinary professions, and evidence-based programs, retain the initiative in diagnosing the need for assistance dogs, as well as training, placing, and monitoring their use. In this way assistance dogs will continue to develop as a vital method for accommodating the needs of people with disabilities as they fully participate in modern society.

AUTHOR CONTRIBUTIONS

EP-K drafted the initial document. MY and LH added edits and all agreed on the final version.

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Military Veterans and Their PTSD Service Dogs: Associations Between Training Methods, PTSD Severity, Dog Behavior, and the Human-Animal Bond

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Introduction: Psychiatric service dogs are increasingly being sought out by military veterans as a complementary intervention for posttraumatic stress disorder (PTSD). After receiving a service dog, many veterans continue training their service dog at home. Our objective was to explore the associations between training methods, PTSD severity, service dog behavior, and the veteran-service dog bond in a population of military veterans with PTSD.

Methods: Post-9/11 military veterans with PTSD who had received a psychiatric service dog were recruited from a national service dog provider. A total of 111 veterans (M = 40.1 ± 8.3 years, 80% male) participated in an online survey regarding frequency of training methods, PTSD symptom severity, service dog behavior, and the human-animal bond. Service dogs were predominately Labrador Retriever purebreds or mixes of various breeds (66% male) and mostly obtained from shelters or rescues (58%). Training methods were divided into five categories: positive reinforcement (e.g., physical praise), negative punishment (e.g., ignoring the dog), positive punishment (e.g., verbal correction), dominance (e.g., alpha roll), and bond-based (e.g., co-sleeping). Data were analyzed using general linear models.

Results: Veterans self-reported using all five categories of training methods at least once a month. More frequent use of positive punishment was associated with less closeness with their service dog ($p = 0.02$), more fear ($p = 0.003$), less eye contact ($p < 0.0001$), and less trainability ($p = 0.04$). More frequent use of positive reinforcement was associated with higher closeness to their service dog ($p = 0.002$) and perceived increased attachment behavior ($p = 0.002$) and playfulness ($p = 0.002$). More frequent use of bond-based methods was associated with higher closeness to their service dog ($p = 0.02$). PTSD severity was not significantly associated with reported dog behavior, temperament, or veteran-service dog closeness.

Conclusion: Military veterans with PTSD service dogs reported using many training methods that were associated with different outcomes. In general, the reported

use of positive reinforcement or bond-based training methods were associated with reporting more positive outcomes while the reported use of positive punishment was associated with reporting more negative outcomes. Educating service dog organizations and recipients about the impacts of training methods could be beneficial for service dog efficacy and welfare.

Keywords: training methods, human-animal interaction, animal-assisted intervention, service dog, military veterans, PTSD, human-animal bond, IOS

INTRODUCTION

Military veterans with posttraumatic stress disorder (PTSD) are increasingly seeking out complementary therapies such as psychiatric service dogs. PTSD is characterized by intrusion, avoidance, negative alterations in cognition and mood, and alterations in arousal and anxiety (1). PTSD affects an estimated 6–14% of post-9/11 military veterans returning from deployments to Iraq or Afghanistan (2, 3) and is often linked to suicidal behavior (4), major depression (5), and substance abuse (6). Unfortunately, successful treatment of PTSD remains a challenge and current evidence-based treatments for PTSD often have high dropout and non-response rates (7–9). As a complement to evidence-based treatment, many military veterans are seeking out psychiatric service dogs to address their daily PTSD symptoms.

Psychiatric service dogs for PTSD are a specialized type of service dog specifically trained to perform a variety of tasks designed to mitigate the symptoms of PTSD. In the United States, a service dog must be individually trained to do work or perform tasks for a person with a disability [1]. For individuals with PTSD these tasks may include responding to the veteran's anxiety, "watching" the veteran's back in public, and waking them up from nightmares. If the dog is trained to do this task and is under control of the handler, it is permitted to accompany persons with disabilities in most public places. There are no specific tests required to qualify as a service dog. Regardless of whether a service dog is initially trained by the veteran themselves, a service dog organization, or a third-party trainer, most veterans maintain the service dog's training after placement in the home for optimum application.

Between the organization and the military veteran, a variety of training methods could be used to maintain a service dog's reliability in performing their trained tasks. These training methods could include both specific techniques rooted in operant conditioning theory and specific interactions that may be rooted in a particular style to reinforce a specific relationship with the service dog. Operant conditioning includes four quadrants that can be used in conjunction: positive reinforcement, positive punishment, negative reinforcement, and negative punishment. Positive reinforcement, or reward-based training, is the addition of a rewarding stimuli (i.e., reinforcers) to increase the likelihood of the behavior (i.e., response) occurring again (e.g., giving a dog a treat after it sits). Positive punishment, or aversive-based training, is the addition of an aversive stimuli to decrease the likelihood of the behavior occurring again (e.g., jerking on the leash when a dog pulls). Negative reinforcement is the removal of a punishing or aversive stimulus (i.e., a loud noise or pain) to increase the likelihood of the behavior occurring again (e.g., releasing pressure on the collar when the dog is at your side). Negative punishment is when a rewarding stimuli are removed to decrease the likelihood of the behavior occurring again (e.g., removing attention when a dog jumps). Two additional types of training styles are also present in working dog and service dog organizations: so-called dominance-based (10) and bond-based training (11). Dominance-based training emphasizes the belief that the handler can establish a superior position over the service dog to aid with training (e.g., always eating before a dog or alpha roll). Bond-based training emphasizes the belief that service dogs are best trained by the handler establishing a close bond with their dog (e.g., sharing food with the dog or co-sleeping).

Research suggests that training methods can impact indicators of canine welfare. The use of aversive training methods (e.g., positive punishment) has been found to be related to reduced dog welfare such as stress behaviors during training, elevated cortisol, and problem behaviors such as fear and aggression (12–14). On the contrary, the use of positive reinforcement methods alone has previously been associated with lower dog fear and aggression than other methods (12). Current knowledge on outcomes related to either positive or aversive training methods is limited to companion, police, or laboratory dogs. No previous studies, to our knowledge, have investigated the association between training methods on canine behavior in psychiatric service dogs.

In addition to the effects of training on service dog behavior or welfare, the handler's psychological status may also have an effect on service dogs. For example, a longitudinal study found that owner symptoms of depression and PTSD predicted the development of behavioral problems (aggression, separation anxiety, and attention-seeking behaviors) in search & rescue dogs (15). Additionally, a cross-sectional study found higher aggression in cocker spaniels owned by emotionally unstable owners (16). Finally, a recent study also found a 5-fold increase in the use of aversive training methods in men with moderate depression (17). Currently, the potential relationship between the PTSD symptom severity of military veterans and the behavior of their psychiatric service dogs are unknown. It is important to determine and understand this relationship to enhance the welfare of psychiatric service dogs.

[1]Americans With Disabilities Act of 1990, Pub. L. No. 101-336, 104 Stat. 328. (1990).

Finally, the human-animal bond between a service dog and handler should be mutually beneficial to both the service dog and the handler (18). For handlers, the human-animal bond has previously been found to be associated with mental, social, and physiological benefits for pet owners (19). For dogs, more strongly bonded pet owners are also most likely to walk their dogs, seek preventative care, and follow health-care recommendations from their veterinarians (20, 21). The bond has previously been shown to be impacted by human attitudes and personality (22), but, to our knowledge, no study has investigated the relationship between training techniques, PTSD severity, and dog behavior on the human-animal bond between military veterans and their service dogs.

The objective of this research was to explore the associations between reported use of training methods, PTSD severity, dog behavior, and the human-animal bond among a population of military veterans and their psychiatric service dogs. Based on previous research, we hypothesized that higher reported use of aversive training methods (i.e., positive punishment or dominance) would be associated with higher perceived negative outcomes (e.g., less closeness, more fear, and more aggression), while higher reported use of positive training methods (i.e., positive reinforcement or bond-based) would be associated with higher perceived positive outcomes (e.g., more closeness, more attention, more trainability). Additionally, we hypothesized that higher PTSD severity would be associated with higher perceived negative outcomes.

MATERIALS AND METHODS

The study protocol was approved by the Purdue University Human Research Protection Program Institutional Review Board (IRB Protocol 1607017967). No interactions occurred between the research team and service dogs during the study, therefore we received a waiver from Purdue University's Institutional Animal Care and Use Committee (IACUC).

Participants

Participants were recruited from K9s For Warriors (Ponte Vedra, Florida, USA), an Assistance Dog International (ADI) accredited, non-profit organization that provides service dogs to military veterans across the United States of America. Participants were military veterans who received a service dog from K9s For Warriors. Our inclusion criteria were (1) military service after September 11, 2001, (2) a community diagnosis of PTSD or meeting the clinical cutoff on the validated PTSD Checklist [PCL; (23)] (3) honorable discharge or current honorable service, (4) no history of or current substance abuse, (5) no conviction of any crime against animals, and (6) no more than two pet dogs currently in the home.

All participants attended a 3-week placement class at K9s For Warriors consisting of a set of standardized training and dog handling instruction. Veterans were instructed to use a combination of reward (e.g., positive reinforcement) and correction (e.g. positive punishment) based training and complete 120 h of training with their service dog over the 3-week period. Training methods were matched to the needs of the individual dog based on assessment from experienced dog trainers. Prior to the class, all dogs had been screened for temperament and trained for at least 60 h using operant conditioning with positive reinforcement and leash corrections. The organization also abides with ADI minimum standards for assistance dogs including training for at least three disability-related tasks, basic obedience skills (i.e., down, recall), and appropriate public behavior (i.e., no signs of aggression, acceptable greeting behaviors, appropriate attention seeking, etc.) (24).

Procedure

Participants were recruited between January and May of 2016 via an initial email and attached flyer which included detailed information about study participation. Following voluntary informed consent, participation consisted of completing a 10–15 min online survey. Upon completion of this survey, participants chose between receiving $20 in cash or a $20 Amazon gift card in remuneration (55% chose amazon gift card and 45% chose cash). Potential participants received up to 3 follow-up email reminders. Of 244 veterans with a service dog contacted, 111 (45%) participated in the online survey.

Measures

Demographics

Participants were asked to report their age, gender, number of children, number of pet dogs, and the month and year they received their service dog. Participants also consented for the researchers to access their records on file with K9s For Warriors which allowed for the extraction of service dog information including breed, sex, and source (shelter rescue, owner relinquishment, breeder donation, etc.). Dog breed and source were then coded into broad categories to assist with analysis.

PTSD Checklist

PTSD symptom severity was assessed using the PTSD Checklist (PCL-5), a widely used 20-item scale based on the four DSM-V symptom clusters of intrusion symptoms (subscale B), avoidance (criterion C), negative alterations in cognitions and mood (criterion D) and alterations in arousal and reactivity [criterion E; (25)]. Participants were asked to indicate the degree to which each PTSD symptom has bothered the participant in the past month on a scale from 0 = not at all to 5 = extremely. A higher PCL score indicated greater overall symptom severity, with a diagnosis cutoff of 31–33 on a scale of 0 to 80 (7, 26).

Inclusion of Other in the Self Scale (IOS)

The human-animal bond was assessed with the Inclusion of Other in the Self Scale (IOS), a single question measure that quantifies self-perceived closeness of relationships (27). Participants were asked to describe the current relationship between themselves and their service dog on a pictorial scale (1 = completely separate circles and 7 = highly overlapping circles; **Figure 1**). The IOS exhibited high reliability in the current sample (Cronbach's α's = 0.93), and has established convergent and divergent validity (27, 28). It correlates well with other

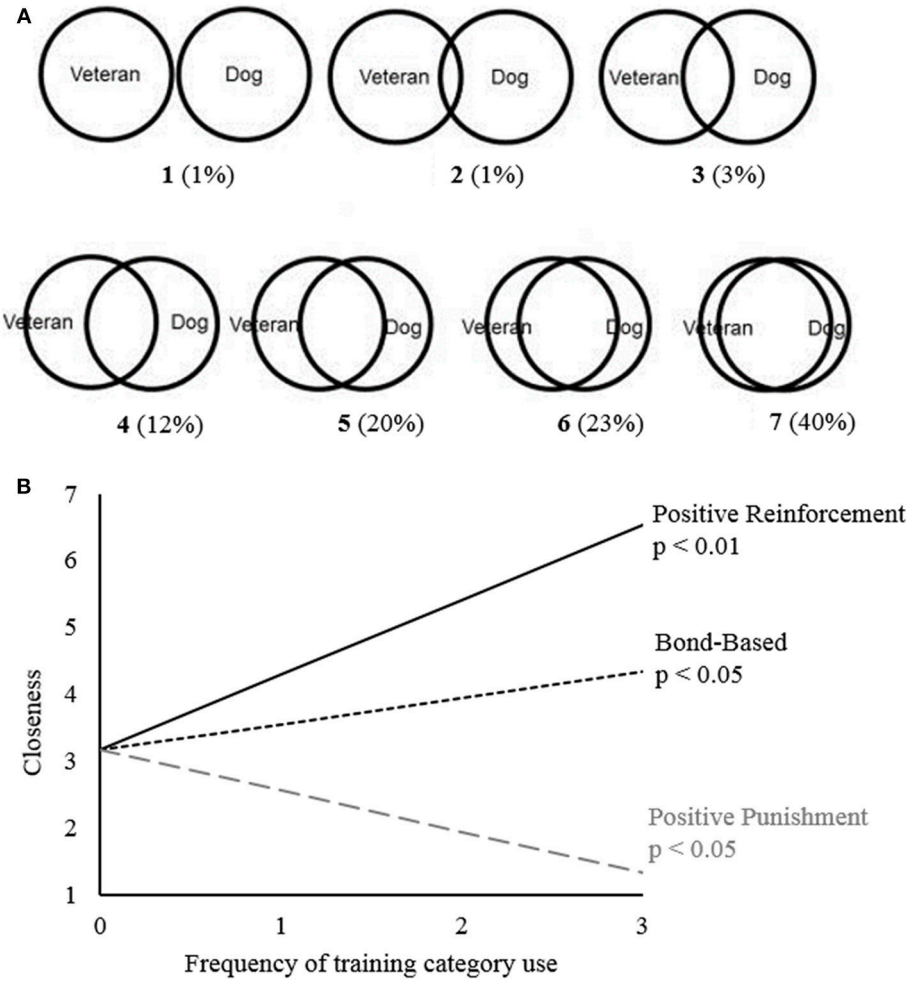

FIGURE 1 | Closeness and Training Methods. Military veterans ($N = 111$) were asked to describe the current relationship between themselves and their service dog (self-perceived closeness) by choosing an item on a pictorial scale. **(A)** The pictorial scale shown to military veterans, replicated from the Inclusion of Others in the Self Scale. In parentheses is the overall percentage of military veterans who chose each picture in this sample. **(B)** Significant associations between reported closeness and training methods resulting from linear regression models. Training Methods Scale: 0 = Never, 1 = Once, 2 = Once a Week, 3 = Daily.

interpersonal relationship measures such as the Relationship Closeness Inventory (29), the Subjective Closeness Index (29), the Sterberg Intimacy Scale (30), and the Positive and Negative Emotions about Others scales (27–29).

Training Methods

Participants' at-home training methods and frequency of use were evaluated using a questionnaire (**Supplemental Table 1**) modified from a previous survey of canine training methods (12). In the survey, each training method was described as objectively as possible and given an example such as "Verbal praise ('good boy')." Participants were asked to estimate how often they had used each training method in the past month (0 = never, 1 = once or twice, 2 = weekly, and 3 = daily). Participants were asked about a wide range of possible training methods (beyond what they were taught by the specific service dog organization) in order to capture their actual in-home interactions with their service dogs. Training methods were grouped into broad categories for analysis based on operant conditioning techniques (positive reinforcement, positive punishment, and negative punishment) and interaction styles (bond-based and dominance-based) commonly used by dog trainers and service dog organizations (**Table 1**) This survey was pre-tested by canine experts in the field as well as pet dog owners.

Although it is difficult to clearly separate between positive punishment and negative reinforcement, we chose to categorize techniques based on positive punishment and use this term for the remainder of the manuscript. This rationale was 2-fold in that the majority of previous literature focuses on potential negative effects of positive punishment (which may be more salient to the dog) and, second, to simplify the analysis and interpretation by ensuring that each training behavior was only included in a single category.

TABLE 1 | Handler Training Methods.

Category and behaviors	M	SD	Range	% Using daily
Positive reinforcement	**2.2**	**0.3**	**1.2–3**	**100**
Physical praise	3.0	0.2	1–3	100
Verbal praise	2.9	0.5	0–3	96
Play reward	2.5	0.8	0–3	64
Food reward	2.4	0.8	0–3	60
Clicker training	0.1	0.4	0–3	1
Bond-based	**1**	**0.6**	**0–3**	**51**
Co sleep	1.8	1.3	0–3	50
"Do as I do"	0.8	1.0	0–3	7
Share Food	0.3	0.6	0–2	0
Negative punishment	**0.7**	**0.7**	**0–3**	**10**
Ignore dog	0.7	1.0	0–3	5
Time out	0.6	0.8	0–3	8
Positive punishment	**1.6**	**0.6**	**0.3–3**	**79**
Verbal correction	2.7	0.6	1–3	78
Flat collar correction	1.5	1.2	0–3	30
Prong collar correction	1.4	1.1	0–3	23
Physical correction	0.8	1.0	0–3	11
Dominance-based	**0.9**	**0.7**	**0–3**	**45**
Eat before	1.4	1.4	0–3	38
Alpha roll	0.7	1.0	0–3	10
Stare down	0.5	0.8	0–3	5

Military veterans (N = 111) self-reported use (mean ± SD, range) of different training behaviors with their psychiatric service dogs.
Bold indicates the larger category of training method used for analysis as categorized by researchers. Scale: 0 = never, 1 = once or twice, 2 = weekly, 3 = daily (in the last month).

Dog Behavior and Character

Dog behavior and character was evaluated via a modified questionnaire (**Supplemental Table 1**) from previous surveys of canine behaviors including the Canine Behavioral Assessment and Research Questionnaire (C-BARQ©) (12, 14, 31). Participants were asked to report how often their service dog had displayed a series of behaviors in the last month (0 = never, 1 = rarely, 2 = sometimes, and 3 = often, 4 = always). Each behavior was described as objectively as possible such as "stayed close to you when you're sitting down or resting." After collecting the data, behaviors were grouped into broad categories for analysis based on previous research studies (12, 14, 31). Dog character was described by directly asking veterans to describe the character of their service dog as best they could on traits such as playfulness, fear, eye contact, and sociability (0 = not at all/never, 1 = a little bit, 2 = moderately/sometimes, 3 = quite a bit, 4 = extremely/always). This survey was pre-tested by canine experts in the field as well as pet dog owners.

Statistical Methods

Data were analyzed in Statistical Package for the Social Sciences (SPSS 24.0) using a series of regression models. Prior to testing, all assumptions of linear regression were confirmed including the independence of residuals, homogeneity of variance, normality of residuals, and multicollinearity in the data. For all summary scales, an average of individual items was calculated (excluding participants with >50% of missing data in each measure). Data is presented as mean ± standard deviation, where applicable. The significance level was set at $p < 0.05$.

The dependent variable for the veteran-dog bond was the Inclusion of Other in Self (IOS) scale. The dependent variables for service dog behavior were total unwanted behaviors, fear/avoidance, overall aggression, trainability, and attachment-attention behaviors. Finally, the dependent variables for service dog character were each individual item.

In each model, explanatory variables included the frequency of use for each training type or style and the veteran's total PTSD Score. For training methods, the numerical frequency of each method was calculated and then averaged. All statistical models also initially included covariates of veteran age, veteran gender, dog sex, and time since placement. We removed covariates above $p = 0.10$ in the final analyses.

RESULTS

Demographics

A total of 111 military veterans participated in the survey. Military veterans were mostly male (80%) with an average age of 40 ± 8 years (range 22–63). Average PCL-5 scores were 44 ± 17 (range 3–80). Veteran-service dog pairs had been together for anywhere from 1 month to 7 years (M = 22 ± 20 months). Service dogs were mostly male (66%) and mostly shelter or rescue dogs (58%) with some from other service dog providers (23%) or other sources (17%; e.g., owner surrender). Their reported breeds were mostly purebred (38%) or mixed (31%) Labrador Retrievers, with a large percentage of other purebred or mixed breeds (31%) such as German Shepherds or Golden Retrievers.

Training Methods

Veteran service dog handlers self-reported using all five categories of training methods in the past month (**Table 1**). Positive reinforcement was reported to be used most often with physical (100%; e.g., petting) and verbal praise (96%; e.g., "good boy") being used by almost all veterans on a daily basis. Positive punishment was the second most commonly used with the majority of veterans using verbal corrections (78%; e.g., "no") on a daily basis. Bond-based methods were the third most common, which was largely driven by half of veterans (50%) co-sleeping with their dogs daily. Dominance-based methods ranked fourth in frequency which was largely driven by 38% of veterans eating before their service dogs. Finally, negative punishment was used rarely (only 10% using daily).

PTSD Severity

Veteran's PTSD symptom severity was not significantly associated with any service dog behaviors, service dog character, or the veteran-dog bond (all p's > 0.05, **Table 2**).

Closeness

Military veterans felt extremely close to their service dogs (M = 5.8 ± 1.3, maximum of 7, **Figure 1**). More frequent reported use of positive reinforcement and bond-based methods were

TABLE 2 | Associations between training methods, PTSD Severity, veteran-service dog closeness (IOS), and service dog behavior and character.

	Positive reinforcement	Bond-based	Negative punishment	Positive punishment	Dominance-based	PTSD severity	Gender	Age	Time
HUMAN-ANIMAL BOND									
IOS	**0.294****	**0.211***	0.057	**−0.249***	0.000	0.067	**−0.317****		
SERVICE DOG BEHAVIOR									
All Problems	−0.060	0.053	0.194	0.160	0.079	0.039	**0.207***	**0.305****	
Trainability	**0.234***	0.017	−0.188	**−0.230***	0.087	0.011		**−0.199***	
Attachment/Attention	**0.307****	0.053	0.076	−0.225	0.096	0.044			
Fear/Avoidance	−0.029	0.161	0.228	0.175	−0.036	0.000	0.172	**0.282**	
Aggression	−0.070	−0.018	0.128	0.070	0.075	0.032		0.181	
SERVICE DOG CHARACTER									
Playfulness	**0.316****	−0.175	0.186	−0.094	−0.169	−0.028		**−0.241***	
Activity	**0.293****	**−0.232****	0.138	−0.123	−0.082	−0.074			
Fear	−0.129	0.088	0.064	**0.344****	−0.118	0.082			
Eye contact	0.168	0.182	0.148	**−0.419*****	0.002	0.016			
Chase drive	**0.275****	−0.128	**0.252***	−0.216	−0.171	−0.047			−0.190
Focus	0.192	−0.032	−0.122	−0.028	0.034	0.162		**0.234***	
Sociability	0.035	0.162	0.088	0.231	−0.115	−0.007			0.198
Reactivity	0.067	−0.005	0.195	−0.073	−0.182	0.092			
Food drive	0.121	−0.006	−0.168	0.028	0.045	−0.038			

*The associations (standardized regression coefficients, β) from linear regression models of self-report data from military veterans (N = 111) about their training method usage, PTSD severity, human-animal bond, service dog behavior, and service dog character. Gender reference category was male. Time was the number of months since the veteran had received his or her dog. Blank cells indicate that the covariate was not included in the final model, with p > 0.10. Bold indicates a significant effect. *p < 0.05, **p < 0.01, ***p < 0.001.*

associated with a closer bond; conversely, more frequent reported use of positive punishment was associated with a less close bond (**Table 2**, **Figure 1**). Additionally, male military veterans reported a closer bond to their service dogs than female veterans.

Service Dog Behavior and Character

Behavior

Participants reported that their service dogs often exhibited behaviors often interpreted as indicative of attachment or trainability and more rarely exhibited negative behaviors (such as those indicative of aggression or fear; **Table 3**). For example, over half of veterans reported that their service dog *always* follows them from room to room when at home (68%), stays close when sitting down or resting (60%), obeys a sit (66%), and listens closely to them (61%). Anxiety and fear behaviors were reported next frequently with over 40% of service dogs reported to show behaviors of anxiety or fear at least *sometimes*. For example, 46% of service dogs were reported to at least *sometimes* be anxious or upset when alone. Finally, behaviors potentially indicative of aggression were reported least often. However, 16% of service dogs displayed at least one potentially aggressive behavior *often* or *always* in the past month, with 10% of service dogs displaying unwanted barking at the veteran *often* or *always*.

In this study, no particular training method was associated with total behavior problems, overall aggression, or behaviors indicative of anxiety and fear in dogs (**Table 2**). However, certain training methods were associated with attachment or attention seeking behaviors and trainability (**Table 2**). Specifically, more frequent use of positive reinforcement was associated with increased trainability as well as attachment and attention-seeking behaviors; conversely, more frequent use of positive punishment was associated with less trainability. Factors such as veteran age and gender were also associated with service dog behaviors. Younger veterans reported fewer total behavior problems, fewer fearful and avoidance behaviors, and greater trainability. Male veterans reported fewer total problematic behaviors in dogs.

Character

On a scale from 0 to 4, most veterans described their service dogs character as extremely food driven (3.3 ± 1), focused (3.4 ± 1), making eye contact frequently (3.2 ± 1), sociable (3.0 ± 1), playful (2.9 ± 1), and active (2.9 ± 1). Dogs were reported to be quite a bit chase driven (2.5 ± 1) and reactive (2.5 ± 1). Although on average dogs were reported to rarely be fearful (1.1 + 1), 31% of veterans described their dogs as at least moderately fearful in new areas or with new objects.

Certain training techniques and styles were associated with aspects of service dog character (**Table 2**). Veterans that reported using more positive reinforcement described their dogs as being more playful, having more activity, and being more chase driven. Additionally, more frequent reported use of bond-based methods was associated with lower activity. Conversely, more frequent reported use of positive punishment was associated with higher fear and less eye contact. Additionally, more frequent reported use of negative punishment was associated with higher chase drive. Finally, younger veterans reported higher playfulness and greater focus in their service dogs. Neither the use of certain

TABLE 3 | Service dog behavior.

Category and behaviors	*M*	*SD*	Range	% Often or always
Attachment or attention-seeking	**3.2**	**0.6**	**1–4**	**97**
Solicits attention	3.5	0.7	1–4	91
Follows from room to room	3.5	0.8	1–4	90
Stays close by	2.9	1.0	0–4	75
Makes & holds eye contact	2.6	1.1	0–4	55
Trainability	**3.3**	**0.5**	**2–4**	**100**
Obeys "sit"	3.6	0.5	1–4	100
Listens closely	3.5	0.6	1–4	96
Obeys "stay"	3.5	0.7	0–4	92
Comes immediately when called	3.0	1.1	0–4	75
Distracted*	1.7	0.9	0–4	15
Steals food*	0.4	0.7	0–4	2
Anxiety & fear	**1**	**0.7**	**0–3**	**37**
Hid, shook, or paced from loud noises	1.5	1.4	0–4	25
Anxious or upset when alone	1.0	1.3	0–4	18
Anxious or upset when in public	0.9	1.0	0–4	9
Cautious or shy around new people	0.4	0.7	0–4	1
Potential aggression	**0.4**	**0.5**	**0–2**	**16**
Nipping at veteran	0.5	0.9	0–4	7
Nipping at other people	0.2	0.5	0–3	1
Nipping at other dogs	0.3	0.7	0–4	3
Unwanted growling at veteran	0.6	1.0	0–4	7
Unwanted growling at other people	0.4	0.9	0–4	5
Unwanted growling at other dogs	0.0	0.2	0–1	0
Unwanted barking at veteran	0.7	1.1	0–4	10
Unwanted barking at other people	0.6	0.9	0–4	7
Unwanted barking at other dogs	0.1	0.4	0–3	1

*Military veterans reported the frequency that their psychiatric service dog (N = 111) performed each behavior in the last month. Bold indicates the larger category used for analysis as coded by the researchers. *indicates that the item was reverse coded for final analysis. Scale: 0 = never, 1 = rarely, 2 = sometimes, 3 = often, 4 = always.*

training technique or styles nor any covariates were associated with food drive, reactivity, or sociability (all p's > 0.05).

DISCUSSION

General

To our knowledge, this study represents the first to compare associations between reported use of different training methods, PTSD severity, the veteran-dog bond, and dog behavior or character among military veterans with PTSD and their service dogs. Our results did not support our hypothesis that veteran PTSD severity would be associated with negative outcomes, but provided mixed evidence of other our hypotheses.

Our results provided mixed evidence in support of our first hypothesis that self-reported aversive training methods would be significantly associated with negative outcomes. Specifically, veterans who reported more frequent use of positive punishment reported less closeness with their service dog and perceiving their service dogs as exhibiting more fear, less eye contact, and being less trainable. However, there was no association between positive punishment and aggression (discussed below) or dominance-based training methods and any outcomes.

Our results also provided mixed evidence in support of our second hypothesis that self-reported positive training methods would be significantly associated with positive outcomes. Specifically, veterans who reported more frequent positive reinforcement reported more closeness, attention, trainability, and playfulness with their service dog. Veterans who reported more frequent bond-based training reported more closeness with their service dogs.

Training Methods

Military veterans in the population surveyed used a wide variety of in-home training methods with their psychiatric service dogs. Since we only asked veterans to report what training methods they were currently using (and did not ask them to specify the reasons they chose their methods) it is likely that these methods are based not only on instruction from the service dog organization, but also previous experience training dogs or seeing others training dogs such as military working dogs or through television programs. All veterans used some amount of positive reinforcement daily (e.g., physical praise, food rewards) and almost all veterans used some positive punishment daily (e.g., verbal correction, leash correction), which aligned with the service dog organization's instruction and recommendations. In comparison, bond-based, dominance-based, and negative punishment training methods were used less often. In terms of bond-based techniques, 50% of veterans reported sleeping in the same bed as their dog, which may be partially due to the fact that some dogs are trained to wake their veterans up during nightmares.

A comprehensive review of previous studies indicates that aversive training methods (e.g., positive punishment and dominance-based training) have been correlated with indicators of compromised welfare in dogs such as stress-related behaviors during training, impaired human-dog bond, elevated cortisol, and problem behaviors such as fear and aggression (13). However, this review also notes that many of the previous studies were non-objective surveys focused mainly on police and laboratory dogs, which may not be representative of the larger dog population and do not indicate causal direction. That is, with a correlational study—as in our current study—it is impossible to know whether behavior problems were caused by aversive methods or increased used of aversive methods were caused by behavior problems (or even if the two are not causally related, but just associated). Furthermore, the previous objective empirical studies have mainly focused on using shock-collars in training (13), which were never used in our population.

In terms of positive reinforcement, there have been perhaps even fewer formal investigations of its impact on indicators of dog welfare. One observational study did show that dogs from a school using positive-reinforcement showed increased attentiveness toward their owner, while dogs from a school using

negative-reinforcement showed signals of stress (32). Reward-based training has also been found to correlate with obedience (14, 33). However, in one of these studies increased use of reward-based training was also associated with increased owner-reported canine aggression and excitability (33), which seems to be contrary to other findings.

There have been even fewer formal investigations of dominance-based training methods (although several discussions of the concept), bond-based training, and negative punishment. For dominance, a survey of dog owners of dogs with behavior problems, directly confrontational methods (including dominance and positive punishment methods such as alpha roll, stare down, physical correction) were reported to elicit an aggressive response from dogs and therefore not recommended (34). Furthermore, scientific reviews on using dominance as a construct in domestic dogs agree that using coercive methods to assert "dominance" (i.e., alpha roll) is counterproductive, unsafe for owners, likely to negatively impact dog welfare, and is associated with undesirable behaviors (35–37). In this study, a lack of findings for dominance-based training methods could be because we included the behavior of "eating before" the dog (based off of common practices in dominance-based training books), which can simply provide structure and routine for the dog and is unlikely to be particularly aversive. Additionally, some veterans may not actually perform "alpha rolls" in an aversive manner to establish dominance. In the survey, we attempted to describe this behavior as objectively as possible ["force dog to roll on their back ('alpha roll')"] to prevent response bias, but in doing so lost the context of the actions. Therefore, it is possible that some veterans perform this behavior in a more playful manner that may not actually be aversive to the dogs.

For bond-based training (although no specific techniques have been assessed) there has been an association that owners who allow their dogs to sleep in their bedroom have higher attachment to their animals (38). Overall, it is clear that scientific evidence is limited in determining the effect of dog training techniques on dog welfare, training efficacy, and the human-animal bond. Our study took an initial approach to evaluating the associations between training methods, dog behavior, and the human-animal bond among military veterans and their psychiatric service dogs.

Closeness

Overall, veterans reported high interrelationship closeness with their service dogs, with 40% of veterans choosing the highest degree of circular overlap between themselves and their dogs, and the mean for all veterans being 5.8 on a 7-point scale. The Inclusion of Other in the Self-Scale (IOS) is a fairly novel measure in the human-animal bond literature; it indicated that veterans both feel close and perform behaviors associated with closeness with their service dogs (27). Our results align fairly well with previous results that handlers of service dogs have higher closeness with their dogs than pet owners. Previously, using the IOS, pet owners have been found to have a mean of 3.5 and 3.9 out of 7 with their closest pet (39, 40), while inmates training service dog puppies were found to have higher means of 6.2 (41). The IOS is advantageous because it is a single item scale that is fast for participants to complete and is not reliant on participants having a specific type of bond, but instead relies on individual perceptions. It also appears to not have the ceiling effect previously seen in other service dog owners (42).

There was no significant association detected between severity of PTSD symptomology and veteran-service dog closeness. This suggests that regardless of the severity of PTSD experienced, veterans are still able to bond strongly with their service dogs. This is mirrored by findings that there is no association between the Monash Dog Owner Relationship Scale and PTSD symptoms among military veterans (O'Haire and Rodriguez, Unpublished data).

There were a few associations between veteran-service dog closeness and self-reported use of training techniques. In particular, we found that both positive reinforcement and bond-based training techniques were associated with closer bonds. Positive reinforcement techniques include verbal praise and bond-based methods including co-sleeping may increase perceived closeness (22, 43). Conversely, we found that greater use of positive punishment was associated with less closeness. However, as this is an association-based study, we cannot determine causality. For example, it is possible that veterans who feel less close to their dogs are more likely to use positive punishment, rather than the use of positive punishment causing less close feelings.

Service Dog Behavior and Character

There was no significant relationship observed between veteran-reported service dog behavior or character and PTSD symptom severity. This suggests that veterans with more severe PTSD may not cause or perceive behavioral problems in their service dogs. This is contrary to previous results finding that emotional instability and symptoms of depression and PTSD are associated with and predicted the development of behavioral problems in pet and search-and-rescue dogs (15, 16). Therefore, it is possible that this result may be unique to specifically trained PTSD service dogs.

Overall, service dogs displayed many positive behaviors and character. Most service dogs frequently showed behaviors typically interpreted as signs of trainability as well as attachment & attention behaviors. This is unsurprising as service dogs are specifically selected and trained to be highly attentive and obedient to their handlers. Their character was generally appropriate for a service dog with most dogs being highly food driven and displaying frequent eye contact. A high display of eye contact is important because of literature showing that eye contact increases the production of oxytocin in both dogs and humans and facilitates owners' affiliative behaviors (44). Increasing oxytocin production is particularly relevant to veterans with PTSD as the application of intranasal oxytocin has been suggested as a complementary strategy for PTSD treatment (45).

The most common problem behavior category cited by veterans was signs of fear and anxiety. Veterans reported that 45% of their service dogs were at least sometimes anxious or upset when left alone. Previously, signs of owner-reported separation anxiety of pet dogs has been measured at rates between ∼34–38% (12, 14). Service dogs are very rarely left alone since they are

allowed to accompany their handlers in public places. Therefore, this issue may be less observable in service dogs than pet dogs simply because it occurs less often. However, because service dogs are rarely left alone, it may leave dogs less prepared to be alone when they must be, which will undoubtedly occur occasionally. Relatively high levels of separation anxiety may also relate to service dog training to form high attachment with their owners–as indicated by most service dogs always following their owners around at home–which is also considered as a potential signal of separation anxiety. Signs of at least rare fear of noises were reported in 46% of service dogs which is similar to previous studies of companion dogs where percentages range from 12.1 to 43% (12, 46, 47). On the contrary, 94% of service dogs in our study never or rarely showed signs of anxiety when in public, which is important since public access is the main feature distinguishing a service dog from a pet dog.

Although there was no association between overall behavior problems in dogs and training techniques, there were several associations between behavior and character subscales and training techniques. Positive methods such as positive reinforcement and bond-based training generally were associated with more positive behaviors such as higher eye contact, attachment and attention behaviors, and playfulness. These findings support prior research that positive reinforcement was associated with lower undesirable behaviors (12, 14). On the contrary, positive punishment was associated with more signs of fear, less eye contact, and less trainability. This finding supports previous work indicating associations and causality of negative outcomes when positive punishment is used (12–14). However, it is possible that handlers who find their dogs less trainable are more likely to use positive punishment, rather than positive punishment causing less trainability. However, this alternative explanation makes less sense when considering the association between self-reported fear and positive punishment; that is, it less logical for handlers who perceive their dogs are more fearful to use positive punishment to combat that, rather than positive punishment actually leading to higher fear. Finally, increased use of negative punishment was slightly associated with higher perceived chase drive toward balls or moving objects. It is possible that dog's that chase more frequently are also subject to techniques such as "time outs" in the crate, rather than negative punishment actually causing increased chasing.

Some veterans reported potentially aggressive behaviors occurring–albeit at very low levels and rates–such as unwanted barking or growling at other people. The American Disabilities Act requires that service dogs must be under control of the handler at all times [2]; however, these results do not necessarily indicate that the dogs are not under control or even showing true aggression. We did not distinguish as to whether these instances occurred in public situations or while the dog was in the home. Furthermore, in the comment section of this section of the survey, some veterans noted that the dog aggression was toward off-leash dogs that had approached the service dog while working or mouthy-ness during normal play with the family dog. Additionally, some unwanted barking could be due to excitement or attention seeking behavior. However, other veterans noted in the comment section of the survey that some growling was due to dogs becoming protective of their handlers.

Other than training methods, there were a few factors that were also associated with service dog behavior and character. Younger veterans reported that their dogs had fewer negative behaviors (both overall and specifically anxiety/fear) and more positive behaviors (playfulness and trainability). It is possible that younger veterans may simply be more able to prevent negative behaviors and elicit positive behaviors or be more effective dog trainers. On the other hand, they simply may have a more positive view of their service dogs and report fewer problems and more positive behaviors.

Limitations

There are several limitations to this investigation. First, since this study was cross-sectional it is impossible to determine causation in the associations that were uncovered. For example, it is possible that veterans who feel closer to their dogs are simply more likely to use positive reinforcement techniques, rather than positive reinforcement actually causing more feelings of closeness. Further studies would benefit from randomly assigning training methods to subsets of the population to determine the direction of causality of this association. However, this study provides initial insight into associations between training methods and relevant outcomes, which could provide rationale for future study.

Second, this survey only evaluated veterans receiving service dogs from a single service dog provider. This may have reduced possible variation in our results and masked additional relationships that could be identified. However, as we did find acceptable variation and this is one of the largest providers of PTSD service dogs that serves a nationally representative sample of veterans, the results may still be applicable to a wide population.

Finally, since this survey only included indirect, handler-reported behavioral assessments of their service dogs, there is the potential for subjective biases to occur. Additionally, handlers reported behaviors may not accurately reflect their training styles for the best assessment of dominance- or bond-based training styles. Further studies would benefit from objective behavioral observations with either live or video coding, assessment of the context of these behaviors, and an assessment of the handlers' overall training philosophy. However, this study provides insight into the experiences and perceptions of veterans with service dogs, which are uniquely important to consider in the context of an intervention targeting human-perceived outcomes. Additionally, handler perceptions of dog behavior are critical to understand as they likely influence the human-animal bond, which is the basis for the practice of service dogs for PTSD.

CONCLUSIONS

In conclusion, there appear to be associations between higher reported use of positive training methods and positive outcomes for service dogs. Additionally, there are a few associations between higher reported use of negative training methods

[2] Americans With Disabilities Act of 1990. (1990). 104.

and negative outcomes for service dogs. Finally, there was no association between PTSD severity, closeness between a veteran and their service dog, or the dog's behaviors or character. Overall, educating service dog organizations and recipients about the relationships between training methods, service dog behavior, and service dog character could be beneficial for service dog efficacy and welfare.

AUTHOR CONTRIBUTIONS

All authors contributed to the conceptualization and methodology of the study. ML and KR contributed to data curation. ML, KR, and MO performed the statistical analysis. ML wrote the first draft of the manuscript. All authors contributed to manuscript revision, read and approved the submitted version.

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SUPPLEMENTARY MATERIAL

The Supplementary Material for this article can be found online at: https://www.frontiersin.org/articles/10.3389/fvets.2019.00023/full#supplementary-material

Supplemental Table 1 | Questionnaire for military veterans. The question scale, question text, response options, and coded response values of the survey given to military veterans about their PTSD service dogs.

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REVIEW
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Paving the Path Toward Retirement for Assistance Animals: Transitioning Lives

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Assistance animals play significant roles in human therapy and well-being and represent a rapidly growing demographic of animals in society. Most research in the field of assistance animals has been focused on the effect of these animals on people. Only recently has there been a growing interest in the welfare and well-being of these animals and the effect of the work on the animals themselves. The concept of retirement, or withdrawing the animal from its working life, is an important welfare consideration that has received minimal discussion in the scientific literature. The notion of retirement is typically regarded as a reward earned after a lifetime of work, but this inevitable phase of an animal's working life has positive and negative implications for both animal and handler. Some of these implications include recognizing the emotional impact of this life-altering event on both animal and handler. The decisions of when and how to appropriately retire an animal are typically made at the discretion of the assistance animal agencies and handlers, but standard evidence-based guidelines for the proper retirement of assistance animals are currently unavailable. This review will provide considerations and recommendations for the retirement that assistance animals deserve.

Keywords: retirement, aging, assistance animals, service animals, welfare

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INTRODUCTION

Recently, I watched an older mobility service dog join her family on the plane. Her handler had some significant mobility impairments, and it was clear that her dog was a tremendous asset to her. As they got settled, we began to talk. She let me know that "Trixie" was getting quite old, and they were planning to retire her in the next 4 to 6 months. They felt that her role as service animal was becoming too demanding for Trixie, and they felt she deserved a break. The woman shared how concerned she was about Trixie's retirement primarily because she wondered how she would handle this new change in life. She noted, "Humans make the choice to retire, and for some of us, we are ready for our new future…" On the other hand, "Our animals don't consent to this process, and I wonder how some will do, including my dear Trixie." Although Trixie would be retired, she planned to keep her as her family dog, while they would be adopting a new service dog to take on that role. There was never a thought in her mind that Trixie would leave the family.

The emotional conundrum of retiring an assistance animal is an issue every handler must confront at some point of the animal's life. The cessation of a working career should be perceived as a well-deserved, positive celebration and a guarantee that the animal will enjoy the remainder of his or her life. However, retirement also marks finality and can be a difficult road for both animal and handler to navigate physically and emotionally.

There has been growing attention to the welfare of assistance animals during their active working lives. Despite the fact that every assistance animal will inevitably face the reality of retirement and end of life, research has rarely addressed these issues. Evidence-based guidelines of when and how to appropriately retire an assistance animal are necessary for the welfare of the animal and handler. The purpose of this review is to define the retirement of an assistance animal, describe the implications of assistance animal retirement for both handler and animal, and discuss the challenges in determining when to retire an assistance animal. While the concept of retirement may be applied to any species designated as assistance animals, this review will be specific to the canine species.

DEFINING RETIREMENT

Retirement represents one of the greatest lifestyle changes an individual can experience in life. It signifies the beginning of a new era and, more specifically, the beginning of the last phase of life. This topic is of utmost importance in today's world because of technological advancements in medicine permitting humans (and animals) to live healthier and longer lives than ever before (1). Of course, longer lives lead to longer retirement (1). This period represents a significant portion of the animal's life that should receive special attention because of its aging physical state. While retirement is exclusively a human concept, it certainly applies to the life of working animals.

Retirement is the ultimate respite from the work an assistance animal performs. An assistance animal may spend its retirement in the home of the handler he or she has been assisting, in the home of the individual who raised the dog as a puppy, or in the home of another individual screened and approved by the agency from a waiting list (2). However, retirement is spent, the animal should be free of obligations and be simply considered a pet that belongs to an owner, rather than a medical device specifically trained to perform a task for an individual with a disability.

This, however, does not mean that the animal is duty-bound to a sedentary, isolated lifestyle. The animal should continue to remain active, stimulated, and engaged in a manner that is not distressing, with adequate environmental enrichment (3). Instead of full retirement, the animal may also enter semi-retirement, in which the animal retires from his or her full time assistance animal role but still works part time at a reduced capacity. This is likely not an option for the handler that requires an assistance animal full time. Rather, the animal can transition to a different, less demanding career in semi-retirement as a therapy dog, search and rescue dog, or detection dog. The frequency, duration, and intensity of work can gradually decrease to complete cessation of work and full retirement, depending on the response of the animal. Some working animals are rejuvenated with a new role. For example, a military working dog diagnosed with post-traumatic stress disorder (PTSD) after deployment was not fully retired, but rather trained to be a service dog; this shift and new sense of purpose reportedly eased this dog's PTSD signs (4). However, retirement is lived, it should be a positive experience, ensuring good quality of life until the animal's end of life.

IMPLICATIONS OF RETIREMENT

Retirement of assistance animals has both positive and negative impacts on the well-being of both the animal and handler. A great deal of research has been conducted concerning the psychosocial and health ramifications of retirement on humans, but little research has specifically addressed issues regarding the retirement of assistance animals. The term "retirement adjustment" is used to describe when people prepare and become accustomed to the changes associated with the transition from work to retirement (5) and can be applied to assistance animals as well. With proper planning and maintaining a healthy lifestyle, retirement should be a positive experience.

For the Animal

In retirement, the animal no longer has obligations or duties to fulfill; life is more calm, less stimulating, and perhaps less stressful for the animal. Factors, such as unintentional maltreatment of the animal, overstimulation from humans other than the handler, lack of predictability in daily routines, and insufficient opportunities for recreational activities, have been reported to be welfare concerns for service dogs (6, 7). Because of the nature of their work, these dogs may also be exposed to adverse environmental conditions and the transmission of zoonotic and other infectious diseases (8). Retirement provides freedom from these stressors of working life.

While it may be perceived that retirement is a liberation of sorts, this human sentiment of retirement may not be similar to how assistance animals experience retirement. Assistance animals may not necessarily perceive their working roles as arduous work they wish to escape in the traditional sense that some people do. Retirement can, in fact, be distressing for some animal retirees because the transition from working full time to not working at all can be a dramatic and challenging adjustment.

Potential negative implications of retirement for the animal may be extrapolated from the human literature. Various studies in humans have shown that retirement resulted in negative effects on physical health (9, 10) and declines in mental health characterized by decreased well-being and increased depression (11–13). Being forced into retirement while still having a strong desire to continue working or feeling without a purpose are negative outcomes that some may struggle with during post-work life (14). People who have worked for decades may not realize they are no longer physically or mentally capable of the same type of work that was part of their daily routine for most of their adult years. Assistance animals have been trained to perform certain tasks and have been performing them for most of their lives. In essence, it becomes part of their nature, and their work habits are embedded into their daily lives, potentially making them harder to break because they do not see a life without them. Retirement may be perceived as a disengagement from their typical life routines because they do not know a life that is any different. Such a dramatic change may not only be confusing, but also emotionally taxing.

How the animal responds to this life change likely depends on the drive of the individual animal. Houlfort et al. (15) points out that the type of relationship a person had toward work, whether

"harmonious or obsessive," will be a factor in his/her mental adjustment to retirement. For example, a person who has an obsessive need to work will not adapt as easily to retirement as someone who has a less intense need for work satisfaction (15). Every individual is different, so while one obsessive assistance dog with high drive may have a difficult time adjusting to retirement, another slothful assistance dog with lower drive may adapt to retirement without issue. However, the majority of assistance dogs are selected because of their "drive" to work and thrive when they have a specific purpose and role (16). The lack of purpose can be distressing to these dogs that crave constant attention and purpose. The dog may continue to perform tasks he or she is accustomed to doing, such as picking up objects when they are dropped (as a previous disability assistance dog) or barking when the phone rings (for a hearing dog). When the task is not rewarded or perhaps discouraged in retirement, the dog may become frustrated and anxious, leading to maladaptive behaviors indicative of poor welfare. In essence, the dog may need to be re-trained to not function as a working dog. As we begin to understand more about canine cognition, we may discover that the loss of purpose associated with retirement has an emotional toll on dogs (17, 18).

The difference between retirement for people and retirement for working animals is that people can consciously anticipate it and understand why they are no longer working. Animals, however, live moment to moment and are unable to be comprehend that they will retire in the future and do not understand the reason why they are no longer required to work. While people have control of their own lives and have the will to decide when and how retirement will commence, animals are unaware this is even an option since this fate is determined by the handler and/or assistance animal agency.

Where the animal spends its retirement also depends on the handler and/or assistance animal agency. Specific changes to daily routine in retirement largely depends on whether the animal retires in the home of the handler or in a different home without the handler. When the animal retires with the handler, the challenge for the animal to adapt to is no longer accompanying the handler at all times in all locations. The animal is likely strongly attached to the handler, and the separation can be stressful, especially when the animal does not understand why this is happening. Signs of separation anxiety may manifest because the animal is now left home alone without the social interaction or attention he or she has been accustomed to for the majority of their life. In addition, since the assistance dog accompanied a human at all times, the needs of this dog were attended to constantly, such as the need to be walked, fed, watered, and played with. When the dog is left home alone in retirement, there is the potential for the dog to receive less diligent care and attention. It is essential that provisions and services, such as regular dog walking or alternative means of care, be provided for the retiree. One of the most significant stressors for the animal retiring in the home of the handler can be the introduction of the new animal that will be replacing him or her. Particularly in a single dog household, the addition of a new dog may present problems resulting in inter-dog aggression and other maladaptive behaviors.

The stress of coping with retirement may be mitigated or magnified if the animal is taken out of the home and assigned to live with a new owner. A dog may not be as confused if the handler he or she has been working with for their whole life is no longer present. If the retirement home is the original puppy raiser or another person the dog is familiar with, the dog may be able to adjust more comfortably. Conversely, a dog may not adjust to a new home very well, not only because of the change in routine, but because of potential changes in numbers and types of people in the household, numbers and types of other animals in the household, and differing home environments (i.e., climate, flooring, physical space, etc.).

Since assistance animals typically do not interact with strangers while working to avoid distraction, they have not been accustomed to unfamiliar humans interacting with them. In retirement, these dogs will likely be approached and pet by strangers, which may be confusing to the dog. Studies have shown that older dogs cope less efficiently to stress caused by mild social challenges (19). Aged dogs in this study behaved more passively, showed less interest in interaction with a stranger, and demonstrated a significantly increased physiologic stress response after exposure to a stranger. This indicates that older dogs may not be as adept at managing social situations. This may be particularly true for older assistance dogs that have retired, which can certainly impact their emotional well-being. For this reason, the process of entering retirement should be carefully planned and modified according to the response of that particular animal.

For the Handler

It is no surprise that the retirement of an assistance animal affects the handler just as much as, if not more than it affects the animal itself. The period of transition into retirement may cause some handlers an enormous amount of stress, difficulty, and pain because of the strongly established bond (20). Wrobel and Dye (21) also suggest that the bond between the assistance dog and handler is unequivocally strong, and the process of grieving due to retirement or death of the animal may be significant. The ramifications may impact mental health and activities of daily life.

There is a plethora of research that highlights the physiological and psychological significance that animals provide to humans (22, 23). It is only logical to assume that the benefits found in humans' relationships with their companion animals would be similar or even more substantial in the relationships with individuals requiring assistance animals. Sachs-Ericsson et al. (24) highlighted numerous studies demonstrating that the assistance animal provides for not only the individual's enhanced independence, but in promoting the individual's psychological well-being as well. Camp (25) reported that numerous individuals who have assistance animals identify their relationship with the dogs as one of the most important benefits of the relationship, oftentimes superseding the functional tasks the animals perform. Lane et al. (26) reported that most owners consider their assistance dogs a critical member of their family, instead of just a working dog. The emotional significance that these animals have in the lives of the humans they support is crucial in understanding why individuals may experience

tremendous hardships when retiring their assistance animals. In essence, the handler feels very connected to his animal. He or she has learned to rely on that animal over the years to live his or her life.

In addition, attachment theory provides additional insight into the reason why humans are so attached to companion animals and particularly the assistance animals they care for. Attachment theory was developed by John Bowlby (27), who described the major element in parent-child relationships as attributed to humans' desire to protect their infants. This theory suggests that our strong relationships with animals exist because of our innate attachment needs as caregivers. Zilcha-Mano et al. (28–30) suggest that humans view their companion animals in a similar fashion as those taking care of an infant. Furthermore, Kwong (31) discovered that caregiving was an important dynamic in the development and preservation of the relationship between assistance dogs and their human counterparts. Recipients of assistance animals are taught early in their training with their selected animals that caring for and engaging with the animals is essential for a strong human-animal bond that forges an effective working alliance. This helps to understand why a handler can have a difficult time coping once the working alliance is terminated upon retirement of the assistance animal. Folk (32) believes that it may be harder on the human partner than the dog because it represents a significant adjustment in the human's everyday life.

Once the decision to retire an assistance animal is made, the impact of this change on the handler will depend on whether the animal spends retirement with the handler or with a new family. While a handler may desire to keep the retired animal while integrating a new assistance animal, there may be numerous challenges to the transition. The indication for the retirement of the animal may be due to the development of a physical illness that requires advanced care. This care may include frequent veterinary visits, medication administration, and implementing special accommodations that the assistance animal may need. The handler may be unwilling or inept to attend to animal's needs (i.e., life changes or physical handicaps the handler may be experiencing that interfere with the ability to provide for the animal). Additionally, it is emotionally draining for a handler to watch a previously robust assistance animal age, slowly decline in health, and inevitably make end of life decisions on behalf of the beloved animal.

For these reasons, many handlers are comfortable with retiring their assistance animal to a good home. However, Folk (32) believes that the handler may begin to feel a sense of guilt about relinquishing the assistance animal. She explains that an individual may feel that relinquishment may be similar to abandoning their companion at the end of his or her life after all that the dog has done for him or her. The sentiment that the dog will ultimately be adopted into a dependable home that is guaranteed to meet all his or her needs to ensure a healthy and fulfilling retirement may comfort these handlers during the separation. While some may find consolation in visiting the assistance dog in his or her new home during retirement, others may find it difficult to only visit for a short period of time. Although the handler should logically perceive that retirement is unavoidable and in the best interest of the animal, the handler copes with many logical hardships during the transition.

WHEN TO RETIRE AN ASSISTANCE ANIMAL

An animal should retire when, and preferably before, it exhibits physical or mental health conditions that impair its ability to work. Currently, there are no evidence based studies nor standard, established guidelines that indicate when an assistance animal should retire. Assistance Dogs International (ADI) is a leading international umbrella organization that provides guidance and membership for approved non-profit programs that train and place assistance dogs. As a leading authority, assistance dog agencies seek their counsel on assistance dog issues worldwide. ADI standards do not state specifics regarding the retirement of assistance dogs (33). According to Gorbing (34), secretary of ADI, "There are no mandatory standards around the retirement of assistance dogs within ADI, although to some extent, the issue is addressed through some of the other standards e.g., the need for annual follow-up by programs on all of their clients, including the requirement to obtain a veterinary report assessing the dog's fitness to remain working." Regardless, universal guidelines are non-existent for those seeking formal recommendations.

In situations where the dog is still owned by the assistance dog agency, each agency may have their own parameters to determine when the animal is ready to retire, typically based on veterinarian reports, annual reports from handlers, and site visits (2). However, there is no oversight for the retirement of dogs of agencies that completely transfer ownership to the handler or dogs that are individually trained and owned by their handlers. Gorbing (34) also notes that "programs also have a mandatory duty to prepare clients for the retirement of the dog at some stage through the provision of information and support. In practice, it is always a tricky issue to deal with, but if programs start from an understanding of what is best for the dog, from my experience, it is fairly clear when the point of retirement comes."

By Health Status

The clearest indication for retirement is the presence of any disease that inhibits the animal's ability to work. Any change in the animal's physical health warrants veterinary evaluation and cessation of work until the problem is addressed and resolved completely. One study investigated the incidence of health conditions, time of retirement, and cause of retirement in 7,686 guide dogs in the UK (35). The most common causes for early retirement in guide dogs were musculoskeletal and neurologic conditions (35). Clinical signs of musculoskeletal disease include slowing down, weakness, difficulty getting up and down stairs, and challenges with rising and lying down. Osteoarthritis was the main cause and diagnosis of musculoskeletal signs that mandated retirement (35). Clinical signs of neurologic disease include seizures, circling, falling, and paraparesis. Epilepsy was the main cause and diagnosis of neurologic signs that mandated retirement (35).

The assistance animal may succumb to a multitude of other conditions affecting body systems that impair his or her ability to work. Clinical signs of cardiorespiratory disease include excessive coughing, increased respiratory rate, difficulty breathing, weakness, and collapse. These signs warrant immediate attention as they can be indicative of rapidly fatal disease. Clinical signs of gastrointestinal disease include vomiting, diarrhea, decreased appetite, and weight loss. Although many gastrointestinal conditions may be temporary and likely due to dietary indiscretion, signs that are chronic in nature warrant retirement. Clinical signs of urinary disease include urinary incontinence, increased drinking, increased urination, and straining to urinate. Because these signs may be linked to endocrine diseases, thorough veterinary investigation is necessary. Clinical signs of dermatologic disease include scratching, rashes, and skin masses. Interestingly, dermatologic conditions caused by atopic dermatitis were the ailments that reduced the working life of guide dogs the most, by an average of 5 years (35).

Impairments of the senses, specifically vision and hearing, critically affect the life of an assistance animal. Clinical signs of ophthalmic disease include difficulty navigating, sudden blindness, clouding of the eye, excessive ocular discharge, and redness of the eye. Clinical signs of hearing loss include decreased reactions to sounds or verbal commands, which can be more difficult to appreciate. In general, any physical changes in the animal's health including weakness, lethargy, change in activity or rest, and changes in performance should be addressed immediately. Most importantly, any conditions that cause significant pain to the animal warrant cessation of work. The animal should not be forced to work while trying to recover from a health condition and veterinary guidance is necessary to determine if and when the animal should return to work.

Changes in behavior warrant a veterinary evaluation and consultation with a behaviorist. Clinical signs including aggression, vocalization, atypical behavior, changes in attitude, and disorientation may indicate a behavioral disorder, but systemic medical conditions must be ruled out first. Behavioral changes may actually be due to neurologic, endocrine, or pain-related conditions. Furthermore, older dogs that exhibit changes in mental status may suffer from the canine equivalent of Alzheimer's disease, which is called canine cognitive dysfunction. Cognitive dysfunction is prevalent among 14.2–22.5% of all geriatric dogs (36, 37). The condition is characterized by altered sleep cycles, decreased social interactions, disorientation, anxiety, and house soiling. Although the disease progression can be delayed and managed, the condition is irreversible and clearly impacts the assistance dog's ability to work, making retirement necessary.

In addition, handlers and veterinarians should monitor for behavioral signs of stress and anxiety. Signs of stress commonly exhibited in dogs include increased restlessness, snout licking, paw lifting, yawning, body shaking, nosing, circling, increased locomotor activity, and lowering of body posture (38, 39). An increase in these subtle behavioral indicators of stress while working may be the first sign that retirement should be considered. Therefore, handlers must pay careful attention to any trends in these signs.

By Age

While these changes in physical health and behavior indicate consideration for retirement, the ideal retirement should be mandated long before signs of illness ensue. This presents a challenge because an individual may not feel that a healthy animal needs to be retired, especially when it is fully functional at its work. However, the animal should retire in order for it to enjoy retirement in good health, rather than in a debilitated state. The ideal duration of time the retired animal should be in good health is unknown, but it is reasonable to consider when the animal reaches the senior life stage, defined as the last 25% of the dog's expected lifespan (40).

To address the challenge of retiring a healthy animal, some individuals may be inclined to use age as the major factor for retirement. However, using an age cut-off may be unreliable given the varying life expectancies of species and breeds. For example, it is widely accepted that larger breeds of dogs have shorter lifespans than smaller breeds (41, 42). Of course, this is not always the case since genetics and preventive health care practices play large roles in lifespan. For example, a chihuahua expected to live to 16 years could be cut off to retire at 12 years of age to achieve 25% of life in retirement but could pass away at 13 years of age due to an unforeseen condition. Alternatively, a great dane expected to live to 8 years of age could be instructed to retire at 6 years of age to achieve 25% of healthy life in retirement but could live to 12 years of age. Therefore, these would have been inaccurate choices to make.

Age is just a number, and this crude assessment of age as a determinant of retirement assumes that the animal is experiencing healthy aging. Healthy aging is a normal process of life that can be defined as cognitive and behavioral health in conjunction with normal function of individual body systems (43). Even in the absence of disease, normal age-related changes, such as graying of the muzzle and moderate reduction in activity, are bound to occur (44). Healthy aging is also associated with behavioral changes, such as a decline in attentiveness (45), play level, and response to commands (46). Interestingly, healthy aging dogs also change from spending a lot of time interacting with humans to simply spending more time near humans (47). Therefore, a handler should not be surprised that an older assistance dog may choose simply to be around, but not necessarily engage with the handler. This healthy aging phenomenon should be distinguished from senescence, which is defined as the collective, deteriorative changes that negatively affect an aged dog's quality of life (44). Signs of senescence may include osteoarthritis and impairments in vision, smell, and hearing (48). Regular veterinary consultation is essential for every assistance animal to determine healthy aging. Ideally, every assistance animal should be assessed biannually, especially as the animal approaches the senior life stage.

Most service and working dogs, which are typically Labrador Retrievers, German Shepherds, and Golden Retrievers, are estimated to have an average working life of 8 years (35, 49). Since most working dogs do not officially begin their careers until

2 years of age, they are typically retired at around 10 years of age. Because these breeds of dogs have a typical life expectancy of 12–14 years, retirement at 10 years is consistent with the understanding that an animal should retire when it reaches 3/4 of its lifespan. Another study demonstrated that factors associated with early death in guide dogs were an elevated alanine aminotransferase (ALT, a liver-associated enzyme measured on routine bloodwork) and evidence of skin nodules (50). Therefore, veterinarians should routinely assess bloodwork and closely examine the skin in assistance dogs to properly assess their health statuses. Perhaps an assistance dog should be retired earlier than expected if the dog has evidence of elevated ALT or skin nodules since there is a possibility the dog will have a shorter life than the average asssistance dog.

By Alternative Assessment Tools

Determining when an assistance animal should retire is unclear, multifactorial, and dependent on the individual. Therefore, this decision should be based on careful assessment by the handler/owner in conjunction with veterinary and behavior consultation. To make an informed decision, the veterinarian or behaviorist should be familiar with the duties, working conditions, and potential stressors of that particular assistance animal. However, access to additional parameters that assess animal welfare may help in making a better informed decision regarding retirement.

Objective diagnostic tools to determine appropriate time of retirement would be helpful but do not currently exist. One potential parameter that could be measured is cortisol level, representing the dog's level of stress. While measuring cortisol in saliva, blood, or urine samples reflect acute stressors, these methods may not be helpful when assessing the animal's overall welfare and well-being, since it only represents one point in time (51). To overcome this challenge, cortisol can also be measured in hair samples and reflects chronic stress levels because cortisol accumulates in hair over time (52, 53). This is a relatively new area of study, and numerous factors impact hair cortisol levels. Therefore, universal cutoff levels signifying high stress for assistance dogs cannot be recommended at this time. However, hair cortisol may be measured biannually or annually to assess trends within the individual. If cortisol levels increase significantly from baseline levels, further investigation for underlying disease or chronic stress should be pursued. If the elevated hair cortisol level is associated with behavioral changes in the work, there should be recommendations for either retirement, temporary break from work, or change in lifestyle.

The handler is the most important advocate of the animal's welfare since he or she knows the animal best. The decision to retire an animal, however, is currently quite subjective and biased not only because of the personal relationship with the animal, but also because the handler is strongly bonded to the dog. Handlers have the potential to have their own emotional attachment to the animal assistance work or perceive assistance animals simply as "medical devices," rather than living entities with welfare needs. Therefore, the handler should remain as objective as possible when assessing the assistance animal for retirement from work. A survey on assistance dog quality of life (QoL) may be a useful tool that can assist the handler in considering retirement in an aging animal that is free of clinical disease or pain. Many QoL surveys and scales have been developed to assist pet owners in deciding when to euthanize an animal, but no scale has yet been established for healthy retirement. Because QoL scales are subjective and not correlated with objective clinical outcomes, their validity and reliability should be interpreted cautiously (54, 55). The proposed scale for assistance dog QoL (**Appendix 1**) should only be used when the animal is free of clinical disease or pain. Any animal with disease or pain should be automatically relieved of work duties. The survey requires the handler to objectively assess 10 factors that characterize QoL. The survey should be taken while the animal is in optimal working capacity to provide a baseline score and then retaken when retirement is in question. Since QoL is very specific to the individual, rather than using a standard cutoff value, a decrease of 25% or greater from baseline warrants the consideration of retirement in conjunction with veterinary and behavioral consultation, as this instrument is intended to detect subtle declines in QoL. Therefore, this instrument is not intended not be used in isolation, but rather as an impetus to begin a dialogue about the dog's working life with a veterinarian, behaviorist, or other animal expert (56).

RETIREMENT AND BEYOND

There are many factors to consider to ensure that the animal is properly taken care of during his or her older years. The designated caretaker of the animal during retirement maintains a critical role in the animal's health and welfare. According to *Guiding Eyes for the Blind* (57), the handler has the opportunity to adopt his or her retired assistance animal or place the dog with an approved adopter. The adopter could be a close friend or family member, which could facilitate a continued relationship with visits (58). If this option is not possible, the retired service animal has the opportunity to return to his or her original foster family who reared the dog during the early training years. In the event that none of these options is possible, the assistance animal may be put up for adoption. Typically, senior assistance dogs are very desirable because of their expert training and calm temperaments. Consequently, there is typically a very long waiting list to adopt a retired dog. Additionally, adopters may be held accountable to follow strict criteria that are put in place by the agency before adopting the dog. For example, some agencies indicate that if you adopt a retired assistance dog, the dog is not allowed to be home alone for more than 4 hours at a time. This oversight helps to ensure the responsibility of the caretakers and thus quality of life for the animal.

As the handler prepares for the animal's retirement, he or she will likely obtain a new assistance animal. One should consider the impact of introducing a new dog into the family on the retiree. Some may expect that the new assistance dog will learn behaviors from the retiring dog, but this cannot be guaranteed. The handler should have realistic goals for the new animal and not expect the new animal to function like the previous one. In addition, while some dogs may enjoy the company of a new conspecific, an aging dog may not be as accepting of a young

dog's presence in the home. The aging dog will likely be less active than the new dog and may encounter interdog aggression (59) or even jealousy, especially if the retiring dog perceives the handler giving more attention or rewards to the new dog (60). These adverse events can negatively impact the animal's welfare in retirement. Managing the relationship between household dogs through proper introductions and diligent observation and intervention is essential.

The assistance dog that is retired at the appropriate time will experience a significant portion of time in good health in his or her senior years. Unfortunately, mortality is inevitable and will most frequently be due to neoplasia, musculoskeletal, and neurologic conditions (61), with neoplasia being the most common cause of death in large-breed dogs (62). The loss of any animal is difficult for an owner, but the loss of an assistance animal is particularly challenging because of the nature of the attachment, the role the animal had in assisting the handler in functioning, and the strong bond between handler and animal (63, 64). The owner should be prepared for end-of-life decision making by defining specific criteria for end of life and objectively assessing the animal's QoL in consultation with a veterinarian. This QoL assessment for end-of-life (65) is different from the QoL assessment for retirement. The decision is never easy and requires the selfless regard for animal welfare. Since these animals have devoted a lifetime of work to a human being, the most difficult, yet most noble, decision we can make for them is to elect humane euthanasia before unnecessary pain and suffering occur.

Overall, these animals should be highly regarded and treated with the utmost respect in retirement. They should be spoiled, loved, and permitted to do whatever they please as a reward for the lifetime of service they have given. It could be argued that assistance animals should be honored the same way that military veterans are honored. Like a military veteran who has devoted his or her life to his or her country, an assistance animal has devoted his or her life to a human in need. These retired heroes should be clearly identified with gear such as bandanas or collars that state "retired assistance dog" to indicate to the public that this animal deserves special attention. These animals should receive the benefits of exceptional healthcare in retirement, especially if any conditions were the result of the service they provided.

AREAS FOR FUTURE STUDY

Although retirement is a phase of life granted to every service and working animal, research has rarely investigated questions regarding this particular issue. The authors believe the reason for this is 2-fold. First, the need for this type of research has not been imperative because retirement is a process that most handlers and agencies accept, facilitate, and value. Many assistance animal agencies have been managing their programs and endorsing retirement for generations with few reports of adverse events or concerns for animal welfare. In addition, the limited funding available for assistance animal research is typically allocated toward studying the benefits to the human recipient or the factors that produce a successful assistance animal. When an assistance animal retires and becomes a pet, that animal realistically loses its inherent value and purpose to an agency. With this in mind, efforts have not been thoroughly justified to study animals in retirement. As the field pays more attention to the health and welfare of working animals and advances in science and knowledge permit more insight into cognition and biomarkers of stress, researchers and funding agencies may be compelled to conduct and support this type of research to further enhance our scientific knowledge and understanding of the lives of these animals. Secondly, quality research on these retirement issues is challenging to execute because it is a complicated area of study. The questions regarding the specific timing of retirement and impact of retirement on the dog and handler are multifactorial and dependent on the individual animal, handler, lifestyle, work, genetics, and countless other variables that are difficult to control. The inability to control for real life factors limits the conclusions that can be drawn. Despite this complexity, research is still justified, even with its transparent weaknesses.

The main priority for research in this topic should be determining the appropriate timing of retirement of assistance dogs that best maximizes the dog's working life while still guarantees a healthy retirement. Currently, the timing of retirement is relatively subjective. Objective measures such as hair cortisol and instruments such as the QoL discussed previously may be used in research to assess their utility, accuracy, and validity in retirement determination. In addition, there is a lack of understanding of the lifestyle of retirement that ensures the best quality of life for that animal. Whether the dog should be fully or semi-retired, whether the dog should retire with the handler or original puppy raiser or unfamiliar home, and whether the animal should retire with other animals in the household are just some of the questions that exist. Investigations may reveal how these factors influence or are associated with the animal's QoL, emotional health, physical health, and longevity. These findings will provide evidence-based guidelines of when and how to retire an assistance animal to ensure the best welfare and quality of life for that animal. Agencies without standard guidelines for retirement may refer to these; agencies with already established guidelines for retirement may modify their own to align with evidence based guidelines. However, each agency must consider the unique needs of their particular demographic of handlers, breed of dogs, type of training, and type of work when implementing universal guidelines. Some recommendations may be appropriate while others may not be, so animal welfare experts familiar with the specific details of that agency should critically assess and modify standard guidelines to best meet their needs.

On the human side, studies should explore the handler's experience when preparing for and adjusting to an assistance animal's retirement. The transition can be challenging for the handler, but positive emotions, such as a feeling of relief that the animal is free of responsibility, may be evoked. Through interviews and surveys of handlers, an understanding of their challenges and successes can inform agencies how to properly counsel their clients on what to expect and how to cope with an animal in retirement.

While some research has explored the retirement of guide dogs by established agencies, to the authors' knowledge, there is no information regarding the retirement of assistance dogs

that are individually and independently trained and owned. Any individual with a disability may be permitted to train and designate any type of dog as an assistance animal. This freedom to label an owner-trained dog as an assistance dog along with the challenges of acquiring an agency trained assistance dog have resulted in the rapid growth of self-proclaimed service animals and enable a wide variety of problems. Without oversight or guidance by experienced agencies or organizations such as ADI, the welfare of these animals may be at risk and retirement may not even be considered. Without standard guidelines, these independent handlers have little incentive or reason to retire their dogs (34). An investigation into the attitudes and practices of these handlers is difficult to achieve because they do not belong to a universal community that can be easily contacted. If investigators were able to capture this specific population of self-trained animal handlers, we would be able to understand the concerns that surround retirement among this unique category of animals.

The process of retirement is fraught with unique rewards and challenges humans and animals alike. Controlled retrospective and prospective studies should explore this process with the ultimate goal of enhancing the health and welfare for all assistance animals.

CONCLUSIONS

Every assistance animal deserves to be rewarded with a good quality of life both during and after his or her career has ended. The connotation of retirement is inherently positive and enhances welfare because the animal is free to enjoy life without responsibility. However, as discussed, this permanent end of work constitutes a complex emotional process for all parties involved. Both animal and human must confront the dramatic lifestyle changes associated with adapting to a new life without one another or in the capacity as a pet. As the field of human-animal interactions becomes more attentive to the physical and emotional needs of the assistance animal, research to support evidence based guidelines on the complete care of the animal becomes more necessary. Studies that investigate timing of, reason for, and lifestyle of retirement will provide further insight into these critical issues. Even if guidelines are established, however, adherence to them may be challenging. This may be especially true for handlers of those assistance animals that are individually and independently trained by the handler rather than a professional assistance animal agency. These individuals may be unaware that guidelines exist or ill-equipped to properly implement practice standards. Recommendations for retirement may arguably be more important for these independent handlers to adhere to than for agencies that may have their own retirement standards. It is important for these independent handlers to have a common resource for guidance and support. The authors endorse the need for more oversight of all assistance animals, regardless of their origins, to ensure that standard guidelines are sanctioned and the welfare of the animals is prioritized.

The life and welfare of an assistance animal should always be kept in the highest regard. The assistance animal lives a humble life of purpose and can be the essential lifeline for a human being, a fate that nature could have never commanded. There is no question that the assistance animal must be honored treated with the utmost respect in every stage of life. As the animal transitions into retirement, the lives of both animal and handler change, but the memories and history between the two lives do not. Robert Frost (66) once stated, "The afternoon knows what the morning never suspected." By supporting these hard working beings, we will be able to provide more formidable opportunities for assistance animals to have a better quality of life.

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All authors listed have made a substantial, direct and intellectual contribution to the work, and approved it for publication.

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frontiers in Veterinary Science

REVIEW
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Enhancing Success of Veterinary Visits for Clients With Disabilities and an Assistance Dog or Companion Animal: A Review

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Despite increasing information on enhancing client communication and compliance/adherence in veterinary medicine, literature focusing on special cases remains limited: working with clients with special needs, challenges or disabilities, or when the patient is an assistance or emotional support animal. This paper summarizes current recommendations on how best to build successful working relationships with these clients, including action items to implement in practice. In addition, this paper reviews current literature on important considerations for care of assistance dogs as patients.

Keywords: veterinary care, client communication, assistance dog, therapy animal, special needs, disabilities, dementia, service dog

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INTRODUCTION

Despite increasing information on enhancing client communication and adherence in veterinary medicine, literature focusing on special cases remains limited: working with clients with special needs, challenges or disabilities, or when the patient is an assistance or emotional support animal. Although the body of research measuring benefits of companion and assistance animals for people with disabilities is growing, much of the available literature on working with clients with disabilities is based on expert opinion. Additional research into best practices would be beneficial to ensure that all practices are evidence-based and effective for both the animals and the human clients. This paper summarizes current recommendations on how best to build successful working relationships with these clients, including action items to implement in practice, and important considerations for providing veterinary care to patients working as assistance animals.

Abbreviations: AAI, Animal-assisted Interventions; AAT, Animal-assisted Therapy; ACAA, U.S. Air Carrier Access Act (1986); ADA, Americans with Disabilities Act (1990); ADHD, attention deficit hyperactivity disorder; ADI, Assistance Dogs International; AVMA, American Veterinary Medical Association; BCS, body condition score; DOT, U.S. Department of Transportation; ESA, emotional support animal; FHA, U.S. Fair Housing Act (Title VIII of the Civil Rights Act of 1968); HUD, U.S. Department of Housing and Urban Development; PTSD, post-traumatic stress disorder; RP, responsible person (i.e., the individual responsible for animal's welfare); TTY, teletypewriter (used in phone relay service).

RELEVANCE FOR VETERINARY PRACTICE—THE NUMBERS AND POLICY

According to the U.S. Census Bureau, about 56.7 million Americans (19% of the population) were living with a disability in 2010, with more than half describing the disability as severe (1). Of these, ∼8.1 million Americans had difficulty seeing (including 2 million blind), 7.6 million had trouble hearing (1.1 million with severe difficulty), and 30.6 million Americans had mobility problems (often requiring a cane, walker, or wheelchair). Not all of these disabilities are "visible": depression and/or anxiety at levels that interfere with normal daily functioning were reported by 7 million adults. Older Americans were more likely to have a disability than younger Americans, with ∼2.4 million Americans with Alzheimer's disease, senility or dementia. Almost 1/3 of all US families (∼20.3 million) are impacted by disabilities (2). Pet ownership in the US is high, with 68% of all U.S. households including a pet, and numbers have increased over the last two decades (3). It is probable, therefore, that many Americans living with a disability will have pets. In addition, the number of Americans with a disability is increasing; between 2005 and 2010, the total number of people with a disability increased by 2.2 million; the number (and percentage) with a severe disability also increased. Correspondingly, numbers and percentages of people needing assistance also increased (1). Current estimates report there are ∼75 million people over the age of 65 in America, and it is estimated that by 2030, ∼50% of these may have a disability (2). For these reasons, it is likely that veterinarians (and other practitioners) will see an increase in clients with disabilities in the near future (4). These clients should have their needs met and receive the same high quality of care provided to clients without disabilities. Sensitivity toward and inclusion of clients with disabilities makes good business sense, and can help both build the veterinary practice and better serve clients and patients (5, 6).

These disabilities frequently have significant impacts on the lives of these individuals. For example, Americans with a disability are less likely to be employed: 41% of Americans between the ages of 21–64 with a disability were employed, compared to 79% of Americans in the same age range without a disability; and they tend to earn less: median income of Americans with a disability is <70% of median income for those without a disability (7). Americans with a disability are more at risk of experiencing persistent poverty (defined as continuous poverty over a 2 year period): nearly 11% of Americans between the ages of 15 and 64 with severe disabilities, and nearly 5% of those with a non-severe disability, experienced persistent poverty, compared to 3.8% of Americans with no disability (1). Challenges are faced on a daily basis: 9.4 million non-institutionalized Americans reported having difficulty with at least one typical activity such as bathing, dressing, and eating (1). Health care has been noted as an area that has been "slow to progress" toward equal accessibility for those living with a disability (2). In a 2012 study of visually-impaired persons in the UK, authors documented an "extremely worrying" lack of access to medical facilities such as doctor's surgeries, with 33% of visually-impaired persons reporting difficulty in accessing services, and 36% reporting frequently leaving without having achieved their objectives for the visit. It is unlikely, these authors note, that veterinary practices perform any better than their human medicine counterparts (4).

In the US, the Americans with Disabilities Act (ADA), originally established in 1990 and revised in 2008, is the primary law designed to ensure that people with disabilities have the same rights and opportunities as people without disabilities. The ADA prohibits discrimination and ensures equal or reasonable accommodation for persons with disabilities in employment, state and local government offices, public accommodations (including private businesses providing goods or services to the public), commercial facilities, and transportation (2). To be considered as having a disability under the ADA, a person must satisfy at least one of the following requirements: (1) have a physical or mental impairment which substantially limits one or more of a person's major life activities, such as walking, seeing, sitting, breathing, etc.; (2) have a record of such impairment; (3) be regarded by the covered entity as having such an impairment (with the covered entity consisting of any organization subject to ADA rules against discrimination) (2). The ADA requires most businesses and facilities to provide reasonable access and accommodation for all disabled customers, clients, and members of the public; this applies to almost all businesses that are open to the public, regardless of size. Reasonable accommodation refers to "necessary and appropriate modification and adjustments not imposing a disproportionate or undue burden, where needed in a particular case, to ensure to persons with disabilities the enjoyment or exercise on an equal basis with others of all human rights and fundamental freedoms" (8). Veterinarians could be impacted by the ADA with regard to how they treat animals owned by clients with disabilities, how they hire those with disabilities, and how facilities are designed and operated (9–11).

An increasing number of studies have documented that individuals with disabilities can benefit from interactions and/or partnership with non-human animals. For instance, pets provide benefits for individuals living with mental health issues [reviewed in Brooks et al. (12)], such as reduced feelings of loneliness and depression in military veterans with post-traumatic stress disorder (PTSD) (13) and increased social interactions and connectivity in patients living with a long-term mental health condition (14). More structured animal-assisted interventions (AAI) show benefits for human participants [reviewed in Bernabei et al. (15) and Charry-Sánchez et al. (16)], such as significant decreases in aggressiveness, anxiety, and caregiving burden in elderly patients with Alzheimer's and dementia following six bi-weekly AAI sessions (17), and reductions in loneliness scores for patients with clinical depression who participated in one or more animal-assisted therapy (AAT) sessions over the course of 6 weeks (18). Assistance dogs have been reported to provide significant social and logistical support for persons with disabilities [reviewed in Winkle et al. (19)], such as increased social greetings and approaches when with a service dog (20, 21), as well as decreased need

for paid assistance, and increased self-esteem and feelings of well-being (9, 19, 22–27).

The exact numbers of assistance animals working in the US is unknown, but available data suggest that this number is substantial and increasing (27). Domestic dogs are the most common species seen in this role; only dogs (and miniature horses) are recognized as assistance ("service"[1]) dogs under the ADA, although other species may qualify as assistance animals in housing or air travel regulations.

Assistance Dogs International (ADI), a well-regarded organization that accredits non-profit facilities that train and place assistance dogs, recognizes three types of assistance dogs: (1) guide dogs (for the blind and visually impaired), (2) hearing dogs (for the deaf and hard of hearing), and (3) service dogs (for people with all disabilities other than those related to vision or hearing) (28). Between 1975 and 2015, Canine Companions for Independence (one of the largest US organizations placing assistance dogs in homes, primarily service dogs for mobility support) has placed ∼5,000 dogs (27). The Seeing Eye, a guide dog organization, reports partnering over 17,000 people with guide dogs since the organization's founding in 1929, with ∼1,770 of their dogs currently working in North America (29). Guide Dogs for the Blind, another major organization training and placing guide dogs, reports partnering more than 14,000 teams since their founding in 1942, with ∼2,200 guide dogs currently working in North America (30). The number of roles that assistance dogs fill is also increasing, and the rate of dog placement is accelerating (27). For example, dogs are now being partnered with individuals on the autism spectrum or who are experiencing psychological issues such as anxiety or PTSD, or working in a human medical capacity (as cancer-detecting dogs, seizure-alert dogs, diabetic alert dogs, and similar).

Emotional support animals with their handlers who have disabilities are provided access to housing (under the U.S. Dept. of Housing and Urban Development) and transportation (U.S. Dept. of Transportation) for reasonable accommodation. These animals are not trained to perform tasks, but provide emotional support and companionship to their owners who have disabilities, including anxiety or other psychological issues (31). For more information on the different types of assistance animals, rights of access, and more, see the American Veterinary Medical Association's 2017 whitepaper on this topic (11). It is clear from these increases in the number of working assistance dogs and emotional support animals that veterinarians will likely see them increase in their practices as patients (4).

Another category of animals working in supportive roles are therapy animals managed by handlers without disabilities. These animals have no special legal access. Usually these are dogs, specifically trained, tested and registered to work in hospitals, nursing homes, schools or other institutional settings to comfort residents and facilitate interventions. These human-canine pairs may be registered with Pet Partners (https://petpartners.org/) or Therapy Dogs International (https://www.tdi-dog.org/), as sometimes required by institutions, but these registrations provide no special legal access. Pet Partners offers online courses for AAT handlers in reading canine body language and infection prevention and control which meet the recommendations from the Society for Healthcare Epidemiology of America for "Animals in Healthcare Facilities" (32).

Guidelines and Implications for the Veterinarian:

For veterinarians, and as with all clients, the primary goal in working with clients who have a disability should be to enhance comfort, engagement and adherence of the client, in order to ensure the best possible care for the patient (5, 33). In the practice of veterinary medicine, there is a triad of relationships at play: the bond between the client and the animal, between the clinician and the patient, and between the clinician and the client (**Figure 1**). All three relationships are important for optimal care. Bond 1, Client-Animal: Given the degree to which companion and assistance animals depend on their human caretakers, maintaining the bond between owner and animal is important for their wellness (34). In cases where the pet is an assistance animal, part of this bond may be the trust that the human partner feels with respect to the animal's ability to do the job: to support them and keep them safe (4). The veterinarian often needs to play the role of educator, as well as medical practitioner, to ensure that the human client is sufficiently knowledgeable about the animal's species-specific physical, mental and behavioral needs. Without this knowledge on the part of the caretaker, the risk of suboptimal welfare for the animal is high. Bond 2, Clinician-Patient: The quality of the clinician's interactions with the animal can influence quality of care, and the owner's perception of the clinician. Low-stress handling approaches (35, 36) are recommended for minimizing patient fear, putting the least amount of strain on this bond feasible in this setting. Bond 3, Clinician-Client: To provide the patient the best quality of care for life, it is important for the veterinarian to build and maintain this bond, to engage and stay connected to the client (37). A wide range of literature exists on strengthening client communication in veterinary practice [e.g., (38)]. All three bonds need attention and maintenance, for the working relationship to be a success.

To increase access to services, Sandler (39) recommended considering offering discounts on services, or special payment plans, to assistance dog partners; this recommendation could be extended to all clients with disabilities, given the income inequities noted above. As Eames and Eames (40) note, given the financial challenges faced by many people living with a disability (7), it is likely that cost of care, including veterinary care, is an obstacle for obtaining and living with an assistance dog for many of these individuals. This was confirmed in a small 2008 study of guide dog owners, when cost of maintaining the dog was noted as a significant concern (41). Pet insurance plans

[1]The ADA defines a "service animal" as "any dog that is individually trained to do work or perform tasks for the benefit of an individual with a disability, including a physical, sensory, psychiatric, intellectual, or other mental disability" (ADA 1990, Section 35.136). This definition is very similar to the more recent use of the term "assistance animal" used by ADI and others, under which definition "service animal" usually refers to assistance animals trained for work with people with disabilities other than those related to vision or hearing (see text for more on the ADI categories).

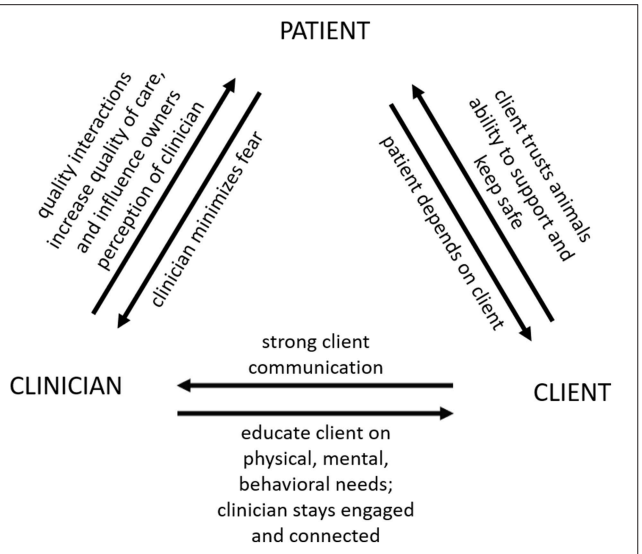

FIGURE 1 | The clinician-client-patient triad in veterinary medicine (credit: A.P. Thigpen; ©Emma Grigg & Lynette Hart 2018).

are becoming more commonly available, and are offered both by large veterinary practices and private insurance firms; such plans may benefit clients working with limited income, and/or with the costs of maintaining a working assistance or therapy dog. Websites comparing pet insurance and payment plans are available online, such as at ASPCA Pet Insurance (https://www.aspcapetinsurance.com/research-and-compare/compare-plans/compare-pet-insurance-plans/) or via Nationwide (https://www.petinsurance.com/comparison). The largest assistance dog training facilities sometimes offer annual stipends for veterinary care. Organizations such as the International Association of Assistance Dog Partners (IAADP) provide a wide variety of resources to human partners of guide, hearing and service dogs, and some preventative treatments (such as flea and tick prevention, glucosamine) to dues-paying members.

The remainder of this paper will focus specifically on building successful partnerships with clients who have disabilities, and/or when the patient is an assistance dog. Experts in this field suggest that allotting a small amount of extra time, effort and communication skill can greatly enhance the visit of a client with a disability, thereby improving the quality of care for the patient and the satisfaction of the client (4, 33). In the clinic, two specific target areas to focus on for building successful working relationships with clients with disabilities are: (1) orientation and assistance, and (2) successful communication, promoting client adherence (4).

ACTIONABLE RECOMMENDATIONS

Orientation and Assistance—Overview

Two important overarching goals to address in order to ensure an effective working relationship with clients with disabilities are: (1) the physical space (accessing and navigating the physical space safely), and (2) access to resources (ensuring the client has access to resources needed to make the visit a success) (4). Client needs will vary by disability; when in doubt about the best approach or accommodations needed, the clinician should ask the client. Veterinarians should be aware that two clients with the same or similar disability may use different adaptive techniques, and cater to the adaptive technique used by that client (33, 40, 42). Reasonable accommodations are required by law (43). A brief summary of these recommendations can be found in **Figure 2**.

Basic etiquette recommendations for interacting with clients with disabilities include the following (6, 10, 33):

1) Always speak directly to the client (not to the helper, translator or companion, if present), and maintain eye contact while speaking.
2) Ask before you help; offer help only if the client appears to need help. If the client does want help, ask how to assist before acting.
3) Similarly, if the client has an assistance dog with him, always ask before interacting with the dog in any way, particularly if the dog is actively working (e.g., in a harness, with the client holding the harness).
4) Be sensitive about making physical contact, and avoid actions (such as grabbing the client's arm) that might put the client off balance. This caution extends to personal equipment such as wheelchairs, canes, and scooters, which are often considered part of personal space.
5) Don't make assumptions about the client's abilities, or make decisions (about treatment options, for example) for them without their participation. Remember that a physical disability is not synonymous with a mental or cognitive disability, and the presence of one is not necessarily an indicator of the presence of the other. The client is the best judge of what she can or cannot accomplish.

A final etiquette recommendation very relevant to veterinary visits is to: (6) respond graciously to requests for accommodations needed to visit the practice. Such accommodations may require changes to the way the practice usually works, but staff should be flexible: a positive experience at the practice will make them more likely to return for future visits, and perhaps they will spread the word with others about the excellent service that they received (6). The improved quality of visit experienced by the client may also have a positive impact on quality of care the patient receives, for example by maintaining consistency of care through repeat visits (44).

Meeting these two overarching goals will require staff training. One of the most commonly-cited problems encountered by patients with a visual impairment when accessing human medical offices was the lack of staff training to understand their needs, according to a 2012 study of guide dog owners across 19 EU member states (4, 45). Train all staff with the goal of building a culture of sensitivity, understanding, and kindness; Paul (42) suggests asking oneself, "What would I be willing to do if this person was a family member or friend?" Many well-meaning staff may feel awkward in the presence of clients with a disability, if they are unsure of how to behave and worried about inadvertently offending the client. At minimum, ensure that all staff are aware of the basic etiquette recommendations listed above. Continually work on improving listening skills, and remember that every

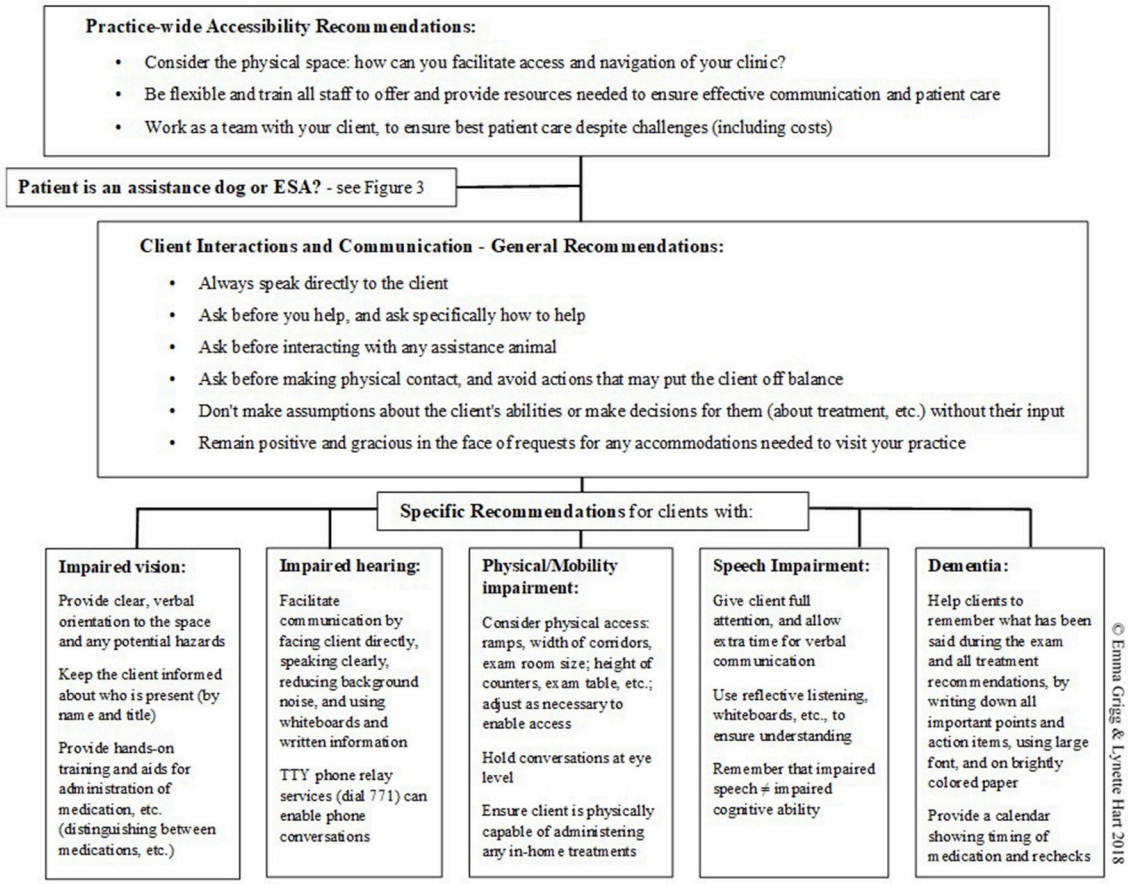

FIGURE 2 | Summary of recommendations for working with clients with disabilities. Detailed recommendations and references are provided in the text (©Emma Grigg & Lynette Hart 2018).

client may have special needs from time to time (46). Confront any prejudices or misinformation amongst staff members about people with disabilities, as prejudging clients can interfere with successful communication and care (46). Remember that the mission as practitioners is to make life better for pets and their people (42). Put standards of practice in place to ensure that clients with a disability receive the same quality of care as all other clients. At staff meetings, discuss specific strategies designed to ensure access and availability of resources necessary to make these client visits a success (10). When appropriate, instruct staff to proactively ask what accommodations or assistance the client will need during the visit, to ensure that the client's and patient's needs are met (4). Empathy alone is not enough; for patient care to be effective, the working relationship with the client must also be effective (9). If some staff members are particularly patient or experienced with individuals with special needs, request that they be present in the exam room during these visits (42). Using checklists (listing steps to take before and during a visit, and resources to have on hand) can be very helpful; a sample checklist is available online (46); checklists can be modified or expanded as appropriate for the specific clinic and clientele. The summary provided in **Figure 2** may also be a useful reminder of key points for staff.

Schedule appointments at slower times of the day, to allow ample time for working with clients with disabilities (42). Consider allowing flexibility in exam times, scheduling the client to arrive within a window or block of time, rather than a set appointment time. If unable to drive themselves, many of these clients may rely on taxis, ridesharing services or public transportation, making meeting exact appointments with their pets challenging (33, 39). Note, however, that it is not appropriate to charge more if these appointments take longer because the client was disabled; any action that disadvantages a person based on his or her disability would be considered discriminatory (43).

In order to ensure that clients with disabilities are able to safely and comfortably access the physical space, assign at least one parking space for these clients, with highly visible signage. Have at least one entrance accessible to wheelchairs, ensure ramps, and hallways are free of obstructions, and post easily-understandable, highly visible signage with good contrast (4). If feasible, help to arrange transportation as needed for clients who cannot drive, including arranging for delivery of medications, supplies, etc., if

needed (46). Be flexible with use of the existing clinic space. For example, if the exam room is too small to accommodate a client's wheelchair, find another suitable space where the exam can be completed; this is vastly preferable in most cases to separating the pet and the client (or worse, separating the client from his or her assistance dog). Consider having seats with arms in the reception area, as these make it easier for senior citizens and those with mobility issues to sit down and get back up (6, 46). Good lighting; marked visual contrast between floors and walls, and on staircases; handrails mounted in appropriate locations; and use of large font on all written materials will be appreciated by many clients with disabilities (4, 46).

Successful Communication:

Two primary areas to focus on to ensure successful communication with clients with disabilities are (1) finding modes of communication that work best for the individual client, as disabilities vary and thus, most effective means of communication will vary; and (2) given challenges that exist in veterinary medicine for achieving optimal communication with, and adherence by, clients without a disability, it is important to acknowledge that additional challenges can exist when working with disabled clients (4, 33, 37).

It is important to acknowledge all clients as individuals. Eames and Eames [(33); p. 1] stress a "People First" concept, noting that "these clients (with disabilities) are people first. They are not their disabilities." This is perhaps most evident in the language we use to refer to, communicate with, clients with disabilities. Put the person first: referring to a "person with a disability" is preferable to "disabled person" (6). It is also generally acceptable to refer to specific disabilities, e.g., person with hearing loss, or person with Alzheimer's disease. Avoid outdated terms, like "handicapped" or "crippled"; negative terms like "suffering from"; and euphemistic terms like "physically challenged" or "differently abled," which many individuals with disabilities find patronizing (6). It is generally best to respect the client's privacy and not ask directly about their disability; however, Cohen (6) notes that many people with disabilities are not bothered by children's natural curiosity and don't mind answering their questions.

Recommended theoretical approaches to client communication in the veterinary field have evolved from compliance (a more traditional approach in which the clinician simply tells the client what treatment to follow, and which is now considered too paternalistic toward the client), to concordance (in which the clinician and client should come to an agreement about the treatment approach), to adherence (in which the client takes an active—vs. passive—role in the treatment and care of their animal) (47). Adherence is defined by the World Health Organization (WHO) as "the extent to which a person's behavior (taking medication, following diet, and/or executing lifestyle changes) coincides with agreed recommendations from a health care provider" (48). This concept describes the relationship between the patient and health-care provider as a partnership drawing on the abilities of each; the WHO notes that "the literature has identified the quality of the treatment relationship as being an important determinant of adherence" [(48); p. 3]. Adherence relies on designing a treatment plan around the client's lifestyle, rather than the other way around, and the term itself implies the tenacity that clients will need to follow the treatment regimen (47). In addition, more "relationship-centered" or "family-centered" (49) approaches may be more suitable for meeting the needs of companion animal patients, given the role of the human household members in the health and well-being of companion animals. For these reasons, and in the absence of research into outcomes for different communication approaches when working specifically with clients with disabilities, adherence may be an optimal model for working with these clients.

To facilitate adherence to the recommendations for care and treatment, elicit the client's perspective, as clients are more likely to follow treatment recommendations that they understand and endorse. Communication is a two-way street; identify barriers to successful treatment of the patient, and work with the client to develop a plan that will work for them (37). Barriers could include logistical challenges, physical or mental challenges, incomplete understanding about exactly how to administer the treatment, lack of conviction that the treatment is necessary, and/or discomfort with the procedures (clients with a fear of needles, for example, will have trouble using needles for administering treatments at home). This is particularly important if/when the client is already facing significant daily challenges associated with a disability. Do not assume that the client has understood; work with the client to ensure mutual understanding. After discussing treatment recommendations with the client, Abood (37) recommends assessing client conviction and confidence, two important factors influencing the client's level of preparedness and commitment to adhere to the clinician's recommendations:

> *Assessing conviction*: Ask the client, "On a scale of 1–10 (with 1 representing completely unnecessary, and 10 representing completely essential), how valuable do you think (this treatment) is to helping (patient's condition)?" A low rating by the client indicates that they are not convinced, and/or not ready to take action.
> *Assessing confidence*: Ask the client, "On a scale of 1–10, how confident are you that you can carry out this treatment plan?" Here, a low score indicates that adherence to the recommended treatment will be low.

As noted in the Basic Etiquette section in *Overview*, above, staff should always address the client directly, even in cases where a translator is present. If the client is seated or using a wheelchair, the clinician or staff member should sit down so that they are at eye level with the client for any extended conversations such as history-taking or discussion of treatment options.

Specific Recommendations (by Disability)

Working With Clients who Are Blind or Have Impaired Vision

Upon entering a room (such as the reception area or waiting room), provide a clear verbal description of the size of the room, location of available seating, and other animals present; even if the client has been to the practice before, seating and presence of other animals will vary, and clients with visual impairment will not be able to read warning signs of aggression

in other animals present (4). Offer physical assistance, but if declined, still provide a verbal orientation to the room. If the client has not been to the practice before, consider offering him a tour of the facility (6). Remember to always speak directly to the client.

When it is time for the appointment, staff should approach the client rather than calling their name from across the room; introduce themselves by name and title, and ask whether the client would prefer guiding or to follow their guide dog, if present (4, 33). If the client has a guide dog, it is best to walk on the opposite side as the dog. When guiding, the person guiding should stand on the client's right and offer his or her left arm (50); allow the client to take the arm of the person guiding, rather than grabbing the client's arm, pushing or pulling, as this may put the client off-balance. While walking, describe the path of travel, including any obstacles such as stairs (up or down), furniture or fixtures, doors (noting whether the door is open or closed, and if closed, which way the door opens, in or out); use approximate number of steps to indicate distance (4). The person walking with the client should warn her of an obstacle in her path, be specific and use non-visual warnings: "Look out" is less helpful than "Be careful of the step up two paces in front of you" (6). Ensure that clear glass doors and panels are clearly marked at the appropriate height (4).

If meeting the client in the exam room, the veterinarian should introduce herself and other staff present by name and title; similarly, indicate if/when anyone leaves the room, so that the client does not end up unknowingly talking to someone who is no longer present. Indicate locations of any possible hazards, like the exam table, to prevent injury to the client (when bending down to reach their pet, for example) (33). The clinician should narrate each step of the exam verbally, including weight, temperature, and the like; avoid using descriptors relying on vision, such as "over here" and "this," as these generally do not provide useful information to a client with vision impairment. Audible cues should be used when appropriate to indicate location (such as tapping the chair or exam table where staff would like the client to stand) (33).

When dispensing medication or other treatments, clients with limited vision may need a hands-on demonstration in the exam room of how to administer medication, change dressings, etc.; allow the client time to practice this to ensure comfort with the procedure. If the client has brought a helper along who will be assisting with treatments, the helper should receive this training as well. When possible, staff should ask if the client would prefer liquid or pills, and ask if they prefer easy-open caps (46). It is best to use pre-measured doses whenever possible (for example, split pills ahead of time), use notched syringes to indicate proper levels of liquid to administer, and if possible, consider dispensing extra medication to allow for spillage (9). Offer to read aloud any written information on the medication or product packaging. If multiple medications are dispensed, use different sized and/or shaped containers to allow the client to differentiate between medications; alternately, rubber bands around one of the containers can help (33, 46).

Working With Clients who Are Deaf or Hard of Hearing

When speaking to the client, staff should always face him directly, speak clearly and expressively (gestures and facial expressions can be helpful in providing context for what is being said), speak directly to the client (not to an interpreter, if present), but should not raise the volume of their voice above normal levels unless requested to do so by the client (33, 51). Do not cover any part of the face (e.g., with hands, a pen, clipboard, or tablet) while speaking (6), as this can impede the client's ability to read lips. In the veterinary clinic, clients may be stressed or distracted; be sure to get the full attention of the client before speaking (52); tap the client gently on the arm or shoulder if necessary (6). Reduce background noises, ask straightforward questions, and allow extra time for the client to understand and respond (46). Note that the staff may need to repeat themselves, but should be patient in pursuit of effective communication. It is still important to explain verbally what is being done throughout the exam, so that the client understands what is being done to their animal (51). Use of a whiteboard in the exam room can be very helpful by allowing back-and-forth written communication and providing visual aids to help explain medical terms, procedures, or treatments (42).

When a phone is used for scheduling appointments or follow-up, veterinary staff should be aware that telecommunications relay services are available to assist in phone communications with clients with impaired hearing (33). These relay services can be used by clients relying on a teletypewriter (TTY) to make and receive calls, and allow these clients to call businesses that do not have a TTY available. If staff receive a call through the telecommunications relay, the operator will identify it as such (6). In the US, this service is accessed by dialing 711 to connect to a trained operator; more info on this service (and similar services available using internet or video) can be found at: https://www.fcc.gov/consumers/guides/telecommunications-relay-service-trs. In the age of smart phones and electronic tablets, it may be easier for many clients with hearing impairments to communicate by text messaging, web-based communication or email.

Working With Clients With Physical/Mobility Impairments

The capabilities of clients with physical disabilities can vary widely, and may include mobility difficulties, impaired motor skills or hand strength, or other issues. Ensure that the recommendations designed to facilitate access to the physical space, described in the *Overview* section above, have been reviewed and addressed as necessary. It is essential to personalize the treatment plan so that the client is physically able to adhere to it (including being able to open medication bottles, prescription diet cans, and the like); if a helper is present, enlist their help and ensure that both client and helper are comfortable with the techniques required (33). See also "Assessing Conviction and Confidence," above (37). Some clients may benefit greatly from in-home (vs. clinic) visits for veterinary care, if this service is or can be made available, even if just for help with ongoing treatments (giving pills, administering topical ointments, changing dressings, etc.) (46, 51).

For clients using wheelchairs, consider the height of signage, counters (in the reception area, for example), and the exam table, particularly when the client is expected to be able to see what is happening (9). Don't make clients "talk to the wall" of a high reception desk when checking in; instead, staff should come around the counter to speak directly to the client, and take a seat for longer conversations. If it is difficult for the client to see his pet during the exam, or when the patient is an assistance dog, the veterinarian should consider doing the exam on the floor rather than on the exam table. For some clients with mobility issues (those who rely on service dogs, for example), shaking hands might be difficult, so follow the client's lead during greetings (51). Ask the client what assistance or additional accommodations they will need to make the visit a success (33). Note that some wheelchair users appreciate being pushed over difficult surfaces (such as carpeting), but others do not; when help appears to be needed, always ask before pushing an occupied wheelchair (10).

Working With Clients With Speaking Difficulties

Veterinarians and staff should give the client their full attention during conversations. As noted above, it is important to remember that impaired speech is not synonymous with impaired cognitive ability (33). Be patient and allow the client extra time to communicate questions or concerns; resist the temptation to interrupt or attempt to finish the client's sentences, even if trying to be helpful (6). Many of the recommendations for facilitating successful communication with a client with hearing difficulties can also be beneficial for clients with speaking difficulties, such as reducing background noise and using a whiteboard to allow written communication. Staff should not pretend to understand the client if they have not; instead, they should ask the client to repeat himself or to write down the information on the whiteboard. Practice reflective listening: summarize what you have heard, and look for confirmation or clarification from your client (33). For example, when possible, ask short yes or no questions that can be answered with a nod (for example, "Do you feed Max once per day?" is easier to answer than "Tell me how often you feed Max.") In most cases the client will appreciate the staff's effort and interest in understanding what he has to say (6, 33).

Working With Senior Clients With Memory Loss or Dementia

A primary challenge for these clients is remembering what is said during the exam, including treatment recommendations. Staff should write down all instructions, preferably in large/bold font and on brightly colored paper, and ask the client to post the instructions prominently in their home (such as on the outside of the kitchen refrigerator). Make a calendar for the client to take home with dates when medicines and/or upcoming recheck visits are due (46). When necessary, use reminders and follow-up by phone, and if possible, help make arrangements with a family member or carer to ensure that the treatment recommendations are followed. Clients with dementia may also suffer from other physical/mobility or sensory impairments, so the recommendations above on these topics may need to be implemented when appropriate. In addition, clients with dementia may become anxious in the veterinary clinic, and require patience and calm interactions. A number of recent studies and white papers [reviewed in Kruger and McCune (53)] have documented mental health and quality of life benefits for seniors living and interacting with pets (54, 55), and it thus seems advisable to support pets living with their senior owners for as long as quality of care can be maintained. Veterinarians can play a role here by more actively monitoring the health of patients living with these clients, for example by using more frequent follow-up calls or scheduled visits; it may be particularly useful to identify a family member or caregiver for the client who is able to assist with care for the pet and/or communicating with the veterinary practice.

ASSISTANCE DOGS AS PATIENTS IN THE VETERINARY PRACTICE

Assistance dogs can provide significant physical, psychological, and social benefits for persons with special needs (19, 23, 24, 26, 27). Veterinarians play a crucial role in maintaining this working relationship, primarily by maintaining the wellness of the animals involved (56). The physical and behavioral health of these dogs is essential to maintaining their ability to do their jobs, and in this sense, the veterinarian is also indispensable to the human partners of these animals, who depend on their dog's abilities to function in their worlds (9). In addition to their value as companions and helpmates, these dogs are very valuable animals in the monetary sense; the average cost to raise and train an assistance dog can range from $15,000 to $50,000 (57, 58). Unusual precautions may be necessary to maintain the working relationship these dogs have with their human partners (39, 58). In some cases, for example when the dog has been owner-trained to assist with their own disability, veterinarians may provide the only professional oversight for the welfare of these animals. For any procedure, medication, hospitalization, etc., veterinarians need to consider how this will impact the dog's ability to do his/her job, and thus how it will impact the dog's human partner. This requires an understanding of exactly how the dog helps the human; what specific tasks does the dog do? If not sure, the clinician should ask the client to ensure that understanding of the dog's needs (9, 40); questioning what tasks the dog has been trained to perform is permitted under the ADA, as this question is not considered to violate the rights of people with disabilities (59). A brief summary of recommendations for treating assistance and therapy animals as patients can be found in **Figure 3**.

A comprehensive wellness plan should be in place; these dogs rely on excellent senses and mobility to do their jobs, and thus regular examination and assessment are important (56, 58). The wellness program should consider the life stages of the dog (60), be flexible and tailored to the needs of the individual dogs and clients. Up-to-date records should always be maintained, and wellness visits should be regular enough to detect any signs of physical and/or behavioral decline (56). Migday (58) recommends that visits should occur as frequently as every 2 months, if possible, particularly as these dogs age. Mechanisms

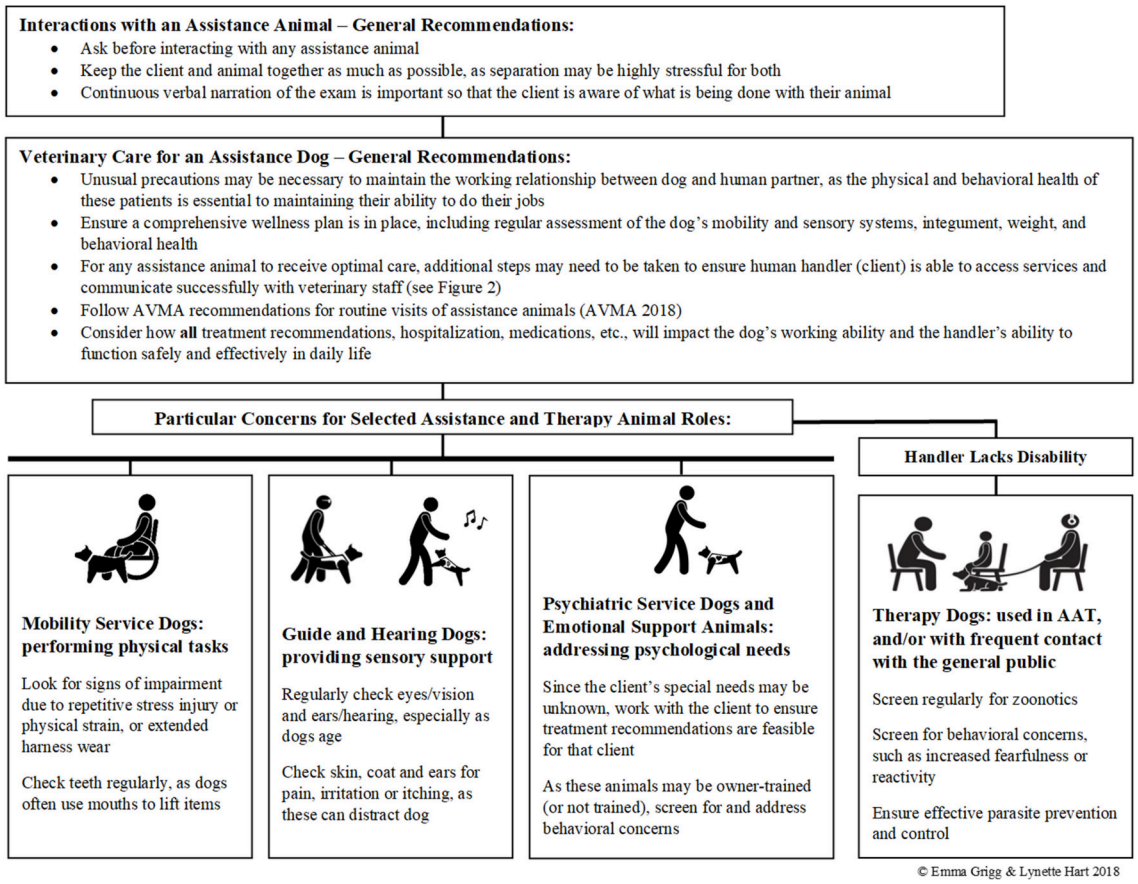

FIGURE 3 | Brief recommendations for assistance and therapy animals as veterinary patients. Detailed recommendations and references are provided in the text (©Emma Grigg & Lynette Hart 2018).

should be in place (scheduled appointments, for example) to ensure that the veterinarian is able to regularly complete these wellness checks. AVMA (56) guidelines for the care of animals involved in animal-assisted interventions of any kind stress that wellness includes both the physical and behavioral health of the animal.

Recommendations for routine visits include (56):

- Vaccination
- Parasite control and prevention
- Screening for common diseases and conditions as applicable to the dog, region, etc.
- Behavioral evaluation
- Preventative medical, dental, and nutritional care
- Preventative behavioral care (education about normal behaviors, reading body language, and the importance of enrichment)
- Assessment of genetic health as appropriate

Given the physical nature of the work that many of these dogs do on a daily basis, regular, and careful assessment of eyes/vision, ears/hearing, hips, teeth (as many of these dogs regularly pick up items for their human partners using their mouths) and feet is important (40). Clinicians should be vigilant for signs of impairment due to repetitive stress injury and/or excessive physical strain, such as pulling wheelchairs or opening doors, and be familiar with the physical strain put on the dog by typical harnesses, such as may be caused by asymmetrical torque placed on guide dogs by handlers holding on to the harness handle (61–64). Skin, coat, and ears should be checked regularly and treated as needed for pain, irritation or itching, as these can be very distracting to the dog and may interfere with focus and working ability. Skin should be checked for lesions caused by rubbing or pressure sores from harnesses or backpacks (58). Coat maintenance may be difficult for clients with disabilities, so the dog's coat should be checked regularly for mats, particularly in areas like the groin, or behind the ears (58). Healthy weight should be maintained through diet and regular exercise, to sustain peak physical and mental condition. Wakshlag and Shmalberg (65) recommend keeping most assistance dogs between a body condition score (BCS) of four and five (using a nine-point scale) to prevent fatigue and joint-related problems associated with carrying excessive body weight. Assistance dogs' diet and activity level will be largely determined by the lifestyle of their human companion, and many of these dogs may

have nutritional needs similar to active companion dogs, but they should be regularly monitored for weight gain that may interfere with their working ability (65). Assistance animals and animals used in animal-assisted interventions should be screened regularly to reduce bi-directional risk of zoonotics transmission (56, 66). For example, in a cross-sectional study of 102 dogs visiting hospitals in Ontario zoonotic agents were isolated from 80% of the dogs, primarily *Clostridium difficile*; others identified included *Escherichia coli*, *Salmonella*, and *Giardia* antigen (67). Chomel (68) provides an overview of zoonoses in dogs and cats, including a discussion of recent studies of zoonoses reported in dogs fed a raw meat diet.

During the exam, best practice is to keep the dog and client together as much as possible, as either or both may become highly anxious when separated from their partner (40). Verbally narrating the exam can reduce client anxiety (particularly for clients with impaired vision) and improves communication; when the client is using a wheelchair, examining the dog on the floor will allow the client to see what is being done (40, 51). Targeted recommendations are listed above for working with clients with specific disabilities.

Behavioral Welfare of Assistance Dogs, Therapy Dogs and Facility Dogs

As noted in the AVMA (56) guidelines, wellness encompasses both the physical and behavioral health of the animal. Working as an assistance animal can be a demanding job, and there may be many potential sources of chronic stress for these dogs [reviewed in Serpell et al. (63)]. Public concern for the wellbeing of these dogs while working is increasing. Bremhorst et al. (69) described risk areas for welfare of assistance dogs, including lack of sufficient time off, ergonomics of harnesses, and weight gain, and noted that veterinarians need to look for signs that problems like these exist. Education of clients about the behavioral needs of these dogs is crucial: clients should be familiar with the behavioral signs of stress in dogs and use rewards-based training only. Ziv (70) reviewed impacts of training approach on welfare of companion and working dogs (primarily dogs trained for military and law-enforcement work), and concluded that use of aversive training methods such as positive punishment and negative reinforcement can jeopardize both the physical and mental health of dogs, and that there was no evidence that aversive training methods are more effective than positive reinforcement-based training. LaFollette et al. (71) found that use of positive reinforcement or "bond-based" training methods for PTSD service dogs was associated with more positive outcomes for the veterans (such as higher perceived closeness to the dog and more attachment behavior), while use of positive punishment was associated with more negative outcomes (such as more fear and less trainability). Serpell et al. (63) also recommend use of only rewards-based training methods for training assistance dogs. In addition, clients working with assistance dogs should understand the importance of downtime and play, and of monitoring the dog during interaction with others to avoid inadvertent harm by children, or others with disabilities (69).

A number of recent studies have investigated stress levels in working assistance dogs. These studies have focused primarily on dogs working in animal-assisted-interventions, and overall the results are encouraging, although sample sizes are often small. Palestrini et al. (72) looked at heart rate and behavior of one experienced service dog over >20 20-min sessions working as a therapy dog, and reported no physiological or behavioral signs of stress, fatigue or exhaustion. Glenk et al. (73) and McCullough et al. (74) observed dogs used in therapy sessions in very different settings, and both reported that dogs in their studies were not stressed by repeated work in these sessions, based on behavioral and physiological (cortisol) indicators. King et al. (75) monitored stress in dogs working in animal assisted therapy in varied environments using cortisol measurement, and assessed effect of a quiet play time-out session during work shifts. That study reported no significant impact of the time-out session, but did note a trend of increased cortisol from baseline to 1-h into the work shift (75). They also reported more behavioral signs of stress in young (<6 years old) dogs and inexperienced dogs, vs. older and/or more experienced dogs. Haubenhofer and Kirchengast (76) looked at cortisol in pet dogs working in animal-assisted therapy, and reported that cortisol levels were significantly higher on working days vs. control days; however, as this study did not measure behavioral indicators, it is unclear whether this was negative stress or positive excitement, as the authors themselves note. Additional research would be beneficial to understand if, when, and in what ways assistance dogs experience work-related stress.

Although stressors on assistance dogs will vary according to the type of work that they do, a widely-accepted baseline for assessing and improving animal welfare is the Five Freedoms concept (77). This concept has been recommended as a useful tool for working toward wellbeing and good quality of life for working, assistance, and companion dogs (62, 78, 79), and is endorsed by organizations such as the American Society for the Prevention of Cruelty to Animals (ASPCA) and the Association for Shelter Veterinarians (ASV). The Five Freedoms, originating from a 1965 report (80) on production animal welfare in the UK, are as follows:

1. Freedom from Hunger and Thirst (by ensuring ready access to fresh water and diet to maintain health and vigor).
2. Freedom from Discomfort (by providing an appropriate environment including shelter and a comfortable resting area).
3. Freedom from Pain, Injury or Disease (by prevention or rapid diagnosis and treatment).
4. Freedom to Express Normal Behavior (by providing sufficient space, proper facilities and company of the animal's own kind).
5. Freedom from Fear and Distress (by ensuring conditions and treatment which avoid mental suffering).

Working with the client, veterinarians can conduct a brief "Five Freedoms Test" (81), comparing the dog's current health and lifestyle with these basic minimums, and paying particular attention to the last two freedoms (as these are more challenging for many humans to understand and provide for their dogs).

Education of the client about behavioral needs of domestic dogs (e.g., having an outlet for natural behaviors, spending time with conspecifics, sufficient physical, and mental exercise) and about canine body language are important components of caring for these dogs. Veterinarians should inquire about behavior as an indicator of welfare during each exam, bearing in mind that some clients' disabilities may interfere with their ability to read canine body language, and should address any deficiencies in the dog's care that might be contributing to decreased welfare (65). In particular, fear and anxiety can compromise not only the assistance dog's welfare, but also the dog's working performance (82, 83), and can lead to early withdrawals from working roles (84) [reviewed in Rooney et al. (85)].

Medications, Sedation, Anesthesia, Hospitalization and Emergencies

In order to maintain the working abilities of assistance dogs, the clinician should always consider how any of these procedures and/or treatment options will impact the dog's physical, mental and sensory competence, and for how long. Medications that cause sedation (e.g., antihistamines), mental "dullness," vomiting or diarrhea can impact the dog's ability to work effectively [reviewed in Sandler (39)]. Even a commonly-prescribed medication such as a corticosteroid to treat itching or allergies can cause real problems for the dog's human partner, as a common side effect of these medications is a marked increase in the dog's need to urinate (39, 40, 86). The dog should be back to full working capacity by the time he leaves the clinic with his handler, as the client depends on the dog's abilities (40). It is important, in any case, to provide complete information about the dog's current physical and mental condition to the client. Eames and Eames (40) relate cautionary tales of when this information was not provided to the human handlers, for example in the case of a guide dog released into the care of his handler while still disoriented after suffering a stroke. Hospitalization should be reserved for the most serious cases, or when empiric treatment is not possible (39). Loss of the dog, even temporarily, can represent a significant logistical hardship for the client; if hospitalization is necessary, it may be better to discuss this in the privacy of the exam room, as this may be a sensitive issue for clients who depend on their dog (4). The veterinarian's responsibility in these issues is to both the animal and the client, however, and this can present contradictory goals (87). If the animal's well-being (distinct from their continued ability to work as an assistance dog) requires hospitalization, the veterinarian should work with the client to find a way to get the dog the necessary treatment with the least possible hardship for the client (88). If the client has to leave the clinic without his dog (for example, in the case of an unexpected emergency), ensure that he has safe transportation home. Guide dogs should not return to work for 24 h after a sedative or anesthetic has been administered; in these cases, the staff should notify the client in advance so that he or she can arrange for alternate transportation back home (4). The extreme stress that the client may experience in an emergency situation may exacerbate existing communication challenges. Staff should be aware that getting necessary information may take longer than is desirable in such situations (52), and they should be prepared to be particularly patient with these clients during emergency visits.

Aging, End of Life and Loss of an Assistance Dog

As these dogs age, veterinarians caring for assistance dogs should continue to track how the welfare and working ability of these dogs may be changing (57, 62). Many domestic dogs experience cognitive decline and physical impairments as they age, which can include symptoms such as disorientation, altered interactions with humans and other animals, sleep-wake cycle disturbances, house-soiling, and changes in activity levels (89); clinical signs that are often classified with the acronym DISHA Loss of previously-learned cues may also be evident (89), particularly in highly-trained assistance dogs. These changes can significantly impact working ability, and if detected by the owner or veterinarian, the dog's duties may need to be curtailed, or retirement for the dog considered (63). Recommendations for maintaining cognitive function in domestic dogs as they age include ensuring sufficient mental and physical enrichment, feeding a diet specifically formulated for senior dogs, and supplementation with antioxidants (90, 91) nutraceuticals (92), and/or medication such as Anipryl (L-deprenel; Zoetis) (93). Guidelines such as the American Animal Hospital Association's Senior Care Guidelines for Dogs and Cats (94) can assist in ensuring optimal physical and mental wellness in aging assistance dogs. Many guide dogs are retired due to problematic changes associated with aging (95), but the choice about when to retire an assistance dog will vary depending on the dog, the owner, and the type of work that the dog does on a daily basis. Veterinarians can assist with this decision-making process by providing ongoing information about the mental and physical health of the dog, and options for prolonging working ability and quality of life. Research-based recommendations for assisting these dogs to transition from working into retirement are lacking (69).

These dogs fulfill important attachment and caregiving needs for their human partners, and the loss or imminent loss of an assistance dog can be a source of intense grief for these clients (96, 97). Veterinarians and clinic staff should familiarize themselves with the ways in which client grief may be expressed, and may benefit from continuing education or additional training in helping clients cope with their grief, provided by a qualified counseling professional (especially if they feel uncomfortable working with clients in this situation, and/or if sufficient training was not provided by their veterinary school curriculum) (98). Clients who are already experiencing adverse events in other aspects of their lives will be particularly at risk of severe grief associated with loss of an assistance dog (99). Levels of stress at retirement of the dog are generally lower for clients who continue to live with the dog after retirement, or who are able to place the dog in a home of their choosing (99). In addition to the emotional impact, however, there are significant logistical challenges and added stress associated with this event (100). Loss of the dog represents a significant loss of independence and mobility for many clients, and in most cases, these impacts continue while

the client applies for, waits for, and trains with a new dog (40). Veterinarians working with clients relying on assistance dogs should provide these clients as much information as possible on the timing of the illness, quality of life, and the ability to keep working, and assist with planning for transitions in any way relevant to their role in the veterinarian-client-patient triad. Some clients may benefit from working directly with a human medical professional trained in grief counseling, or by seeking support and advice from an assistance dog organization (100). If euthanasia is necessary, clients with disabilities may benefit from in-home euthanasia of the animal, which is not only less stressful for many clients and patients, but also eliminates the logistical challenges for the client in accessing the veterinary clinic.

Special Considerations for Wellness of Kenneled Dogs

Numerous studies conducted to assess welfare of domestic dogs living in kennel facilities, and using behavioral, physical, physiological, and cognitive measures, have reported that these dogs may experience suboptimal living conditions, particularly when kenneled for longer periods of time (101–108). For example, in a study of 148 dogs at eight rescue shelters in the United Kingdom, kenneled dogs displayed behaviors commonly associated with frustration and depression for 8 weeks following admittance to a shelter (104). Two groups of beagles housed for 6 weeks in social and spatial restriction showed both behavioral and physiological signs of chronic stress (102, 109). Although these studies focus on companion, research/laboratory, or working (military) dogs, given the frequently reported associations between kennels housing and stress in domestic dogs, risks to welfare of assistance dogs should be considered when these dogs are living in a situation where they are regularly kenneled (such as during their training, or when working as therapy dogs in a residential facility) (63, 69, 78). Welfare of these dogs may be compromised due to numerous factors, including lack of exercise and/or control over their environment, confinement to a small area, high and/or unpredictable noise levels, and minimal social contact (78, 110, 111). Behavioral indicators of stress in these conditions may include salivating, panting, restlessness, lowered body posture, trembling, hypervigilance, and an intensified startle response, among others (101); these behaviors likely indicate the presence of fear, frustration, and/or internal emotional conflict (105). Changes in behavior, such as the development of repetitive and stereotypical behaviors (e.g., spinning, circling, jumping in place, excessive barking) are also associated with chronic stress due to kenneling, particularly when dogs are housed alone (103, 111). Note that not all dogs will show these negative effects, but the development of behavioral issues associated with fear and aggression may make dogs experiencing these issues unsuitable for use as assistance dogs. High levels of physiologic stress experienced in kennels can result in poor training performance, which may in turn negatively impact working performance (78). Veterinarians responsible for the medical care of dogs housed in such facilities should review the facility's management protocols for these dogs in light of the American Association for Shelter Veterinarians' Standards of Care document (79), which provides recommendations for all aspects of the care of kenneled dogs. Any signs of behavioral decline in these dogs should be investigated and addressed promptly.

The AVMA (56) guidelines for animal-assisted interventions recommend ensuring that, in addition to being physically healthy, animals serving these roles are behaviorally appropriate for the program (given the type of interactions between the dogs and people), and that animals are protected from being harmed by participation in the program. There should be a clear "chain of command" and identification of those individuals responsible and accountable for the care of kenneled dogs. Veterinarians should identify the specific person responsible for the animals' welfare (the "responsible person," or RP) and all necessary contact information, and should communicate regularly with the RP in both the development and implementation of an optimal wellness plan for these dogs (56, 61).

Invisible Disabilities: Working With Psychiatric Service Dogs and Emotional Support Animals

As noted above, the number of assistance animals is increasing, along with the types of roles these animals fill. This likely reflects the parallel changes in the way that humans view their companion animals (87, 112); increasingly, clients tend to view their animals as part of the family (113), and in one recent survey, 93% of respondents reported that they would risk their lives to save their pets (114). Companion animals are now regarded as beneficial to human mental health (12), and often now serve as assistance animals for those with "invisible" or "hidden" disabilities, as psychiatric service dogs or emotional support animals[2]. Invisible disability is a broad term that covers a wide range of physical and mental disorders; to be considered a disability under ADA, the disorder must substantially limit one or more of a person's major life activities, such as walking, seeing, sitting, breathing (43). Many invisible disabilities would meet this criterion, such as chronic pain, chronic fatigue, attention deficit hyperactivity disorder (ADHD), Asperger's syndrome, anxiety disorders, and clinical depression (to name just a few) (115).

This can put the veterinarian in a challenging situation, as they may only learn of the animal's status as an assistance or emotional support animal after the exam is completed, or treatment recommendations have been made (88). In fact, the veterinarian may never know about the disability if the client does not wish to share this information, but if present, any disability that interferes with normal life function may also interfere with the client's adherence and thus the success of treatment and care. In either situation, the best course of action may be to observe best communication practices such as those described earlier in this paper. The veterinarian should work with the client to arrive at a treatment plan to which the client can realistically adhere, given challenges in the client's life which

[2]Definitions and examples of invisible disabilities can be found at Disabled World. (2018-10-03) Invisible Disabilities: List and General Information. Available online https://www.disabled-world.com/disability/types/invisible/ (accessed October 2018).

may or may not be known to the veterinarian or her staff. It is important to accept the client's own descriptions of their ability or disability; as the term implies, many of these individuals may not "look like they have a disability." Clinicians should familiarize themselves with state and national laws to establish what they can and cannot legally ask their clients about their disabilities and the status of their assistance animal (88, 116). While it is not generally appropriate (or legally permissible) to ask questions about the client's personal medical history, it is acceptable to ask them what tasks the dog does for them, what they need to make the visit a success, and if they are comfortable with a proposed treatment plan. The AVMA (98) also provides recommendations for working with clients with allergies or who are immunocompromised.

To qualify as an Emotional Support Animal (ESA) in the legal sense—for example, in order to be granted access and be exempt from additional fees, as covered under the U.S. Fair Housing Act (FHA) and the Air Carrier Access Act (ACAA)—the owner must possess a letter from a licensed human medical professional stating the animal's necessity for supporting the client's health. They may be required to provide this letter as proof of the animal's status. If asked by a client to provide a letter in support of the animal serving as an ESA, the veterinarian should decline; this letter needs to be written by a human medical professional familiar with the client's medical history (31). Because these animals are not task trained, they may look exactly like pets not serving as ESAs, and thus there is a high potential for fraudulent claims (11). The lack of training and socialization provided to some ESAs can result in the animal behaving inappropriately (for example, when the animal is aggressive, presents a risk to others in the facility, or is not under the handler's control). In these cases, staff may ask the client to leave the facility with the animal (11). The veterinarian should assist clients with ESAs in selecting an animal with a temperament suitable to that role, and should ensure on an ongoing basis that working ESAs are physically healthy and behaviorally appropriate for being taken out in public (31). This would include assessing whether the animal is displaying signs of stress or aggressive behavior when in locations where he/she may be taken in their role as an ESA (such as out in public, or in unfamiliar locations such as airplanes) (31).

In all cases, however, the veterinarian's mission is to provide care for the animal, and to make life better for both the animal and its human family (42). ESAs can provide essential support for many individuals with emotional, psychiatric, and other disabilities, and thus clinicians should consider how treatments or hospitalization, etc., will impact the ESA's ability to perform this function for the client.

CONCLUSIONS

This review summarizes current recommendations for veterinarians working with clients who have disabilities and/or in cases when the patient is an assistance dog. Common themes emerge from the body of literature available on this topic:

- Clients with disabilities, and their pets and/or assistance animals, should receive the same quality of care as clients without disabilities.
- Providing this care may require flexibility, accommodations or alternate approaches, and team training.
- Extra time may be required in orienting and assisting clients with disabilities, to ensure that their needs are met and the veterinary visit is a success for both client and animal.
- Effective communication is paramount, and veterinarians should implement steps needed to best communicate with clients with specific disabilities.
- Veterinarians should ensure that the client understands and is willing and able to follow treatment recommendations.
- When in doubt about what the client needs to make his/her visit a success, staff should ask the client directly.
- When the patient is an assistance dog, the veterinarian should consider what impacts treatment will have on the dog's ability to function in its role for the client.
- Veterinarians should actively monitor physical and behavioral wellness of assistance animals, work regularly with persons responsible for their care, and educate owners of these animals about their physical and behavioral needs.
- Dogs living in kennels may be particularly at risk of behavioral problems, and veterinarians should be familiar with the signs of chronic stress in dogs.

AUTHOR CONTRIBUTIONS

EG conducted the literature review and wrote the manuscript. LH provided the original concept, contributed to the literature review, and commented on manuscript drafts.

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Predictive Models of Assistance Dog Training Outcomes Using the Canine Behavioral Assessment and Research Questionnaire and a Standardized Temperament Evaluation

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Assistance dogs can greatly improve the lives of people with disabilities. However, a large proportion of dogs bred and trained for this purpose are deemed unable to successfully fulfill the behavioral demands of this role. Often, this determination is not finalized until weeks or even months into training, when the dog is close to 2 years old. Thus, there is an urgent need to develop objective selection protocols that can identify dogs most and least likely to succeed, from early in the training process. We assessed the predictive validity of two candidate measures employed by Canine Companions for Independence (CCI), a national assistance dog organization headquartered in Santa Rosa, CA. For more than a decade, CCI has collected data on their population using the Canine Behavioral Assessment and Research Questionnaire (C-BARQ) and a standardized temperament assessment known internally as the In-For-Training (IFT) test, which is conducted at the beginning of professional training. Data from both measures were divided into independent training and test datasets, with the training data used for variable selection and cross-validation. We developed three predictive models in which we predicted success or release from the training program using C-BARQ scores ($N = 3{,}569$), IFT scores ($N = 5{,}967$), and a combination of scores from both instruments ($N = 2{,}990$). All three final models performed significantly better than the null expectation when applied to the test data, with overall accuracies ranging from 64 to 68%. Model predictions were most accurate for dogs predicted to have the lowest probability of success (ranging from 85 to 92% accurate for dogs in the lowest 10% of predicted probabilities), and moderately accurate for identifying the dogs most likely to succeed (ranging from 62 to 72% for dogs in the top 10% of predicted probabilities). Combining C-BARQ and IFT predictors into a single model did not improve overall accuracy, although it did improve

accuracy for dogs in the lowest 20% of predicted probabilities. Our results suggest that both types of assessments have the potential to be used as powerful screening tools, thereby allowing more efficient allocation of resources in assistance dog selection and training.

Keywords: C-BARQ, canine, assistance dogs, prediction, temperament, behavior, service animal

INTRODUCTION

Assistance dogs can greatly improve the lives of people with disabilities. By performing tasks such as picking up dropped items, opening doors, and turning on and off lights, they allow their handlers to approach life with greater independence and confidence. However, even among dogs that are specifically bred for these tasks, the rate of success typically ranges from 30 to 50% (1). At Canine Companions for Independence (CCI)—the largest nonprofit provider of assistance dogs for people with physical disabilities in the United States–the success rate over the past 13 years has averaged 43% when breeders and medical releases are excluded (K. Levy, personal communication, November 26, 2018). To be successful, these dogs must be robust to environmental stressors (large crowds, loud noises) and distractions (other animals and people, food on the ground), and exhibit impulse control, flexible and sustained attention, appropriate social behavior, and independent problem solving. Given the extensive resources required to raise and train these dogs, predicting the development and proficiency of these skills as early as possible is crucial to saving time and expense, while ensuring productive placements.

To this end, researchers have turned to a variety of tools in order to find early precursors of success: questionnaires that ask owners, raisers, or trainers to rate a dog's behavior [e.g., (2, 3)] and early environment [e.g., (4)], tracking of physiological measures (5), observations of maternal style (6, 7), batteries of temperament tests [e.g., (8, 9)], and measurements of cognitive variability through test batteries (10–12) and fMRI brain scans (13).

For the past 13 years, two formalized methods of evaluation that take no more than 15 min per dog have been regularly implemented in the dog population at CCI, an organization that breeds, trains, and places assistance dogs. The first is a standardized behavioral questionnaire that is completed by volunteer puppy raisers that care for each dog from 8 weeks of age until the dog returns for professional training (∼18 months). The Canine Behavioral Assessment and Research Questionnaire (C-BARQ©, www.cbarq.org), consisting of 100 items, was developed and validated for guide dogs (14) and pet dogs (15), and is now widely and systematically used among assistance dog organizations (1, 12). This method of assessment is advantageous in that it is easy to collect large amounts of data that provide a glimpse into each dog's behavioral profile prior to the dog entering training, with this information provided by the person who has been raising and observing the dog from 8 weeks of age. On the other hand, these measures include a degree of subjectivity, may not be available for all dogs (depending on puppy raiser compliance), can be noisy because every dog is evaluated by a different person, and it is impossible to confirm the accuracy of responses.

Secondly, CCI also conducts a standardized temperament test known as the In-For-Training (IFT) test, when dogs return to training campuses for professional training (16). The IFT is similar to behavioral tests that have previously been used by working dog groups in Sweden (17) and the UK (18). Like the C-BARQ, the IFT is characterized by distinct strengths and limitations. IFT scores are determined by a much smaller pool of trained evaluators who record behavior under experimental conditions using a clearly defined rubric. However, dog behavior and test results may be affected by uncontrolled variables, such as minor differences in the test procedure across time or location, variation in weather, or external distractions.

Past research has uncovered associations between questionnaire-reported assessments of behavior and working dog outcomes. Arata et al. (19) had trainers fill out questionnaires 3 months into training and found that the reported measure of distraction was especially effective at predicting guide dog outcome. Harvey et al. (20) developed and validated a questionnaire for guide dog trainers, then created a predictive model in which traits such as adaptability, body sensitivity, distractibility, excitability, general anxiety, trainability, and stair anxiety showed the potential to predict later outcomes. In another study spanning five working dog organizations (including CCI) that used the C-BARQ specifically, Duffy and Serpell (1) found significant associations between favorable raiser-reported scores and successful program outcome on 27 out of 36 traits. Thus, while many studies have described robust associations between aspects of behavior and temperament and training outcomes, few studies have developed and tested predictive models for forecasting these outcomes [but see (20)].

Additionally, researchers have found relationships between working dog success and temperament tests with similar components to the IFT. In a pilot study, Batt et al. (21) found that measures of reactivity at 14 months were associated with ultimate guide dog success. Harvey et al. (18) conducted a temperament test at 8 months of age and found that 5 of 11 behavioral measures were associated with success in a guide dog program, including posture when meeting a stranger, reaction to and chase behavior toward novel objects, and playfulness with a tea towel. Other researchers have found associations between temperament measures and later guide dog success as early as 8 weeks of age (22). However, to our knowledge, data from the specific IFT test implemented by CCI has never been used to predict whether a dog will graduate.

In the current work, we conducted a formal prediction study to determine how effectively we could predict which dogs would graduate as assistance dogs or be released from the program for behavioral reasons. As the predictor variables, we used C-BARQ scores collected by puppy raisers around 12 months of age (Experiment 1), behavioral IFT evaluations assessed by trainers around 18 months of age (Experiment 2), and a combination of both assessment types (Experiment 3).

GENERAL METHODS

Subjects

All dogs in the study were Labrador retrievers, Golden retrievers, or crosses of the two breeds purpose-bred by CCI. CCI granted informed consent to all aspects of the study. CCI is a non-profit assistance dog organization that places service dogs (with adults with physical disabilities), skilled companions (with a team consisting of an adult or child with a disability and a facilitator), facility dogs (with a facilitator in a health care or educational setting), hearing dogs (with an adult who is deaf or hard of hearing), and service dogs for veterans (with physical disabilities or post-traumatic stress disorder). CCI has a nationwide presence; their national headquarters and Northwest Region Training Center are in Santa Rosa, CA (est. 1975) with additional training centers in Oceanside, CA (est. 1986), Delaware, OH (est. 1987), Orlando, FL (est. 1989), Medford, NY (est. 1989), and Irving, TX (est. 2016). Dogs in CCI's program are whelped in volunteer breeder-caretaker homes in Northern CA. Around 8 weeks of age, dogs are placed with volunteer puppy raisers across the country who care for dogs in their homes until the dogs are ∼18 months of age, at which point they are sent to one of CCI's regional centers to begin professional training.

Participating dogs were born between the years of 2004 and 2017. To be eligible for the study, dogs needed to have a C-BARQ completed around 1 year of age by their puppy raiser (Experiment 1), participated in the In-For-Training behavioral test administered by CCI staff at their respective campus around 18 months of age (Experiment 2), or met both requirements (Experiment 3). Additionally, since we were interested in predicting behavioral suitability for assistance work, we only included dogs that succeeded in being placed for at least 1 year or were released from the program for behavioral reasons (e.g., distractibility, anxiety, fear, reactivity, sensitivity). Breeders were excluded from analysis, as were dogs released solely for medical reasons, consistent with previous studies on cognitive, behavioral, and temperamental predictors of working dog outcomes [e.g., (7, 10)]. Hearing dogs were excluded from analysis as they are selected for a different behavioral phenotype than the other roles (10), and they are only trained at a subset of the campuses and thus not representative of the population at a national level. Finally, dogs placed with veterans with post-traumatic stress disorder and dogs from the newest campus in Irving, TX were excluded from analysis due to insufficient sample size.

Missing Data Imputation

For all instances where baseline values were missing, we used an imputation strategy based on a random forest [missForest package in R; (23)]. This method uses bootstrap aggregation of regression trees, which results in less biased parameters than parametric methods using linear regression, and also decreases the risk of overfitting (24). We imputed missing values using all baseline predictors, as well as outcome data and demographic variables accounting for sex, breed, coat color, training region, and the year that the dog entered training. When imputing missing baseline values, including outcomes ensures that the coefficients are closest to "true" coefficients, whereas excluding outcomes leads to biased (underestimated) coefficients (25). We imputed our "training" and "test" datasets separately.

Statistical Analysis

Each dataset was divided into independent training and test data, using 2/3 of the data for variable selection and cross-validation, and 1/3 of the data for assessing predictive validity with an independent sample. As additional covariates we included sex, breed, coat color, training region, and year (in 2-year increments) that the dog entered training. We initially assessed a variety of modeling strategies with each of the different training datasets (Experiments 1–3) to determine what type of model might be most appropriate for these data. Specifically, we performed preliminary modeling using a generalized linear model, linear discriminant analysis, regularized regression (elastic net), partial least squares, and a k-nearest neighbors approach. Within the training data, the performance of these models was evaluated using 4-fold cross-validation repeated 10 times (data randomly divided into 4-folds, 3-folds used for model construction, 1-fold used to assess model accuracy, with this process repeated 10 times). As a measure of performance, we used the area under the curve (AUC) from the receiver operating characteristic, a measure of sensitivity and specificity for a binary classifier. AUC values range between 0.5 and 1, with a value of 0.5 indicating a non-informative model, and a value of 1 indicating a perfectly predictive model. Categorical predictions (graduate, release) were made using a probability threshold of 0.5 (i.e., predict release when predicted probability of graduation <0.5; predict graduate when predicted probability of graduation > 0.5.) Across the different training datasets, a general linear model performed as well or better than all other model types, and thus we used this approach for predictions with the test data. Variables were selected for the generalized linear model using a recursive feature elimination approach (with the training data), as implemented in the caret R package (26, 27).

For the test data, we predicted training outcomes using a model fit to all of the training data, and again used a probability threshold of 0.5 for predicting whether dogs in the test dataset would graduate from the program. In addition to these categorical predictions, we retained the predicted probabilities of graduation for each dog in the test dataset in order to explore accuracy across the range of predicted probabilities. These predicted probabilities were divided into deciles (i.e., 1st decile corresponding to the 10% of the test sample predicted to have the lowest probability of success, 10th decile corresponding to the 10% of the test sample predicted to have the highest probability of success). We then assessed accuracy across deciles to identify probability regions where the predictive model was most and

least accurate. To identify which terms made the most important contributions to the model, we assessed a measure of variable importance, defined as the absolute value of the z-statistic for each term in the model (27). Overall model performance was measured using accuracy and the AUC from the receiver operating characteristic. To test whether model predictions were better than the null expectation, we performed a one-tailed binomial test to assess whether accuracy was significantly higher than the "no information rate" (the accuracy which could be obtained by predicting the majority class for all observations).

EXPERIMENT 1

Methods

Subjects

A request to fill out a C-BARQ questionnaire was sent to puppy raisers via email by CCI when the dog turned 1 year of age. Completion of the questionnaire implied informed consent. Most puppy raisers completed an online version of the survey through the website (www.cbarq.com), although they were also given the option to fill out the same survey on paper and return via mail. These surveys take approximately 10–15 min to complete and were filled out while the dog was still living with the puppy raiser, prior to being returned to campus for professional training. Dogs whose questionnaires were completed after their 2nd birthday ($N = 17$) and dogs missing data on more than 4 variables ($N = 74$) were excluded from analysis. In total, there were 3,569 dogs that met our criteria with a completed C-BARQ questionnaire and a behavioral outcome (1,715 females, 1,854 males; 707 Labrador retrievers, 193 Golden retrievers, 2,669 Labrador × Golden crosses). The average age at evaluation was 58.3 ± 8.4 weeks. In our sample, 60% of subjects were behavioral releases ($N = 2{,}132$).

Measures

The C-BARQ is particularly focused on assessing the frequency and severity of problematic behaviors (28). It consists of several miscellaneous items as well as 14 different categories of behavior—stranger-directed aggression, owner-directed aggression, dog-directed aggression, stranger-directed fear, non-social fear, dog-directed fear, separation-related behavior, attachment and attention-seeking, trainability, chasing, excitability, touch sensitivity, energy level, and dog rivalry—originally extracted by factor analysis (1, 15). Scores on these categories are obtained by averaging scores across raw test items assessing behaviors relevant to these constructs (see **Appendix A**). Dogs only received a score in a given category if at least 80% or greater of the scores that made up the category were recorded (1).

Among the 3,569 questionnaires analyzed in the current study, we only included items that were recorded for 90% or more of participants. Using this cut-off criteria, we dropped the following measures from analysis: chasing other animals (miscellaneous items 74–76), escape behavior (miscellaneous item 77), and rolling in smelly substances (miscellaneous item 78).

Analysis

Data preparation and analysis followed the procedure described in sections Missing Data Imputation and Statistical Analysis.

Results and Discussion

Initial modeling using the training dataset and C-BARQ measures as predictor variables yielded a cross-validated accuracy of 0.65. Estimates, standard errors, z-values, and *p*-values of the C-BARQ predictors are presented in **Table 1**. The five C-BARQ variables of most importance to the final model (in order of importance) included: barking (lower

TABLE 1 | Estimates, standard errors, z-values, and *p* values from the GLM used in Experiment 1 in which the dependent variable was outcome in the assistance dog program and CBARQ scores were the predictor variables.

Predictor variables (C-BARQ scores)	Estimate	Std. error	z value	Pr(>|z|)
Intercept	1.84	0.30	6.03	0.00
Barks persistently when alarmed or excited	0.23	0.06	3.71	0.00
Stranger-directed fear	0.28	0.08	3.64	0.00
Dog-directed aggression	0.26	0.07	3.61	0.00
Coprophagia	−0.16	0.05	−3.26	0.00
Trainability	−0.16	0.05	−2.88	0.00
Pulls on leash	0.16	0.06	2.87	0.00
Begs persistently for food	−0.13	0.05	−2.37	0.02
Chews inappropriate objects	0.12	0.05	2.30	0.02
Fear of stairs	0.12	0.05	2.29	0.02
Separation-related behavior	0.13	0.06	2.23	0.03
Urinates when approached, petted, or handled	0.11	0.06	2.00	0.05
Energy level	0.11	0.06	1.88	0.06
Licks him/herself excessively	−0.10	0.06	−1.82	0.07
Stares intently at nothing visible	−0.09	0.05	−1.74	0.08
Displays bizarre, strange, or repetitive behaviors	0.09	0.06	1.67	0.10
Dog rivalry	−0.11	0.07	−1.60	0.11
Steals food	0.09	0.06	1.56	0.12
Touch sensitivity	−0.08	0.05	−1.51	0.13
Attachment and attention-seeking behaviors	−0.08	0.05	−1.50	0.13
Defecates when left alone	0.08	0.05	1.47	0.14
Owner-directed aggression	0.12	0.08	1.46	0.15
Hyperactive	0.08	0.06	1.36	0.17
Snaps at (invisible) flies	−0.07	0.05	−1.32	0.19
Mounts objects, furniture, or people	−0.06	0.05	−1.15	0.25
Excitability	0.06	0.06	1.07	0.28
Dog-directed fear	−0.04	0.06	−0.65	0.51
Tail-chasing	−0.03	0.05	−0.55	0.58
Non-social fear	0.03	0.06	0.48	0.63
Urinates when left alone	0.02	0.05	0.41	0.68
Licks people or objects excessively	0.02	0.05	0.36	0.72
Stranger-directed aggression	−0.02	0.07	−0.21	0.84

levels predicted higher probability of graduation), stranger-directed fear (lower levels predicted higher probability of graduation), dog-directed aggression (lower levels predicted higher probability of graduation), coprophagia (higher levels predicted higher probability of graduation), and trainability (higher levels predicted higher probability of graduation). Fitting this model to the test data, outcomes were predicted with an overall accuracy of 0.68, yielding an AUC of 0.71. Overall, model predictions were significantly better than the null expectation (no information rate = 0.60; $p < 0.01$).

Assessing accuracy across deciles of the predicted probability of success, we found that the dogs least likely to succeed in training could be identified with a remarkably high accuracy. Specifically, for the 10% of dogs predicted to be least likely to succeed, model predictions were 92% accurate. For dogs in the lowest 20% of predicted probabilities, accuracy was 85% (**Figure 1**). In contrast, for the dogs predicted to have the highest probability of success, predictions were much less accurate (62% accuracy for dogs in the top decile of predicted probabilities). This pattern of results is consistent with the intended purpose of the C-BARQ, which was designed primarily to identify problematic behaviors (15, 29). Thus, from an applied perspective, the C-BARQ may be most useful for identifying the dogs that are least likely to succeed. Given that dogs with the lowest probability of success can be identified with a high accuracy, the C-BARQ has potential to be a powerful screening tool that can be incorporated prior to the commencement of formal training.

EXPERIMENT 2

Methods

Subjects

Subjects included dogs that had completed an In-For-Training Evaluation (IFT) around 18 months of age. As in Experiment 1, dogs missing data for more than 4 variables ($N = 61$) were excluded from analysis. In total, there were 5,967 dogs that met our criteria with IFT test participation and a behavioral outcome (2,892 females, 3,075 males; 1,249 Labrador retrievers, 265 Golden retrievers, 4,453 Labrador × Golden crosses). The mean age at evaluation was 1.6 ± 0.1 years. In our sample, 58% of subjects were behavioral releases ($N = 3,489$).

Measures

The IFT test occurs on a single morning the week after dogs arrive at campus to begin professional training and takes ∼10 min per dog. In the IFT test, the dog is exposed to six scenarios: a physical exam, a looming object, a sudden noise, a 'prey' object, an unfamiliar dog, and a threatening stranger. These scenarios were chosen to be stimulating enough to potentially elicit problematic behaviors, while remaining within the realm of normal occurrences that a dog might conceivably face in his/her working life. In the physical exam portion, the dog is handled by a stranger as if at a veterinary examination, culminating in the tester attempting to roll the dog over onto his/her side without any commands being given. In the looming object portion, a trash bag unexpectedly falls toward the dog from a height of 3–4 feet. In the sudden noise portion, a heavy chain is dragged across metal for ∼2–3 s. In the "prey" object portion, a rag on a string is erratically moved away from the dog, who is given the opportunity to chase it. In the unfamiliar dog portion, the dog is led toward a life-sized stuffed Old English sheepdog (30). In the threatening stranger portion, the dog is led toward a hooded figure who is hunched over, striking a cane against the ground, and yelling (30). In each of these scenarios, the dog's reaction, recovery (where applicable), and body language is coded (see **Appendix B**). Across scenarios, low scores correspond to appropriate behavior, while higher scores indicate visible discomfort, reactivity, and failure to recover.

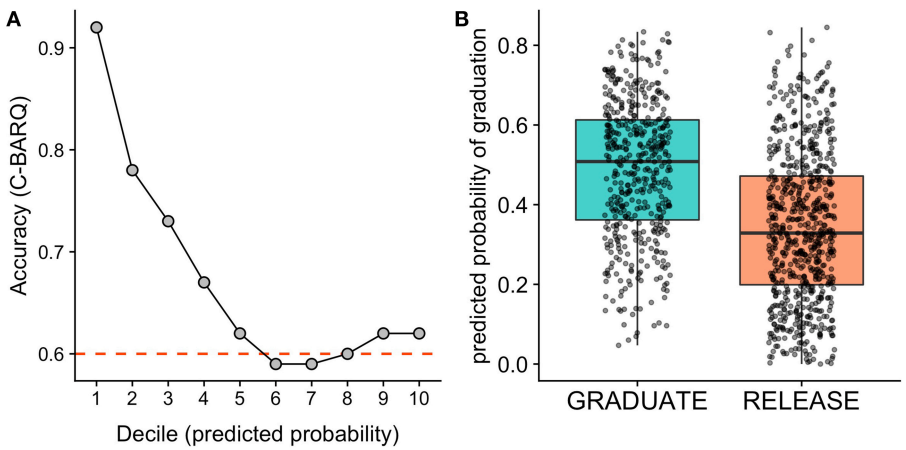

FIGURE 1 | Results of models using the C-BARQ to predict assistance dog training outcomes. **(A)** Model accuracy as a function of deciles of the predicted probability of graduation for the test sample. The model was most accurate at identifying dogs with the lowest probability of success. The red dashed line indicates the No Information Rate (NIR), the accuracy that could be obtained by predicting the majority class for all observations. The C-BARQ predictive model performed significantly better than the NIR. **(B)** Predicted probabilities of graduation for dogs that ultimately graduated or were released from the program. Points overlaid on the boxplots reflect predicted probabilities for individual dogs. Horizonal jittering of points and transparency are used to reduce overplotting.

Among the 5,967 IFT tests included in the current study, scores on all items were recorded for 95% or more of participants. The only measure that was dropped from analysis was the categorization of the dog's general demeanor during the physical exam portion, since it was the only categorical variable.

Analysis

Data preparation and analysis followed the procedure described in sections Missing Data Imputation and Statistical Analysis.

Results and Discussion

Initial modeling using the training dataset and IFT measures as predictor variables yielded a cross-validated accuracy of 0.64. Estimates, standard errors, z-values, and p values of the IFT predictors are presented in **Table 2**. The five IFT variables of most importance to the final model (in order of importance) included: body tension during the physical exam (lower scores—i.e., more relaxed—predicted higher probability of graduation), behavior during the second pass following the sudden noise (referred to as "conclusion" phase in **Appendix B**; lower scores—i.e., less reactivity—predicted higher probability of graduation), recall after confronting the unfamiliar dog (lower scores—i.e., readily leaves—predicted higher probability of graduation), initial reaction during the prey test (lower scores—i.e., less reactivity—predicted higher probability of graduation), and response to handling during the physical exam (lower scores—i.e., lower resistance—predicted higher probability of graduation). Fitting this model to the test data, outcomes were predicted with an overall accuracy of 0.66, yielding an AUC of 0.71. Overall, model predictions were significantly better than chance expectation (no information rate = 0.58; $p < 0.01$).

Assessing accuracy across deciles of the predicted probability of success, we found that the dogs least likely to succeed in training could be identified with a high accuracy based on IFT measures. For the 10% of dogs predicted to be least likely to succeed, model predictions were 85% accurate, and for dogs in the lowest 20% of predicted probabilities, accuracy was 81% (**Figure 2**). Accuracy using the IFT model was also reasonably high for the group of dogs predicted to have the highest probability of success. For the 10% of dogs predicted to be most likely to succeed, prediction accuracy was 72%. Therefore, while the most accurate predictions from the IFT concerned the dogs least likely to succeed, these data were also useful for identifying an elite group of dogs most likely to graduate from the program. Because the IFT is completed after dogs have returned to the training center, but before a large investment in professional training, our findings suggest that outcome predictions based on the IFT may help to streamline and expedite decisions about which dogs to retain for subsequent professional training or breeding purposes.

TABLE 2 | Estimates, standard errors, z-values, and p values from the GLM used in Experiment 2 in which the dependent variable was outcome in the assistance dog program and IFT scores were the predictor variables.

Predictor variables (IFT scores)	Estimate	Std. error	z value	Pr(>|z|)
Intercept	2.89	0.47	6.09	0.00
Physical exam: body tension	0.16	0.04	3.87	0.00
Sudden noise: conclusion	0.15	0.05	3.32	0.00
Unfamiliar dog: recall	0.12	0.04	2.80	0.01
Prey: initial reaction	0.17	0.07	2.51	0.01
Sudden noise: initial reaction	0.11	0.04	2.47	0.01
Physical exam: ease of handling	0.10	0.04	2.36	0.02
Unfamiliar dog: initial reaction	0.09	0.04	2.21	0.03
Looming object: initial reaction	0.09	0.04	2.14	0.03
Unfamiliar dog: tail position	0.16	0.08	1.90	0.06
Looming object: second walk by	0.25	0.15	1.65	0.10
Sudden noise: barks or growls	1.15	0.77	1.49	0.14
Looming object: increase in activity	0.25	0.17	1.48	0.14
Threatening stranger: initial reaction	0.07	0.05	1.46	0.14
Threatening stranger: recovery	0.06	0.04	1.43	0.15
Prey: conclusion	0.06	0.05	1.14	0.26
Threatening stranger: increase in activity	0.08	0.07	1.12	0.26
Threatening stranger: barks or growls	0.13	0.14	0.95	0.34
Physical exam: vocalization	0.03	0.04	0.87	0.38
Unfamiliar dog: barks or growls	0.14	0.17	0.85	0.40
Prey: recovery	−0.04	0.08	−0.51	0.61

EXPERIMENT 3

Because Experiments 1–2 suggested that the C-BARQ and IFT were both useful measures for predicting training outcomes, in Experiment 3 we investigated whether predictive accuracy could be improved by combining data from both instruments. Because not all dogs had data for both the C-BARQ and IFT, these analyses were restricted to a slightly smaller subset of dogs for which both measures were available.

Methods

Subjects

Participants in Experiment 3 consisted of the dogs from Experiments 1–2 who had 12-month C-BARQ scores, 18-month IFT test scores, and a behavioral outcome. In total, there were 2,990 dogs that met these criteria (1,453 females, 1,537 males; 599 Labrador retrievers, 149 Golden retrievers, 2,242 Labrador × Golden crosses). The mean age at evaluation for the CBARQ was 57.7 ± 8.0 weeks, and the mean age at evaluation for the IFT was 1.6 ± 0.1 years. In our sample, 59% of subjects were behavioral releases ($N = 1{,}774$).

Analysis

Because the sample in Experiment 3 differed from Experiments 1–2, we repeated analyses using the C-BARQ and IFT in isolation to obtain a baseline measure of accuracy using these measures in the sample for Experiment 3. We then performed analyses combining information from the C-BARQ and IFT to assess whether higher accuracy could be attained by leveraging both sets of predictor variables. These analyses were conducted in two ways. First, we developed a model using all variables from the C-BARQ and IFT as predictors. This approach exposed the model

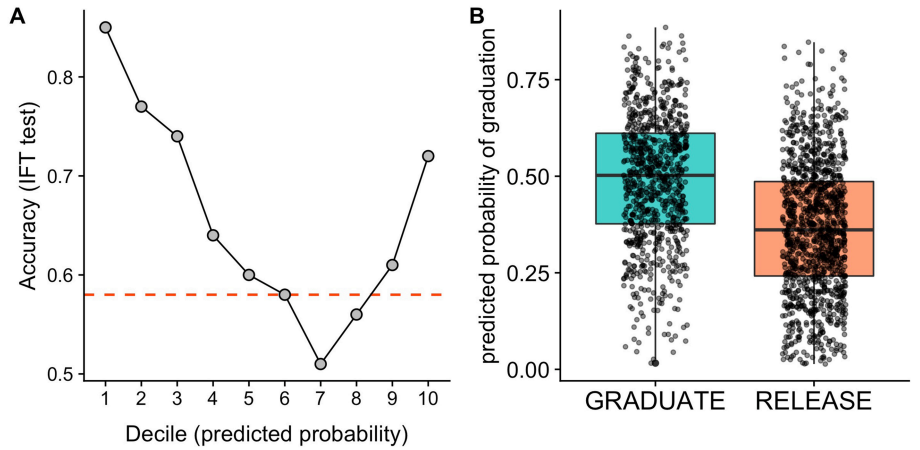

FIGURE 2 | Results of models using the In-For-Training (IFT) temperament test to predict assistance dog training outcomes. **(A)** Model accuracy as a function of deciles of the predicted probability of graduation for the test sample. The model was most accurate at identifying dogs with the lowest probability of success, but also useful for identifying dogs with the highest probability of success. The red dashed line indicates the No Information Rate (NIR), the accuracy that could be obtained by predicting the majority class for all observations. The IFT predictive model performed significantly better than the NIR. **(B)** Predicted probabilities of graduation for dogs that ultimately graduated or were released from the program. Points overlaid on the boxplots reflect predicted probabilities for individual dogs. Horizonal jittering of points and transparency are used to reduce overplotting.

to all raw underlying variables simultaneously. Second, we fit separate models using the C-BARQ and IFT and saved predicted probabilities for each dog from these models. We then fit a final model using the predicted probabilities from the C-BARQ and IFT models as the predictor variables. Although this approach may be suboptimal from a statistical perspective (because not all variables are considered within the same model), it has the practical advantage that if one of the two data sources is missing, it remains possible to generate a predicted probability based on one of the two sets of predictor variables. In addition, because the final model has only two predictor variables (probability from the C-BARQ model, and probability from the IFT model), it is possible to assess which data source carries the most weight by inspecting the beta coefficients associated with each of these predictors.

Results and Discussion

Accuracy for the four models used in Experiment 3 is shown in **Figure 3**. The model using only the C-BARQ data had an accuracy of 0.65, and an AUC of 0.7, performing slightly worse than we observed using a larger sample in Experiment 1. The model using only the IFT data had an accuracy of 0.63 and an AUC of 0.65, again performing slightly worse than the IFT model fit to a larger dataset in Experiment 2. The model combining all C-BARQ and IFT predictors yielded an overall accuracy of 0.64, and an AUC of 0.69. Therefore, the combination of C-BARQ and IFT data actually led to poorer overall performance with this sample, than use of the C-BARQ alone. Lastly, the model using predicted probabilities from the stand-alone C-BARQ and IFT models yielded an accuracy of 0.67, and an AUC of 0.7. Thus, at least in this instance, there was no meaningful information loss in the model using separate probabilities from the IFT and C-BARQ as predictor variables, and in fact, this model outperformed all others.

As with the models from Experiments 1–2, accuracy varied as a function of the predicted probability of success for all models used in Experiment 3 (**Figure 3**). Specifically, all models were best at identifying dogs that were least likely to complete training and were moderately successful at predicting a smaller fraction of dogs that were most likely to complete training. For the dogs predicted to be in the 20% of the sample least likely to succeed (deciles 1 and 2), both models combining information from the C-BARQ and IFT outperformed models using the C-BARQ or IFT in isolation (accuracy collapsing across deciles 1–2: C-BARQ & IFT [raw data]: 86%; C-BARQ & IFT [probabilities]: 86%; C-BARQ alone: 81%; IFT alone: 78%). Therefore, while overall accuracy was not much higher when combining the C-BARQ and IFT, accuracy was appreciably higher with respect to identifying the dogs least likely to succeed. These findings suggest that leveraging both data sources provides an improved strategy for identifying these dogs, and that there is little difference between approaches including all predictors together in a single model vs. aggregating predicted probabilities from independent data sources.

To assess the relative importance of predictor variables from the C-BARQ and IFT, we determined variable importance from the model including raw data from both sets of measures and compared the beta coefficients from the model using predicted probabilities from each data source. Estimates, standard errors, z-values, and *p* values from the former model are presented in **Table 3**. The five most important variables included 3 C-BARQ measures (dog-directed aggression, barking, and chewing, where lower levels predicted higher probability of graduation) and two IFT measures (behavior during the second pass following the sudden noise and initial reaction to the looming object, where less reactivity predicted higher probability of graduation), suggesting that both data sources made important contributions to the model. For the model using independent probabilities based on

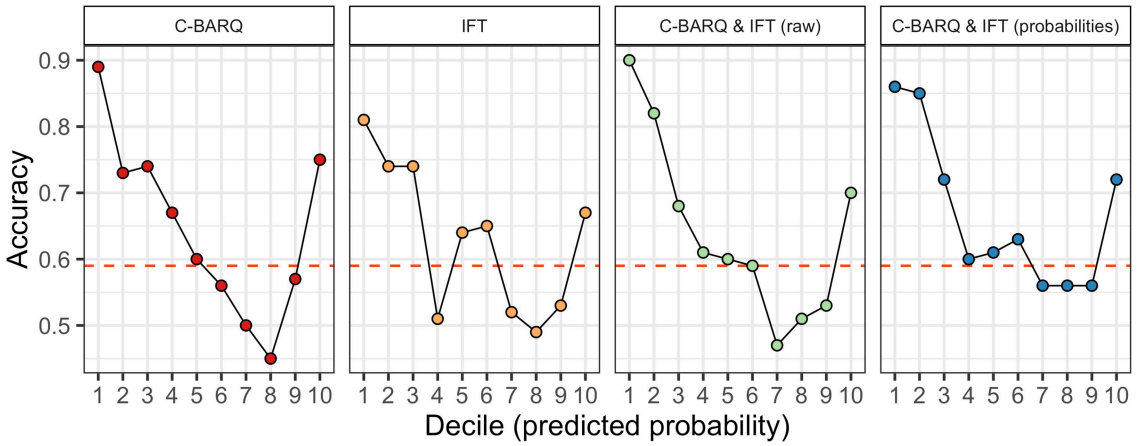

FIGURE 3 | Results of models for a subset of the data ($N = 2{,}990$) for which both C-BARQ and In For Training (IFT) scores were available. All panels depict accuracy as a function of deciles of the predicted probability of graduation for the test sample. The red dashed line indicates the No Information Rate (NIR), the accuracy that could be obtained by predicting the majority class for all observations. The panels for C-BARQ and IFT show accuracy for this subset of dogs using the C-BARQ or IFT in isolation. The C-BARQ & IFT (raw) panel shows results from a model combining raw data from both measures. The C-BARQ & IFT (probabilities) panel shows results from a model using predicted probabilities from the stand-alone C-BARQ and IFT models as the predictor variables (see text for details).

the C-BARQ and IFT, the coefficients associated with each data source were comparable (C-BARQ: $\beta = -3.30$, IFT: $\beta = -3.17$) again suggesting that both sets of measures were important.

GENERAL DISCUSSION

Although several previous studies have identified associations between behavioral or temperamental variables and working dog outcomes, few studies have moved beyond association to formal prediction of outcomes with an independent sample. For applied use, accurate prediction with novel cases provides the most important benchmark, because it addresses the accuracy with which a set of measures can forecast new events, rather than simply describing the past. For assistance dog providers, accurate predictive models can be used to guide decisions about which dogs to invest in, and which dogs are less likely to succeed. Using data from the C-BARQ and an internal temperament test (IFT), we found that statistical models using these instruments were useful for predicting training outcomes in an independent sample.

Notably, our models were best at identifying the dogs least likely to succeed and were less accurate at identifying dogs most likely to succeed. This finding is consistent with the design of the C-BARQ and IFT, which are intended to almost exclusively capture potentially problematic behaviors (e.g., barking, aggression, fear responses to novel stimuli). In contrast, recent studies using cognitive measures were best able to identify the dogs most likely to succeed, with less success at identifying dogs that would be released (10). Thus, a combination of data from diverse kinds of measures may prove most useful for identifying dogs that are both very likely, or very unlikely to succeed. The utility of combining different data sources is suggested by our findings in Experiment 3. Although overall predictions were not more accurate when combining information from the C-BARQ and IFT, the ability to identify dogs least likely to succeed improved considerably when incorporating both instruments. Therefore, an important challenge for future research will be to develop and integrate complementary measures, that together enhance predictive validity.

At a practical level, both of the measures we investigated can be obtained at minimal cost and collected rapidly across large samples of dogs. Specifically, data for the C-BARQ are provided by volunteer puppy raisers, placing no additional burden on professional dog trainers. This measure provides important information about a dog's behavioral profile, even before the dog arrives for professional training. Given that the C-BARQ was highly accurate at identifying the dogs least likely to succeed (92% accuracy for dogs in the lowest decile of probability of success), dog providers could potentially benefit by shifting focus away from these dogs prior to the commencement of professional training. In contrast to the C-BARQ, the IFT requires that a dog has returned to a professional training center and relies on evaluation by a professional dog trainer. Despite this modest increase in demands, the test itself is rapid, relies on observation under experimental conditions, and information is collected within 1 week of the dog's arrival for professional training. Given that the IFT was also highly accurate with respect to dogs least likely to succeed (85% accuracy for the lowest decile of probability of success), this measure provides another early opportunity for identifying which dogs warrant further investment.

Across experiments, our predictive models achieved high accuracy with respect to dogs least likely to succeed in training. However, the ultimate decision about what constitutes acceptable accuracy remains with dog providers, who must weigh the tradeoffs between correctly classifying a majority of cases, but at the cost of misclassifying the remaining minority. For example, using the model from Experiment 1, if 100 dogs in the lowest

TABLE 3 | Estimates, standard errors, *z*-values, and *p* values from the GLM used in Experiment 3 in which the dependent variable was outcome in the assistance dog program and CBARQ and IFT scores were the predictor variables.

Predictor variables (CBARQ and IFT scores)	Estimate	Std. error	z value	Pr(>|z|)
Intercept	17.00	1455.40	0.01	0.99
Dog-directed aggression	0.29	0.08	3.49	0.00
Barks persistently when alarmed or excited	0.21	0.07	3.08	0.00
Sudden Noise: conclusion	0.21	0.07	2.95	0.00
Chews inappropriate objects	0.18	0.06	2.94	0.00
Looming object: initial reaction	0.19	0.07	2.71	0.01
Stranger-directed fear	0.20	0.08	2.43	0.02
Begs persistently for food	−0.14	0.06	−2.27	0.02
Looming object: barks or growls	−1.29	0.58	−2.22	0.03
Threatening stranger: hackles	−0.58	0.26	−2.19	0.03
Unfamiliar dog: recall	0.14	0.06	2.17	0.03
Steals food	0.14	0.07	2.16	0.03
Prey: initial reaction	0.21	0.10	2.02	0.04
Physical Exam: body tension	0.16	0.08	1.95	0.05
Threatening stranger: initial reaction	0.14	0.07	1.92	0.06
Separation-related behavior	0.12	0.06	1.88	0.06
Fear of stairs	0.11	0.06	1.86	0.06
Prey: conclusion	0.15	0.08	1.82	0.07
Urinates when left alone	0.15	0.09	1.77	0.08
Coprophagia	−0.09	0.05	−1.68	0.09
Threatening stranger: recovery	0.11	0.07	1.57	0.12
Looming object: second walk by	0.39	0.25	1.54	0.12
Looming object: increase in activity	0.40	0.27	1.47	0.14
Displays bizarre, strange, or repetitive behaviors	0.09	0.06	1.44	0.15
Excitability	0.09	0.07	1.38	0.17
Touch sensitivity	−0.08	0.06	−1.37	0.17
Physical exam: ease of handling	0.09	0.07	1.37	0.17
Hyperactive	0.09	0.07	1.34	0.18
Trainability	−0.08	0.06	−1.28	0.20
Threatening stranger: increase in activity	−0.14	0.12	−1.18	0.24
Urinates against objects/furnishings in home	−0.07	0.06	−1.14	0.25
Snaps at (invisible) flies	−0.07	0.06	−1.10	0.27
Dog rivalry	−0.07	0.07	−0.97	0.33
Unfamiliar dog: barks or growls	0.27	0.28	0.96	0.34
Mounts objects, furniture, or people	−0.05	0.06	−0.91	0.36
Physical exam: vocalization	0.05	0.06	0.87	0.38
Dog-directed fear	−0.05	0.06	−0.79	0.43
Pulls on leash	0.05	0.06	0.77	0.44
Defecates when left alone	0.05	0.07	0.75	0.45
Unfamiliar dog: hackles	−0.15	0.20	−0.74	0.46
Stares intently at nothing visible	−0.04	0.06	−0.73	0.47
Stranger-directed aggression	0.06	0.09	0.70	0.48
Prey: recovery	−0.08	0.12	−0.67	0.51
Sudden noise: barks or growls	0.49	0.75	0.64	0.52
Unfamiliar dog: tail position	0.08	0.13	0.64	0.53
Owner-directed aggression	0.06	0.09	0.61	0.54
Licks people or objects excessively	0.04	0.06	0.60	0.55
Non-social fear	−0.03	0.06	−0.54	0.59
Threatening stranger: barks or growls	0.12	0.24	0.51	0.61
Attachment and attention-seeking behaviors	−0.03	0.06	−0.50	0.61
Energy level	0.03	0.07	0.48	0.63
Sudden noise: initial reaction	−0.03	0.07	−0.47	0.64
Looming object: recovery	0.03	0.07	0.42	0.68
Urinates when left alone	−0.02	0.06	−0.31	0.76
Tail-chasing	0.02	0.06	0.28	0.78
Licks him/herself excessively	−0.01	0.06	−0.19	0.85
Physical exam: tail position	0.01	0.07	0.16	0.87
Chases shadows	−0.01	0.06	−0.13	0.90
Sudden noise: recovery	0.01	0.07	0.11	0.91
Prey: barks or growls	0.08	1.35	0.06	0.95
Unfamiliar dog: initial reaction	0.00	0.06	0.05	0.96

decile of probability of success were released prior to professional training, this would preempt investment in 92 of these dogs that ultimately would not succeed, but would also come at the cost of releasing 8 dogs that could have been successfully placed. To determine if such a tradeoff is worthwhile, organizations would need to consider the resources that could be devoted to breeding and raising additional dogs in lieu of those released based on a low probability of success. The financial and time costs of these decisions may vary widely across dog training organizations, and it is unlikely that there will be a one-size-fits-all solution.

Although we have emphasized the use of predictive models for the purposes of candidate assistance dog selection, another application for our findings relates to identifying phenotypic targets for selective breeding. A fundamental question in this area concerns the extent to which the traits that are predictive of outcomes are also heritable. If these traits exhibit substantial heritability, dog providers may consider these traits in breeder selection, with ultimate hopes of increasing the prevalence of favorable traits within the entire population of candidate dogs. Along these lines, several studies indicate that traits measured by the C-BARQ are moderately to strongly heritable (31–33), and traits similar to those measured in the IFT have been shown to be heritable in other populations (34, 35), suggesting promise for future developments in this area.

One important limitation of this work is that models were developed and applied within a single working dog population, and thus we cannot assess how well these results would generalize to other assistance dog agencies. This issue is especially important if other organizations breed, train, and evaluate dogs based on different target phenotypes. Indeed, previous studies

investigating cognitive predictors of success as an assistance or explosive detection dog revealed a different set of traits predictive of outcomes in each population (10). Previous studies assessing associations between C-BARQ scores and outcomes in five large assistance dog associations revealed largely similar findings across dog providers, suggesting a common C-BARQ profile associated with assistance dog success (1). Nonetheless, future work will be required to develop and test predictive models for different organizations/training programs. Key questions in this area will consider the accuracy of prediction across organizations, as well as similarities and differences in which C-BARQ items are most useful for forecasting outcomes.

Among the specific C-BARQ findings from our study population, the puppy raiser's assessment of the dog's propensity to bark persistently when alarmed or excited was strongly predictive of later training outcomes; Dogs that exhibited this behavior more frequently were more likely to be released from the program. This finding corroborates recent results in guide dogs. Bray et al. (7) found that dogs who were quicker to vocalize in the presence of a novel, motion-activated stuffed cat (i.e., an occurrence that was likely perceived as exciting and/or alarming) were more likely to be released from the program, and similarly Harvey et al. (18) found that dogs least likely to graduate had higher scores on a principal component that accounted for time spent barking during the testing session. Taken together, these findings suggest that a tendency to be vocal is disadvantageous in assistance dogs—perhaps because vocalization is a useful proxy for some underlying trait, such as reactivity or anxiety, or because practically, it is an inappropriate behavior for a service animal. However, not all findings from our study were as intuitively interpretable. Perhaps most notably, higher levels of coprophagia (eating own or other animals' feces) were associated with higher odds of success as an assistance dog, despite the fact that coprophagic behavior is typically deemed undesirable and problematic for assistance dogs.

In sum, the current study suggests that assistance dog outcomes can be usefully predicted using measures from the C-BARQ and IFT, and that these predictions can be obtained prior to investment in formal professional training. These findings provide proof of concept for how assistance dog providers could use systematic data collection and predictive modeling to streamline the processes through which dogs are selected and bred for assistance work. In turn, improvements in these areas could reduce the substantial costs of assistance dog breeding and training, thereby increasing public health through more successful dog placement for people with disabilities and shorter waiting lists to receive these valuable placements.

ETHICS STATEMENT

This study was carried out in accordance with the recommendations of the University of Arizona IACUC, and was approved by the University of Arizona IACUC (protocol #: 16-175).

AUTHOR CONTRIBUTIONS

EB and EM designed and conducted the research, analyzed the data, and wrote the paper. KL and BK helped with data collection, curation and supervision, and commented on drafts. JS and DD created the data collection tools, facilitated data collection and curation, and commented on drafts. All authors gave final approval for publication.

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SUPPLEMENTARY MATERIAL

The Supplementary Material for this article can be found online at: https://www.frontiersin.org/articles/10.3389/fvets.2019.00049/full#supplementary-material

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Effective Multidisciplinary Search Strategies for Assistance Animals: A Librarian's Perspective

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Successful search strategies are based on good background knowledge and a focused clinical research question. Due to the multidisciplinary nature of research involving assistance animals means there is no one universal database to answer all research questions. The topic of assistance animals can yield better results when creating subheadings based on discipline focus. Subheadings have been divided into ethicolegal, sociocultural, psychobehavioral, and medical/veterinary. Each subheading, or discipline, has their own specific databases that will yield higher relevant content than others. Contacting local academic librarians and utilizing search guides created by those librarians can lead to successful search strategies. The goal of this article is to create a template for successful search strategies in assistance animals. Eighty-nine subject guides curated by academic librarians are reviewed to identify strong databases for each topic of ethicolegal, sociocultural, pscyhobehavioral, and medical/veterinary topics in relationship to assistance animals. A live subject guide has been created and maintained at https://www.library.ucdavis.edu/guide/assistance-animals/

Keywords: assistant animal, service animals, therapy animals, assistive tools, disabilities, databases, subject guides, service dogs

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INTRODUCTION

Assistance dogs touch on all levels of academic thinking that cannot be researched with one database or search strategy. Like the Medical Subject Headings utilized by National Library of Medicine, many diverse subheadings can be incorporated into this subject to improve the sensitivity (or finding the highest amount of relevant articles in searches) (1). The study of assistance animals is highly interdisciplinary in nature because of the level of human and non-human involvement. Four major subheadings (or broader disciplines) have been identified in relationship to assistance animals: ethicolegal, sociocultural, psychobehavioral, and medical/veterinary. All of these disciplines may overlap to some degree, but this broader grouping of disciplines as subheadings can help the researcher identify ideal databases based on the penchant of their research. The goal of this paper is not to create a strict bibliography but to identify key search strategies and tools to find relevant information regarding any level of research around Assistance Animals. Whenever possible, utilizing specialized academic libraries and librarians will prove to be extremely beneficial.

BARRIERS TO SEARCHING ON ASSISTANCE DOGS

In models of evidence-based veterinary medicine training, it is important to develop a strong clinical question or have a developed topic. The same applies to any research. Before having a developed, or "foreground" question, it may require searching "background" information. The sources that are utilized to answer more generalized background questions will be different from someone who is well-versed in a topic and has a highly developed research question (2, 3).

Information overload can be a concern for any investigator, particularly when using search engines like Google or Google Scholar (4). A vague question will yield too many and irrelevant results, so it is important to develop a two-step strategy: A generalized inquiry to further familiarize oneself with the topic and develop a good research question which will lead to a more focused search that will yield higher relevant scholarly literature with fewer irrelevant results (2, 3).

While web search engines like Google Scholar are becoming more efficient at retrieving similar data to bibliographic databases, they still don't have the sensitivity of the more costly bibliographic databases (4–6). Freely accessible databases and search engines will be addressed for each subheading, but it is important to keep in mind that many universities (particularly land grant public universities) may allow the public to enter their library and access their resources (including the librarians) from the physical library. Additionally, many public libraries (89% of 29 scanned library homepages across the United States) can offer generalized bibliographic databases accessible from the comfort of home (7). Inter-Library Loans are also services offered by public libraries to give non-academic affiliated persons access to academic resources (8).

Encouragingly, as more journals are on an Open Access (OA) model which allows for a reader to freely access their content, more researchers have been able to find relevant literature. It is also important to keep in mind that many journals utilize a hybrid Open Access model, where some articles may be accessible while others are behind a subscription pay wall. Hybrid models have created some degree of challenge in the discovery of open access articles because they are embedded in subscription journals (9, 10).

GENERALIZED SEARCH STRATEGIES FOR UNDEVELOPED RESEARCH TOPICS AND BACKGROUND INFORMATION

Asking a good clinical question is predicated on familiarity with a topic in general. A few resources can be utilized to answer background questions or get an overview of a topic. Textbooks and quality websites are certainly a good starting point. Textbook retrieval is as simple as using your library catalog and using a few keywords on the topic of interest. Searching google or any other web searching service is also a good starting point but requires judicious evaluation and selection.

An axiom of the web is that it can have quality and lackluster content in the same results. A few tools have been developed to improve the evaluation of websites. One technique is utilizing a checklist to see how the site measures up to some basic evaluative components (11, 12). Another method that may not be mutually exclusive to the checklist, is to compare websites and see if information on the website is corroborated from other sources (11–13). CRAAP represents utilizing the following criterion to use in evaluating a website (retrieved 12/20/2018 from http://www.csuchico.edu/lins/handouts/eval_websites.pdf):

- Currency – Is the topic maintained and up to date?
- Relevance – Is this information relevant to the topic you are interested in?
- Authority – Who is the author and are they qualified to write on this topic?
- Accuracy- Where is this information coming from and does it use evidence?
- Purpose – why is this paper being written? Is the author objective?

Arguments have been made that a rigid checklist is too much effort and a student can simply compare websites to identify quality differences between them and find what data is corroborated across sources (13). A caveat is that corroboration does require identification that the information came from two independent sources and not from the same one.

Performing background searches is extremely helpful in developing successful keywords. For instance, looking at an E-book on assistance animals can help identify alternative keywords: guide, hearing, service, social, support, or therapy animals. Similarly, common guide and service breeds of dogs are Labrador Retrievers, Golden Retrievers, and German Shepherds which can also help in finding search terms (14). A thesaurus (whether subject or general) can also be a useful tool for finding good keywords for searches (15).

UNDERSTANDING THE LANGUAGE OF SEARCHING: BOOLEAN

Databases and search engines use similar language in combing the web or database, and this language is Boolean logic. Boolean simply takes terms, or keywords, and either looks for the appearance of them together with "AND" (which is often assumed), or it looks for any instance of any term entered with "OR" (see **Figure 1**). The general principle is that if a search needs to be narrowed with fewer results, use "AND, and if it needs to be widened with more results, use OR. Many search engines, like Google, use Boolean, but are more limited than many databases. Google assumes "AND," and will use "OR" if it is written in caps between keywords. "NOT" for exclusion is represented by a—(dash) and Google can limit results by site, words in a title, url, and file type (site:, intitle: or allintitle:, inurl:, or filetype:, respectively) (16, 17). The first rule of any database or web engine being searched, is to contact a librarian or find the help icon on the database that explains what Boolean operators and other tools exist and how they can be used.

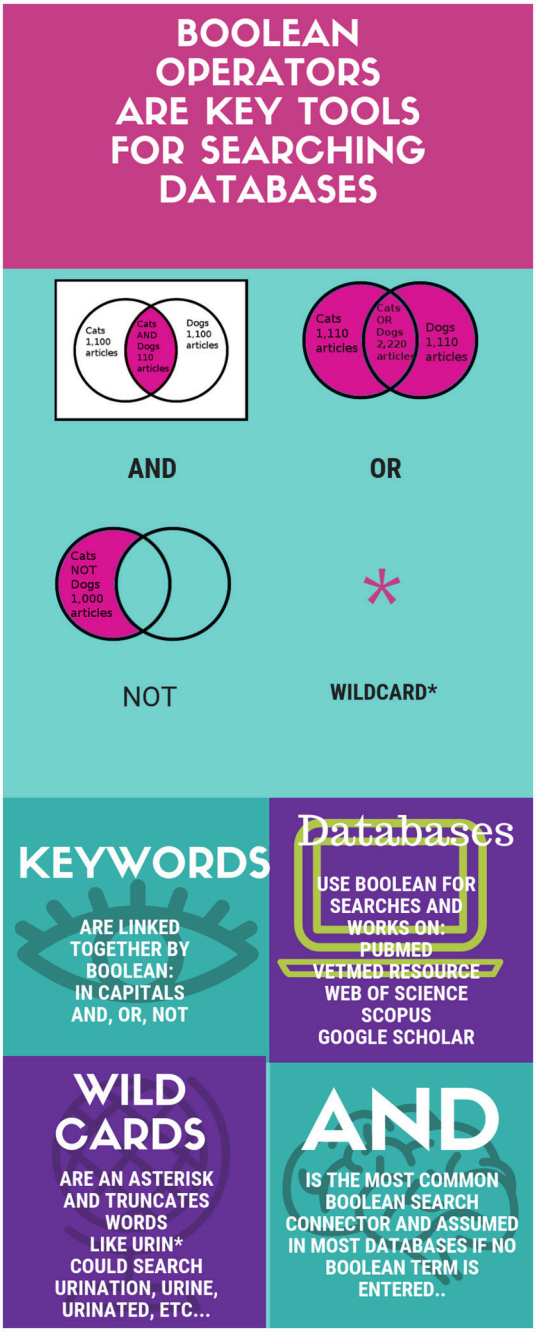

FIGURE 1 | Boolean Basics. Erik Fausak (CC 2017).

FOCUSED SEARCHING (BY SUBHEADING)

Once a research question has been formed, it is time to start to focus on discovering answers to that specific question. The list below is a starting point based on many subheadings or disciplines that can be pursued. The best option is to contact a subject specialist librarian at the nearest academic library. Many University libraries are open to the public and this is a good opportunity to use its resources, including and most importantly, the librarian. Subject specialist librarians at most institutions will curate online subject guides that contain the best content tailored to the level of database access at their institution. The best approach to starting the search of a focused research question is to work with a local librarian to develop the search strategy.

METHODOLOGY FOR SUBJECT SEARCHING

A subject guide dedicated to ethicolegal, sociocultural, psychobehavioral, and medical aspects of assistance animals will be curated and maintained at https://www.library.ucdavis.edu/guide/assistance-animals/ Twenty to thirty subject guides pertaining to the following subheadings were consulted: ethicolegal, sociocultural, psychobehavioral, and medical aspects (see **Tables 1–4**). Search strategies utilized in Google are recorded including authorship (if available) and last date updated when the site was being evaluated. Subject guides utilized were retrieved in order of retrieval on Google search engine results and based on relevance. The number of subject guides utilized was an arbitrary saturation point that the author felt represented a good overview of resources in the subheading area. The total number of subject guides consulted were 89 averaging 22 subject guides per subheading. Subject guides were searched and evaluated between December 21, 2018 and January 2, 2019. In lieu of a specific bibliography, the goal of this article is to identify resources for the investigator to develop their own bibliography at point and time of need. Common repetition of databases between subject guides were used to create these resource lists (see **Figures 2A–D**). Additionally, Three of the five databases were searched for each subheading to see what results (due to the variability in search functionality of databases, some filters were applied appropriate to the topic) occurred when searching: **service AND dogs** (see **Figures 2A–D**). All searches done in databases for **Figures 2A–D** were performed February 11, 2019.

Included in each subheading are journals that are often referenced, but it is worth mentioning that good information comes from many sources, not just one journal (18). The cited journals are only meant to indicate good places to start browsing, but not to conduct an exhaustive search which should be performed with databases. Tools like Google Scholar's H5 score, Clarivate's Web of Science Journal Citation Reports, Scopus' Citescore, Eigenfactor, or Scimago Journal and Country Rank can all help to identify journals that are frequently cited in a particular discipline (19).

ETHICOLEGAL

Ethical and legal issues that surround assistant animals has become a large area of interest in recent years. Legal recognition or definition of different types of assistant animals is important to many investigators (20). Freely accessible resources to explore is Cornell University's Legal Information Institute (LII—https://www.law.cornell.edu) (Personal communication with Adam Siegal on 12/20/2018) and the Library of Congress Law Library (http://www.loc.gov/law/) that provides education and a list of

TABLE 1 | Ethicolegal guides.

Subject guide	Google search term	Last updated
https://guides.library.harvard.edu/animallaw	Animal law library subject guide	3/9/18
https://guides.ll.georgetown.edu/c.php?g=273353&p=1824602	Animal law library subject guide	8/9/18
https://libguides.law.uconn.edu/animal	Animal law library subject guide service	10/16/18
https://blogs.loc.gov/law/2014/07/an-introduction-to-animal-law/	Animal law library subject guide service	9/24/14
https://libguides.tru.ca/animallaw	Animal law library subject guide service	10/2/18
https://guides.sll.texas.gov/animal-law/service-animals	Animal law library subject guide service	12/27/18
http://wilawlibrary.gov/topics/disability.php#service	Animal law library subject guide service	5/8/18
https://researchguides.library.tufts.edu/c.php?g=375798&p=2543147	Animal law library subject research guide service assistance support dogs	11/2/18
https://law.duke.edu/lib/research_guide/	Law library libguide OR subject guide	various (splash page)
https://libguides.law.unm.edu/Animal	Animal law library subject guide service	9/18/18
http://libraryguides.law.pace.edu/animals	From UNM guide	7/25/18
http://libguides.law.uci.edu/c.php?g=20258&p=3080864	Animal law library subject guide service	10/18/18
https://libguides.law.uga.edu/animal_law	Animal law library subject guide service	10/15/18
https://libguides.lib.msu.edu/animalethics/generalinfo	Animal law library subject guide service	7/25/17
http://library.lclark.edu/law/animal-law	Animal law library subject guide service	10/3/18
https://libguides.stthomas.edu/c.php?g=88886	Animal law library subject guide service	8/10/17
https://libraryguides.missouri.edu/animallaw	Animal law library subject guide service	12/17/17
https://www.jenkinslaw.org/research/guides/animal-law/animal-law	Animal law library subject guide service	4/19/18
https://guides.library.ualberta.ca/c.php?g=532114&p=3640391	Animal law library subject guide service	12/19/18
https://guides.mysapl.org/servicedogs	Animal law library subject guide service	7/26/18
http://fclawlib.libguides.com/specialeducation/animals	Animal law library subject guide service	12/12/18
https://libguides.ctstatelibrary.org/dld/accessibility/ADA	Americans with disabilities act subject guide library service animals	10/9/18
http://libguides.law.berkeley.edu/c.php?g=507592	Law subject OR research OR libguide	12/3/18
https://libguides.aston.ac.uk/Law	Law subject OR research OR libguide	11/19/18
http://libguides.cdu.edu.au/cdulaw	Law subject OR research OR libguide	12/6/18
http://guides.library.cornell.edu/onlinelegalresources	Law subject OR research OR libguide	12/12/18

important databases and e-resources. Google Scholar started discovering legal cases in 2009, which makes it a good freely usable tool for legal research. Google Scholar also has a case law filter to help search the legal literature (21). Bepress has an Animal Law Digital Commons that identifies open access (freely available) legal content from many university repositories. Recently purchased by Elsevier, there are some concerns about Bepress' continued open access role (22). Ebsco's GreenFile, and Masterfile are also useful general databases available through many public libraries to help retrieve legal literature (7). Assistance animals are covered under a specialized and rapidly growing area called Animal Law, "Under its broadest definition, animal law covers all aspects of the law—legislative, judicial, regulatory, executive—that deal with issues pertaining to non-human animals"(23). Examining 26 generalized legal research guides and Animal Law specific research guides (see **Table 1**). The following databases were cited the most: Thomson Reuters' Westlaw, Nexis Uni (formerly LexisNexis), and Hein Online (which has a special collection on Animal Studies: Law, Welfare, and Rights) (see **Figure 2A**). Additional databases for consideration are Proquest's Congressional and PAIS. Website sources that have stood out as very useful are Michigan State University's Animal Legal and Historical Center, the National Anti-Vivisection Society's Animal Law Resource Center, and governmental sites like Housing and Urban Development and Americans with Disabilities Act. Journals to follow that cover animal law include *Animal Law Review, Journal of Animal Law,* and the *Journal for Critical Animal Studies*.

SOCIOCULTURAL

A large scale multi-disciplinary approach has arisen to understand humans through their interactions with non-humans. This has given rise to the multidisciplinary efforts called anthrozoology, human-animal studies, or animal studies (24). Identifying the role of assistance animals in a larger psychological, societal, biological, humanistic, or cultural context has become increasingly important. Duke University's Evolutionary Anthropology program has developed the Canine Cognition Center that researches service dogs from an evolutionary perspective. Google Scholar poses a particular problem as recent research suggests that a great deal of social science content is still locked in subscription databases (5, 25). Examination of 22 library subject guides

TABLE 2 | Sociocultural guides.

Sites	Search terms	Last updated
https://guides.lib.unc.edu/ANTH125M	Anthropology sociology human animal Research guide dogs libguide	11/15/18
https://guides.main.library.emory.edu/c.php?g=50800	Anthropology sociology human animal research guide dogs libguide	10/18/18
https://libguides.denison.edu/anthropology-sociology/articles	Anthropology sociology human animal research guide dogs libguide	12/21/18
https://uncg-lis.libguides.com/c.php?g=891820&p=6412790	Human animal bond libguide assistance animals dogs	12/3/18
https://libguides.smith.edu/ant200	Human animal bond libguide assistance animals dogs	8/6/18
https://library.ncc.edu/c.php?g=308945&p=2061646	Human animal studies libguides OR research guides	11/5/18
https://libguides.lib.msu.edu/humananimalbond/websites	Human animal studies libguides OR research guides	10/3/18
http://libguides.evergreen.edu/anthrozoology	Human animal studies libguides OR research guides	12/29/18
https://libguides.canisius.edu/c.php?g=857516&p=6143301	Anthrozoology research subject libguides	10/19/18
https://guides.libraries.wm.edu/animalstudies	Anthrozoology research subject libguides	8/16/18
https://www.carroll.edu/databases/library-databases-subject/anthrozoology	Anthrozoology research subject libguides	No date
https://libguides.rutgers.edu/c.php?g=415715&p=2835073	Anthrozoology research subject libguides	11/1/18
http://www.uwindsor.ca/anthrozoology/301/resouces	Anthrozoology research subject libguides	Not listed
https://www.canterbury.ac.nz/arts/research/nzchas/resources-and-links/	Anthrozoology research subject libguides	Not listed
https://researchguides.library.brocku.ca/c.php?g=99780&p=3125144	Human-animal studies research guide libguide	11/28/18
https://guides.nyu.edu/animalstudies	Critical animal studies library research guide OR libguide	10/30/18
https://library.barnard.edu/find-books/guides/WMST/WMSTX3513001	Critical animal studies library research guide OR libguide	Not listed
https://guides.library.ubc.ca/c.php?g=700746	Critical animal studies library research guide OR libguide	1/18/18
https://simmonslis.libguides.com/c.php?g=832520&p=5944397	Critical animal studies library research guide OR libguide	5/1/18
https://libguides.lub.lu.se/c.php?g=297124&p=1983493	Critical animal studies library research guide OR libguide	8/31/18
http://library.stanford.edu/guides/ladies-tramps-and-other-furry-friends-rhetoric-pets	Critical animal studies library research guide OR libguide	Not listed
https://researchguides.dartmouth.edu/wrt5animalstudies	Animals in literature and art libguide OR research OR study guide	6/9/17

TABLE 3 | Psychobehavioral guides.

Sites	Search terms	Last updated
https://www.lib.ncsu.edu/vetmed/boards/acvb	Animal behavior psychology dogs research guides or libguides	9/25/18
https://guides.library.yale.edu/c.php?g=296049&p=1973511	Animal behavior psychology dogs research guides or libguides	8/14/18
https://guides.lib.vt.edu/subject-guides/psyc	Dog psychology behavior research subject guides libguides	8/31/18
http://libguides.richmond.edu/psychology	Dog psychology behavior research subject guides libguides	4/3/18
https://sru.libguides.com/psychology	Dog psychology behavior research subject guides libguides	8/27/18
https://libguides.utk.edu/c.php?g=188662&p=1246494	Dog animal psychology research subject guide libguide	12/15/17
https://libguides.lib.fit.edu/PSY/Animal-Behavior	Dog animal psychology research subject guide libguide	12/5/18
http://mville.libguides.com/biology/Animal_Behavior	Dog animal behavior research subject guide libguide	10/1/18
https://guides.library.georgetown.edu/animalbehavior	Animal behavior research subject guide libguide	10/4/18
https://libguides.exeter.ac.uk/animalbehaviour	Animal psychology behavior research subject guide libguide	12/17/18
https://guides.library.illinois.edu/psych	Animal psychology behavior research subject guide libguide	12/7/18
http://guides.library.cornell.edu/c.php?g=31828&p=201586	Animal psychology behavior research subject guide libguide	10/25/18
http://guides.highpoint.edu/psy/home	Animal psychology behavior research subject guide libguide	12/11/18
http://libguides.ahu.edu/friendly.php?s=occupationaltherapy/animalassisted	Assistance therapy animals psychology libguide	12/21/18
https://libraryguides.missouri.edu/c.php?g=28337&p=4157952	Assistance therapy animals psychology libguide	10/5/18
https://libraryguides.lib.iup.edu/c.php?g=200983	Assistance therapy animals psychology libguide	7/24/18
https://libguides.northwestern.edu/counselingguide	Assistance therapy animals psychology libguide	12/16/18
https://amplibrary.wvwc.edu/c.php?g=521913&p=3568744	Assistance therapy animals psychology libguide	11/25/18
https://xula.libguides.com/c.php?g=203098&p=1339467	Human animal psychology behavior research subject guide libguide	9/18/18
http://libguides.mtaloy.edu/c.php?g=268088	Human animal psychology behavior research subject guide libguide	1/12/18

TABLE 4 | Medical/veterinary subject guide.

Sites	Google search terms	Last updated
https://libguides.lib.msu.edu/veterinarymedicine	Veterinary medicine research subject guide libguide	11/19/18
http://guides.library.illinois.edu/mbh/vetmed	Veterinary medicine research subject guide libguide	12/5/18
https://libguides.auburn.edu/vetmed	Veterinary medicine research subject guide libguide	11/30/18
https://westernu.libguides.com/c.php?g=301185&p=2009625	Veterinary medicine research subject guide libguide	12/20/18
http://instr.iastate.libguides.com/veterinary_medicine	Veterinary medicine research subject guide libguide	8/9/18
https://libguides.cam.ac.uk/vetmed/research	Veterinary medicine research subject guide libguide	9/6/18
http://library.lmunet.edu/c.php?g=262906&p=1755977	Veterinary medicine research subject guide libguide	11/10/18
https://libguides.usask.ca/VetMed	Veterinary medicine research subject guide libguide	12/12/18
http://libraryguides.missouri.edu/veterinarymedicine	Veterinary medicine research subject guide libguide	6/21/18
https://libguides.murdoch.edu.au/vetmed/home	Veterinary medicine research subject guide libguide	10/23/18
https://www.library.ucdavis.edu/guide/health-sciences-libraries-favorites/	Health medical library research subject guide libguide	9/18/18
http://libguides.brown.edu/health	Health medical library research subject guide libguide	8/31/18
http://guides.library.ucla.edu/medicine	Health medical library research subject guide libguide	11/28/18
https://guides.library.duke.edu/subject/health-medical-sciences	Health medical library research subject guide libguide	12/18/18
http://guides.lib.usf.edu/medicine	Health medical library research subject guide libguide	11/19/18
http://libguides.library.drexel.edu/healthsciences	Health medical library research subject guide libguide	12/21/18
http://fgcu.libguides.com/occupationaltherapy/databases	Occupational therapy research subject libguide	8/29/18
https://belmont.libguides.com/ot	Occupational therapy research subject libguide	12/20/18
https://guides.library.duq.edu/ot	Occupational therapy research subject libguide	12/7/18
http://libguides.utoledo.edu/OT	Occupational therapy research subject libguide	12/10/18
https://researchguides.library.tufts.edu/c.php?g=248790&p=1657207	Occupational therapy research subject libguide	8/31/18
https://libguides.sjsu.edu/c.php?g=230321&p=1528203	Occupational therapy research subject libguide	12/19/18

on anthrozoology, animal studies, and human-animal studies have yielded a great deal of resources (see **Table 2**). Besides Google Scholar, freely available resources include Elsevier's Bepress Digital Commons on Animal Studies and the US Department of Agriculture's Agricola database. Besides Agricola, freely available US government sites like science.gov and the Catalog of US Publications are useful resources to investigate. Many public libraries do have access to some premium access databases that have sociocultural content like Ebsco's Academic Search Complete, Gale's Academic One File and Ebsco's Greenfile (7). Premium databases at academic institutions that warrant investigation (see **Figure 2B**) are Wiley's AnthroSource, Proquest's Social Sciences and PsycInfo databases and JSTOR. Elsevier's Scopus and Clarivate's Web of Science, and Ebsco's Anthropology Plus also warrant consideration. Websites to explore include Animals and Society Institute, International Society for Anthrozoology (ISAZ),and H-Animal. There are many journals that explore the relationship of animals and people, which includes assistant animals. Some frequently cited journals include: *Anthrozoos, Humanimalia, Animal Studies Journal, Between the Species, Antennae,* and *Animals*.

PSYCHOBEHAVIORAL

A great deal of disciplinary overlap occurs between anthrozoology and psychology. Psychological aspects for consideration are the relationship between the human and assistance animal, the psychological behavior for selection of the assistance animal and their training (26, 27). Examination of 20 library subject guides on general psychology and animal behavior suggests a number of resources to find information (see **Table 3**). Freely available databases and search engines include Google Scholar, Pubmed, and Educational Resources Information Center (ERIC). More academic oriented resources include Proquest's PsycInfo, American Psychological Association's PsycARTICLES, Ebsco's Psychology and Behavioral Sciences Collection, Clarivate's Web of Science, and Ebsco's Academic Search Complete (see **Figure 2C**). Useful online resources include: Psychology Today, National Institute of Mind Health, Animal Behavior Society, Association for the Study of Animal Behavior, and the American College of Veterinary Behaviorists. Relevant journals to browse include: *Applied Animal Behavior Science, Journal of Comparative Psychology, Animal Behavior, Animal Cognition, Journal of Experimental Psychology,* and *the American Journal of Occupational Therapy*.

MEDICAL/VETERINARY

In a broad sense, medical considerations can apply to either the assistant animal or whom the assistant animal is assisting. Occupational therapy has found assistant animals as increasingly popular and beneficial assistive tools to the disabled (28, 29). Twenty-two subject guides were examined relating to veterinary medicine and the treatment of assistant animals, general human

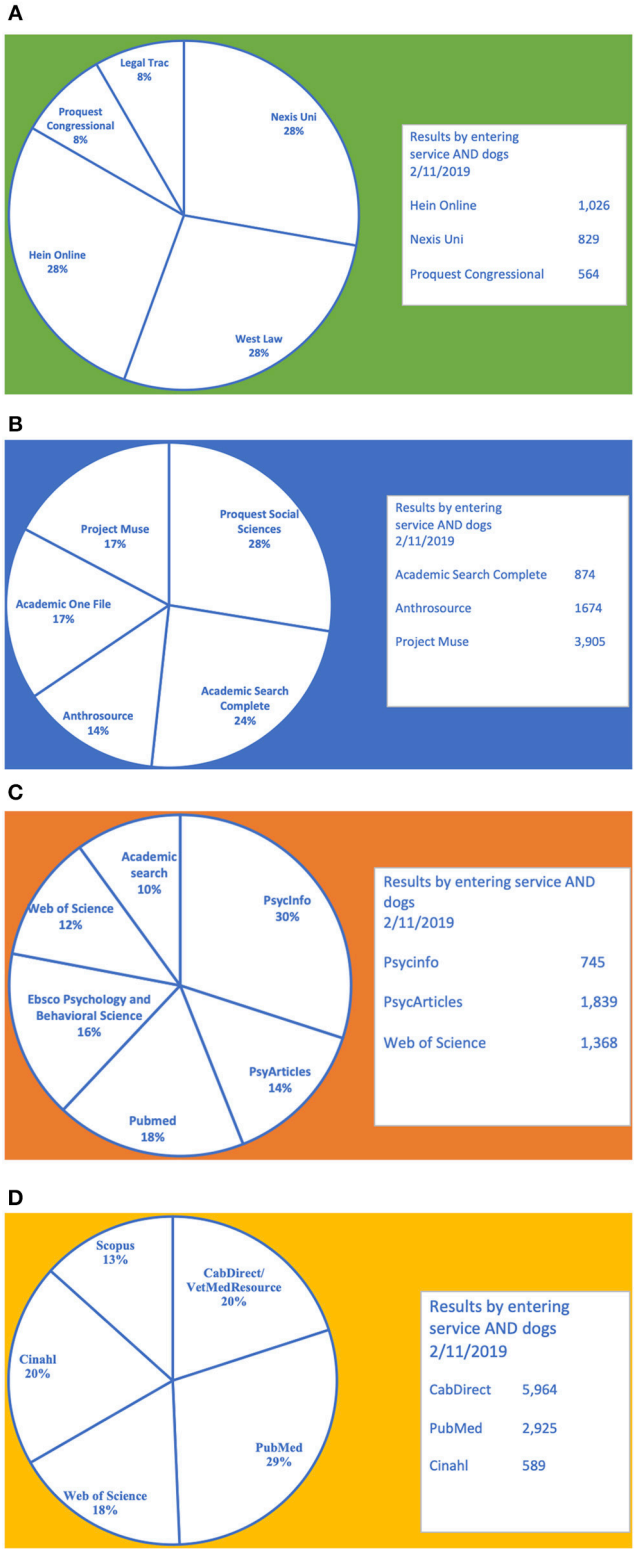

FIGURE 2 | Five most frequently cited databases from 26 Sociocultural subject guides. **(B)** Five most frequently cited databases from 22 Sociocultural subject guides. **(C)** Five most frequently cited databases from 20 Psychobehavioral subject guides. **(D)** Five most frequently cited databases from 21 Medical/veterinary subject guides.

medicine and occupational therapy in the utilization and benefit of assistant animals in human medicine (see **Table 4**). A number of freely available databases are utilized in both medicine and veterinary Medicine. NIH's Pubmed (Medline) is one of the best freely available resources. Google Scholar also has a high success rate in retrieving medical and veterinary related content (5). Additional freely available tools include VetSRev (an index of veterinary systematic reviews), ERIC (includes Social Service citations and occupational therapy) and Agricola (which also includes veterinary content). OTSeeker is a freely searchable database that is specifically geared for occupational therapy. Subscription databases that are most cited include CAB Direct or VetMed Resource, Proquest's PsychInfo and Nursing and Allied Health databases. Ebsco's Cinahl, Clarivate's Web of Science, and Elsevier's Scopus have also been frequently identified as important databases across the veterinary, medical, and occupational health research guides (see **Figure 2D**). Cab Direct has been identified as covering the most veterinary titles and vital to any veterinary search (30). Online resources that have been cited are Cornell Consultant, Best Bets for Vets, British Small Animal Veterinary Association Library, US Food and Drug Administration, Centers for Disease Control, American Occupational Therapy Association and the Veterinary Information Network. Relevant journals to browse include the American Journal of Veterinary Research, the Journal of the American Veterinary Medical Association, Journal of Veterinary Internal Medicine (OA), Veterinary Record, Journal of the American Medical Association, Lancet, New England Journal of Medicine, Nature, Science, and Occupation Therapy International (OA).

CONCLUSION

Effective searching and research start with identifying available resources to answer the investigator's question. The next step is whether a focused foreground question has been formed, or more background information needs to be retrieved. Background information or questions can be answered with textbooks and quality websites. Foreground or focused questions have to be answered by finding scholarly journals in reliable databases or search engines (i.e., Google Scholar). While freely available, Google Scholar is not equipped to answer all aspects of questions that the investigator may have (5). Taking advantage of the investigators closest academic library and librarian is the best first step. Public libraries are also an important resource for those without academic affiliations. Many public libraries have research databases and interlibrary loan programs with regional academic libraries. Based on the type of foreground question and which disciplines are being incorporated, there are different optimal databases.

The greatest limitation of this article is that there cannot be any prescriptive research guide for everyone. A great deal of factors influence how the research topic is approached. As multidisciplinary approaches, like anthrozoology, become more common place, it requires identifying and searching a larger breadth of unique databases. Additionally, regional and

academic levels of access influence the researcher's resources and strategies. The primary goal of this article is to identify that all researchers of all levels have a number of resources at their disposal, and it starts by identifying what academic and in some cases, public libraries and librarians, are at the researcher's disposal. Additionally, very few academic libraries don't have subject guides to assist the researcher in identifying the best resources for their institution and should be utilized. Please see **Supplementary Figure S1** for links of online content referred to in this article.

AUTHOR CONTRIBUTIONS

The author confirms being the sole contributor of this work and has approved it for publication.

SUPPLEMENTARY MATERIAL

The Supplementary Material for this article can be found online at: https://www.frontiersin.org/articles/10.3389/fvets.2019.00063/full#supplementary-material

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An Owner-Independent Investigation of Diabetes Alert Dog Performance

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Objective: To quantify Diabetes Alert Dog (DAD) performance by using owner-independent measures.

Research Design and Methods: Eight owners of accredited DADs used a FreeStyle Libre Flash Glucose Monitoring System (FGMS). Concurrent Closed Circuit Television (CCTV) footage was collected for between 5 and 14 days in each owner's home or workplace. The footage was blind-coded for dogs' alerting behaviors. The sensitivity, False Positive Rate and Positive Predictive Values (PPV) of dogs' alerts to out-of-range (OOR) episodes were calculated. Ratings for 11 attributes describing participant's lifestyle and compliance (taken from each dog's instructor) and the percentage of DAD alerts responded to by the owner as per training protocol (taken from CCTV footage) were assessed for association with dog performance.

Results: Dogs alerted more often when their owners' glucose levels were outside *vs.* inside target range (hypoglycaemic 2.80-fold, $p = 0.001$; hyperglycaemic 2.29-fold, $p = 0.005$). Sensitivity to hypoglycaemic episodes ranged from 33.3 to 91.7%, the mean was 55.9%. Mean PPV for OOR episodes was 69.7%. Sensitivity and PPV were associated with aspects of the dog and owner's behavior, and the owner's adherence to training protocol.

Conclusions: Owner-independent methods support that some dogs alert to hypo- and hyperglycaemic events accurately, but performance varies between dogs. We find that DAD performance is affected by traits and behaviors of both the dog and owner. Combined with existing research showing the perceived psychosocial value and reduced critical health care needs of DAD users, this study supports the value of a DAD as part of a diabetes care plan. It also highlights the importance of ongoing training and continued monitoring to ensure optimal performance.

Keywords: hypoglycaemia, hyperglycaemia, diabetes, alert, canine, behavior

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INTRODUCTION

There are an estimated 4.6 million people in the United Kingdom living with diabetes (1). Of those, ∼400,000 are currently living with Type 1 diabetes, the incidence of which is increasing by around 4% each year (2). Without extraneous insulin intervention, blood glucose levels are susceptible to becoming too high (hyperglycaemia) or too low (hypoglycaemia). This results from

a failure of the body to produce insulin, and people with Type 1 diabetes must utilize exogenous insulin via regular injections or a continuous infusion to maintain blood glucose levels within a "prescribed target range" in order to limit the risk of developing long term complications associated with this condition (3). Whilst there exists clinical definitions of hypo- and hyperglycaemia, many individuals living with Type 1 diabetes will use approximations of these values as they may experience physiological symptoms of hypo- and hyperglycaemia at different blood glucose levels. Each person's "target range" is clinician-guided and based on personal experience at certain "low" and "high" blood glucose values, with measures inside of this range deemed safe for that individual. Outside of this range, corrective measures are required (1). Hypoglycaemia is a prevalent and serious complication of diabetes. Mild episodes can interfere with everyday functioning, while a severe episode requires intervention from another person and, if left untreated, can be fatal (4, 5). People with Type 1 diabetes can become unaware of the symptoms of hypoglycaemia over time, which has been found to increase the risk of a severe hypoglycaemic episode six to seven-fold (6), and is associated with an increased risk of mortality (7). Fear of hypoglycaemia causes some people to restrict their lifestyle in efforts to reduce the likelihood of an episode, which negatively impacts both their quality of life and psychological well-being (8). Individuals may intentionally "run their blood sugars high" (maintaining hyperglycaemia) because of fear of a severe hypoglycaemic episode (9). This practice confers various associated health risks over time, such as cardiovascular disease, nerve, and kidney damage (10, 11).

While an array of developing technologies are available to people with Type 1 diabetes, many are invasive, requiring either finger-pricks or sensor insertion, and can carry considerable financial burdens (e.g., sensor replacement) or physical equipment (12). Diabetes Alert Dogs (DADs) potentially offer a non-invasive method of assisting in the recognition of an oncoming hypo- or hyperglycaemic episode by alerting while their owner is still able to act (13), a concept that has led to an increase in popularity over the last decade in using DADs as a method to facilitate tightened glycemic control (14). DADs are trained to alert their owner by performing attention-gaining behaviors when glucose levels deviate from their target range. Their potential benefits are substantial, preventing patients with glycemic unawareness experiencing dangerous glucose fluctuations, thereby improving owners' quality of life and potentially reducing mortality rates (15, 16). Given the health risks associated with diabetes, it is imperative that the efficacy and value of DADs are objectively assessed.

There have been 22 previous studies on DADs: seven are owner-informed case reports of untrained and trained dogs (13, 17–22), five use *in vitro* laboratory testing (23–26) and the remaining ten use owner-reported information for at least one aspect of data collection (12, 15, 16, 27–32). As Weber et al.'s (33) review highlights, small sample sizes and inconsistent sampling methods make drawing confident conclusions problematic. Prior to this study, there have been no entirely owner-independent assessments of *in-situ* DAD performance.

Rooney et al.'s (32) study of 27 DADs suggests that the accuracy of some dogs is very high, with a median sensitivity to hypoglycaemic episodes of 83%. This is currently the largest single agency study, however, it relies upon owner reports of DAD alerts and owner provided blood-test data. This could result in undetected false negatives; when owners are unaware that their blood glucose has fluctuated outside of their target range and their DAD has failed to alert them (however, this may only impact the number of mild episodes recorded as a severe hypoglycaemic event is likely to be recognized due to physiological effects). Therefore, reported sensitivity of DAD alerts in studies that use point-in-time blood test results [e.g., (12, 16)] may be artificially high, as fluctuation into hypo- or hyperglycaemia that did not produce a noticeable physiological effect and to which a DAD did not alert may have been unreported. Using a monitor that records glucose levels at regular intervals to establish periods of euglycaemia and hypo-/hyperglycaemia is therefore integral to accurately assess DAD alerting sensitivity rates. Furthermore, owners may fail to accurately record false positives (alerts occurring during in-range glucose levels), thus previously reported positive predictive values (PPV) of dog alerts could also be artificially high.

Two recent experimental studies overcame the issue of potentially missing false negatives by utilizing Continuous Glucose Monitoring Systems (CGMS) (30, 31). CGMS are owner-independent as they automatically record interstitial fluid glucose levels via a sensor inserted under the skin, which facilitates a more accurate measure of DAD sensitivity since all OOR episodes are recorded. These recent studies however still rely upon owner reports of DAD alerts. Los et al. (30) found that a cohort of eight DADs from multiple training backgrounds performed variably, with an average sensitivity of 36% to hypoglycaemic events and a PPV of only 12%. However, seven of the eight dogs sampled had been trained to alert to hyperglycaemia, yet only alerts to hypoglycaemia were considered correct. Hence, of the reported 88% "incorrect" alerts, it is unknown what proportion were actually events where the dog was alerting to hyperglycaemia. Gonder-Frederick et al. (31) collected CGMS data, blood test readings, and owner reports of DAD alerts from 14 participants over 6 weeks, and similarly found substantial variation in performance between dogs, with only three out of 14 dogs performing statistically above chance level. The cause of this variability is as yet unexplored.

Whether a dog's alert is considered "correct" will depend on the glucose values used to determine hypo- and hyperglycaemia. Both Los et al. (30) and Gonder-Frederick et al. (31) used the clinical definition of glycaemic states ($\leq$ 3.9 mmol/L: hypoglycaemia and $\geq$10.0 mmol/L: hyperglycaemia) whilst Gonder-Frederick et al. (31) also considered "more extreme" hypoglycaemic ($\leq$3.0 mmol/L) and hyperglycaemic states ($\geq$13.9–16.7 mmol/L). Many dogs are trained to respond to their individual owner's target glucose range (32), so testing their accuracy using these ranges may give a fairer assessment of efficacy, whilst considering extreme glucose levels gives an indication of their value at preventing severe episodes and requiring paramedic call outs. Gonder-Frederick et al.

(31) saw no substantive differences in accuracy to "extreme" glucose levels as compared to the standard definitions of hypo- and hyperglycaemia, however, no previous study has assessed accuracy levels to owners' *individual* target ranges and extreme glucose levels.

The current study was conducted using dogs trained by Medical Detection Dogs (MDD), the only training institution for DADs in the United Kingdom accredited by Assistance Dogs UK. Initial training uses *in vitro* samples obtained from the dog's prospective owner when they are in a hypoglycaemic state, paired with a reward to shape the dog's response to the odor. Response behaviors, which are reinforced, include staring, pawing, licking the owner and/or fetching the owner's blood testing kit (34). *In vitro* training continues for ∼7 weeks. Once a dog is deemed to be consistently responding to these samples in a variety of environments they are placed with their prospective owner and taught to alert in response to the client's target glucose range. Ongoing support and regular assessments of sensitivity and accuracy of the dog's alerting behavior provide information of the success of the transfer from *in vitro* training to *in vivo* alerting. When dogs alert, owners should confirm if they are correct using a blood test. Only if glucose levels are confirmed as outside of their target range should they reward their dog. During training at MDD, dogs are presented with hypoglycaemic samples only, since reducing the likelihood of a life-threatening hypoglycaemic event is the primary aim. However, most dogs subsequently develop spontaneous alerts to hyperglycaemia, which owners are advised to reward (with a lower value reward). Once accredited, the owner is responsible for rewarding their dog and hence maintaining its performance, however systematic instructor visits are carried out. Clients also provide dog alerting and blood test data annually to allow performance to be monitored and re-accredited annually in accordance with Assistance Dog International guidelines.

FGMS and CGMS are currently the best devices with which to compare DAD performance due to their objectivity and facilitation of recording many data points over a period of time [e.g., (30, 31)]. These are devices that use sensors beneath the skin to sample interstitial fluid, in the case of CGMS, continually, or for FGMS at regular intervals, displayed to the user when they choose to scan the sensor. However, DAD behavior is shaped using the results of finger-prick blood tests, and readings taken by each device often differ even when taken at the same time point (35, 36), which may impact upon measured DAD performance. The degree of agreement between blood tests and FGMS readings can be quantified using Clarke-Error Grids (37) and likely varies between individuals (38, 39). Here we explore its association to measured DAD performance.

DAD owners anecdotally report that dogs alert to oncoming episodes before their glucose has fallen outside their target value (32). By using a Glucose Monitoring System, which provides estimates of the time of *transition* from in-range to OOR, we can further explore evidence of pre-alerting. Furthermore, owners report that they may reward their dog for values approximate to their specified low or high glucose value. Here we additionally assess the impact of a fixed vs. ± 0.5 mmol/L margin of error for which values are considered "correct" when assessing DAD performance.

Lastly, an understanding of factors leading to variation in DAD accuracy is vital in order to improve performance in the future. Rooney et al. (32) suggest that behavioral traits in dogs, as well as owners, may contribute. In particular, each owner's response to alerting behavior, and the impact of following the recommended reward regime instilled during training, is likely to be important. This has not been possible to test directly in previous studies due to the reliance on owner reports of DAD alerts. Here, utilizing CCTV footage, we can for the first time assess whether owner compliance may have an effect on DAD performance.

The current study presents the first entirely owner-independent assessment of *in-situ* DAD accuracy. We use FGMS to record owner blood glucose levels and CCTV cameras to assess DAD and owner behavior, to address five questions:

1) Do dogs accurately alert their owners to hypo- and hyperglycaemic episodes as identified by interstitial glucose monitoring?
2) Does using individual glucose target ranges, as compared to the clinical definition of extreme hypo- and hyperglycaemia, affect calculated alert accuracy?
3) Does variation in analysis approach alter reported rates of DAD accuracy? Specifically, does including a 15-min window prior the first OOR FGMS reading (which may include evidence of pre-alerting), or including a ± 0.5 mmol/L range around owners specified glucose target values, alter calculated DAD performance?
4) How do clients' FGMS values compare to blood test results, and does the level of agreement affect their DAD's measured performance?
5) Are aspects of owner lifestyle, compliance and behavior associated with dogs' alerting accuracy?

Elsewhere we report in detail the same cohort's objective behaviors during pre-defined periods of owner glucose stability or fluctuation (40). Here we report accuracy of DAD alerts and factors that may affect it.

RESEARCH DESIGN AND METHODS

Recruitment

Individuals were approached via telephone if they had previously expressed an interest in taking part in research, owned an accredited DAD trained by Medical Detection Dogs, and were above the age of 18. Of the 14 approached, nine accepted. Participants were sent information via email detailing the study protocol and reminding them of their right to withdraw; however none did. One dog was subsequently found to alert their owner using vocalizations as well as motor behaviors, and since the project relies on silent video footage, this dog was removed from analysis since some vocal alerts may have been missed.

Participants

Participants were seven female and one male with Type 1 diabetes, ranging from 26 to 63 years (*Median* = 52.2

TABLE 1 | Information on footage collected during the study period for each participant and each individual's target glucose range.

Number of cameras installed	Total hours of in-sight footage collected	Low glucose value < (mmol/L)	High glucose value > (mmol/L)
3	130	5.0	12.0
2	42	4.0	10.0
3	87	4.5	14.0
2	81	6.0	10.0
4	60	5.0	15.0
3	101	4.7	11.0
2	116	4.0	15.0
3	77	4.5	10.0

Values above or below these parameters are considered "out-of-range" for that individual. Each line refers to one participant. Participant numbers have been removed for anonymity.

years). Dogs were six neutered males and two spayed females. Breeds included four Labradors, two Labrador-Golden Retriever crosses, one Miniature Poodle and one Golden Retriever. All pairs had been accredited between 12 and 72 months (*Median* = 47.1 months).

Initial Visit

Participants were visited in their home (seven) or place of work (one). They were instructed to continue their pre-existing diabetes management without alteration and asked to provide their blood test results for the duration of the study. Their target blood glucose range was recorded (**Table 1**). Participants were provided with an information sheet, consent form, video record sheet (to indicate periods of footage not to be viewed), blood test record sheet and FGMS instruction sheet.

Flash Glucose Monitoring System

Participants were each loaned a FreeStyle Libre Flash Glucose Monitoring scanner (Abbott Diabetes Care, Almeda, CA) and were assisted to insert a sensor to be worn for 14 days (after which the sensor expires). Three participants did not complete the full study period, two for personal reasons (after five and 10 days respectively) and one because the sensor fell off after 13 days. A 6 × 6 cm opaque plastic square was placed over the scanner screen to occlude glucose level results, mitigating the risk of participants modifying their behavior in response to on-screen glucose levels. The FGMS device logs glucose values every 15 min, and stores additional data points every time the sensor is scanned.

Cameras

Swann CCTV Systems were used, with footage stored on a Swann Digital Video Recorder (DVR). Between two and four cameras were mounted in the rooms in which the participant reported spending most of their time, maximizing the time in view. Four participants allowed footage to be taken in their bedroom during sleeping hours to capture nocturnal alerts. Total hours of footage collected with owner and DAD in-view ranged from 42 to 130 h (Mean = 86.8 h) (**Table 1**).

Data Collation

FGMS values were uploaded at The University of Bristol using the FreeStyle Libre software (version 1.0). Each FGMS data point was categorized as "hypoglycaemic," "in-range," or "hyperglycaemic" depending on the individual's target range. In subsequent analysis this procedure was repeated using the clinical definition of "severe" hypoglycaemia (3.0 mmol/L) and hyperglycaemia (13.9 mmol/L) to categorize OOR episodes (31, 41, 42).

Video Data

For each dog, behaviors that constituted an alert were established from their instructor (see **Table 2**). Behavioral coding was carried out using The Nodulus Observer XT Version 11.5. The footage was watched in real time and the frequency of alerts was recorded. For each alert, the time of occurrence, owner's response (including whether the owner tested their blood, whether they rewarded the dog and, if so, whether it was before or after the blood test) and whether the dog's alerting behavior was deemed unambiguous or ambiguous was also recorded. Researchers were blinded to the FGMS values when observing the footage, which included no sound for participant privacy and to ameliorate bias. Participant Two and Seven's footage was second-coded to establish inter-rater reliability.

Statistical Methods

Inter-rater Reliability

The number of video segments in which alerts were and were not recorded by each coder were tabulated and compared using Cohen's Kappa.

In-range and Out-of-Range (OOR) Episodes

OOR episodes were defined by sets of consecutive interstitial glucose readings beyond each participant's limits for hypo- or hyperglycaemia. The beginning and end-point of each episode were estimated by linear interpolation between the first OOR reading and the previous reading, and the last OOR reading and the next reading.

Alert Rates

The total lengths of each participant's in-range, hypo- and hyperglycaemic episodes, and the number of alerts that occurred within each were calculated. The rates of alerts during periods that were OOR to those during in-range episodes were compared using a generalized linear model with Poisson errors. Given that euglycaemia forms continuous rather than discrete events an appropriate denominator cannot be defined for specificity, hence we calculated False Positive Rates (FPR) and Positive Predictive Values (PPV) instead. The rates of alerts that occurred during in-range periods formed the FPR. The generalized linear models used either a log link function (Poisson data) or logit link function (binomial data), and included a scale parameter to account for over dispersion between dogs.

Sensitivity

Sensitivity was calculated as the proportion of OOR episodes with at least one alert within 15 min prior to the beginning of the OOR episode and the end of the episode. Episodes where the dog was out of sight for two or more of the automatic glucose

TABLE 2 | Alerting behaviors shown by each dog.

Behavior	Definition	Partnership 1	2	3	4	5	6	7	8
Fetch blood testing kit or treatment in its mouth	Dog picks up the blood testing kit or energy drink bottle in its mouth and approaches the owner.	X		X	X	X	X	X	
Stare at owner	Dog shows fixed eye contact toward owner with eyes wide open.	X	X	X	X				X
Nuzzle owner	Dog pushes face into any part of the owner's body or clothes. Must be in contact with owner.		X				X	X	
Mouth owner	Dog manipulates any part of owner's body to be held in their jaw. Must be in contact with owner.						X	X	
Paw owner	Dog lifts one front foot to make contact with the owner.	X	X			X	X	X	
Lick owner	Dog makes contact with any part of the owner's body using its tongue.						X		X
Jump up on owner	Dog lifts both front paws, or all four paws off the ground and makes contact with the owner.	X	X	X					

Shaded boxes indicate behaviors identified by the DAD's instructor as elicited when alerting.

readings were excluded. In a supplementary analysis, alerts in the 15 min prior to the start of an OOR episode were excluded to assess whether excluding pre-alerts impacted on performance estimates. Exact confidence intervals were calculated for the sensitivity of each dog. A generalized linear model with binomial errors was used to estimate the confidence interval for sensitivity averaged over all dogs.

Positive Predictive Value (PPV)

PPV was calculated as the proportion of observed alerts that occurred during, or up to 15 min prior to, an OOR episode. Exact confidence intervals were calculated for each dog. A generalized linear model with binomial errors was used to estimate the confidence interval for PPV averaged over all dogs. A supplementary analysis using clinical definitions of "extreme" hypo- and hyperglycaemic events using a glucose value of $\leq$3.0 mmol/L for hypoglycaemia and $\geq$13.9 mmol/L for hyperglycaemia was carried out. Since owners reported that they sometimes reward their dog on occasions where their glucose value was approaching their target value (rather than using the exact value), we repeated the analysis with a $\pm$ 0.5 mmol/L margin of error.

Clarke Error Grids

Interstitial glucose vs. blood glucose were plotted for each partnership using the FGMS reading recorded closest in time to each blood sample and Clarke Error Grids were constructed (37). Results in zones A and B are considered clinically acceptable [(35) c.f. (43)]. The FreeStyle Libre system is reported to have an accuracy of 99.7% of data points within zones A and B (35).

Instructor Ratings

The individual who had trained each DAD partnership was provided with a questionnaire rating 11 attributes taken from Rooney et al. (32) where instructor interviews were used to identify factors deemed important to the training process. They were: *Busyness of the Household*, *Severity of Client's Diabetes*, *Speed of Client's Glucose Drops*, *Client's Willingness to Reward the Alerts*, *Client's Ability to Recognize the Dog's Alerts*, *Client's Confidence in the Dog's Ability*, *Consistency of Client's Behaviour Towards Dog*, *Client's Level of Communication with Instructor, Dog's Motivation and Enjoyment of the Task*, *Strength of Dog's Alert*, *Dog's Willingness to Try New Behaviours and "Get it Wrong."* All of these attributes were rated 1 (Very low) to 10 (Very high). In addition, time since accreditation (months); Number of people in household; and Children in the household (Yes/No) were collected. Generalized linear models with binomial errors were used to assess the value of these scores as predictors of sensitivity and PPV. The percentage of alerts followed by a blood test, the percentage of alerts ignored by owner (as taken from the CCTV footage), and the percentage of FGMS results in zones A and B were also assessed as potential predictors.

Across all analyses, response alerts (those that occur immediately after the owner conducts a blood test) and ambiguous alerts were excluded. SAS V9.4 was used for all statistical analyses.

RESULTS

There was a strong agreement between the two observers' judgment for Participant Two ($K = 0.85$, 95% CI, 0.73, 0.97, $p < 0.0001$) and a moderate agreement for Participant Seven ($K = 0.70$, 95% CI, 0.59, 0.82, $p < 0.0001$) (44).

Do dogs accurately alert their owners to both low and high glucose episodes?

All dogs alerted more frequently during hypoglycaemic episodes than during in-range episodes, on average by a factor of

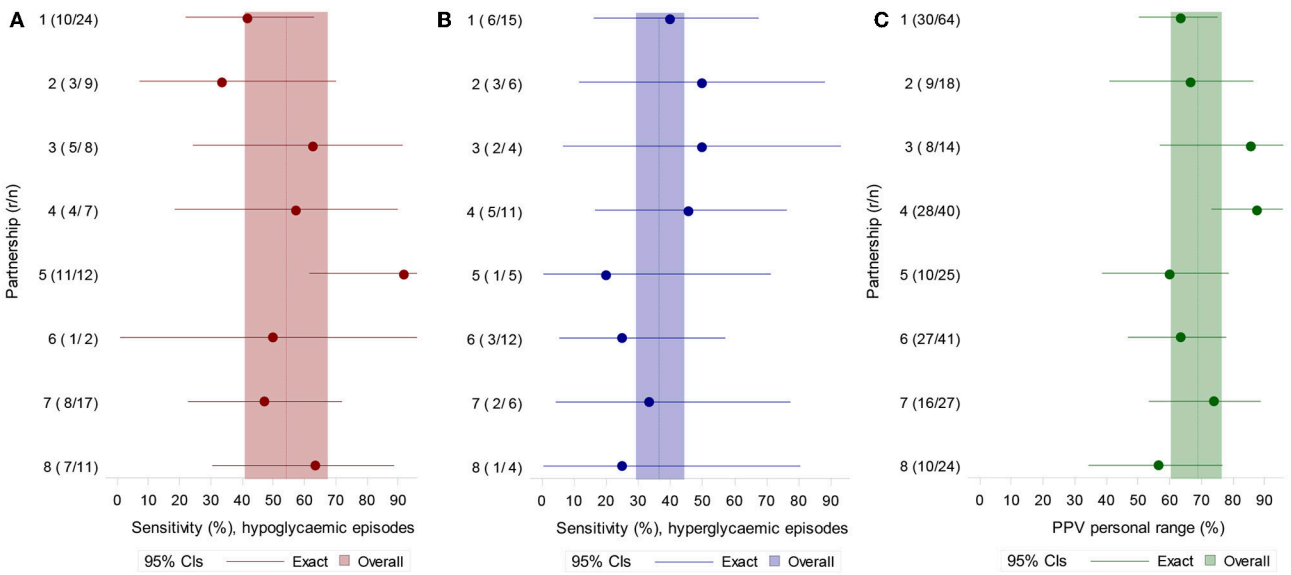

FIGURE 1 | (A) Sensitivity for hypoglycaemic (left) and **(B)** hyperglycaemic episodes (middle) defined by each participant's own target range. **(C)** PPV for OOR episodes defined by each participant's target range (right). *N* = number of episodes, *r* = episodes with at least one alert during the episode or in the 15 min preceding it.

2.80 (95% CI 1.67, 4.68; $p < 0.001$). Six of the eight dogs alerted more frequently during hyperglycaemic episodes, on average by a factor of 2.29 (95% CI 1.29, 4.05; $p = 0.005$). Overall relative rate of alerts occurring during in-range periods (False Positive Rate) was 0.19 per hour.

Sensitivity

Ninety hypoglycaemic episodes and 63 hyperglycaemic episodes were identified in the eight participants, defined by their individual target ranges. Sensitivity to hypoglycaemic episodes overall was 55.9% (95% CI 40.8, 67.4) with individual dogs ranging from 33.3 to 91.7% (**Figure 1A**). When using the definition of severe hypoglycaemia (3 mmol/L), the mean sensitivity was similar: 54.2% overall (95% CI 37.6, 70.0). Sensitivity to hyperglycaemic episodes was 36.5% (95% CI 29.3, 44.4) (**Figure 1B**).

When alerts in the 15-min period prior to an OOR episode were considered "incorrect" (excluded), sensitivity was reduced from 55.9 to 51.1% for hypoglycaemic episodes (95% CI 39.3, 62.8) and reduced from 36.5 to 31.7% for hyperglycaemic episodes (95% CI 26.9, 37.0) (**Figure 2**).

Positive Predictive Value

PPV using each participant's own target range was 69.7% overall (95% CI 60.3, 76.5) (**Figure 1C**). Using the definition of more extreme hypoglycaemia and hyperglycaemia, PPV was 50.4% overall (95% CI 39.4, 61.3). When OOR episodes included a ± 0.5 mmol/L margin of error, PPV to OOR episodes became 75.3% (95% CI 67.0, 82.1).

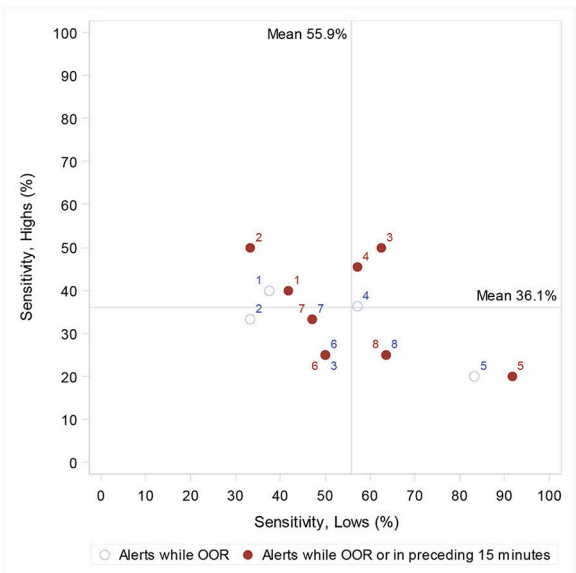

FIGURE 2 | Individual dog's sensitivity to highs (hyperglycaemia) and lows (hypoglycaemia), and, when considering only those alerts once the owner is OOR, and when also including alerts 15 min prior to the first OOR recording. When two circles (one closed and one open) have the same dog number, this indicates a change in sensitivity when alerts in the processing 15 min are considered correct. Lines indicate the population mean (when including the preceding 15 min).

FGMS and Blood Test Accuracy

Clarke Error grids show that the percentage of readings in zones A and B ranged from 83.64 to 100% (**Figure 3**). Agreement levels

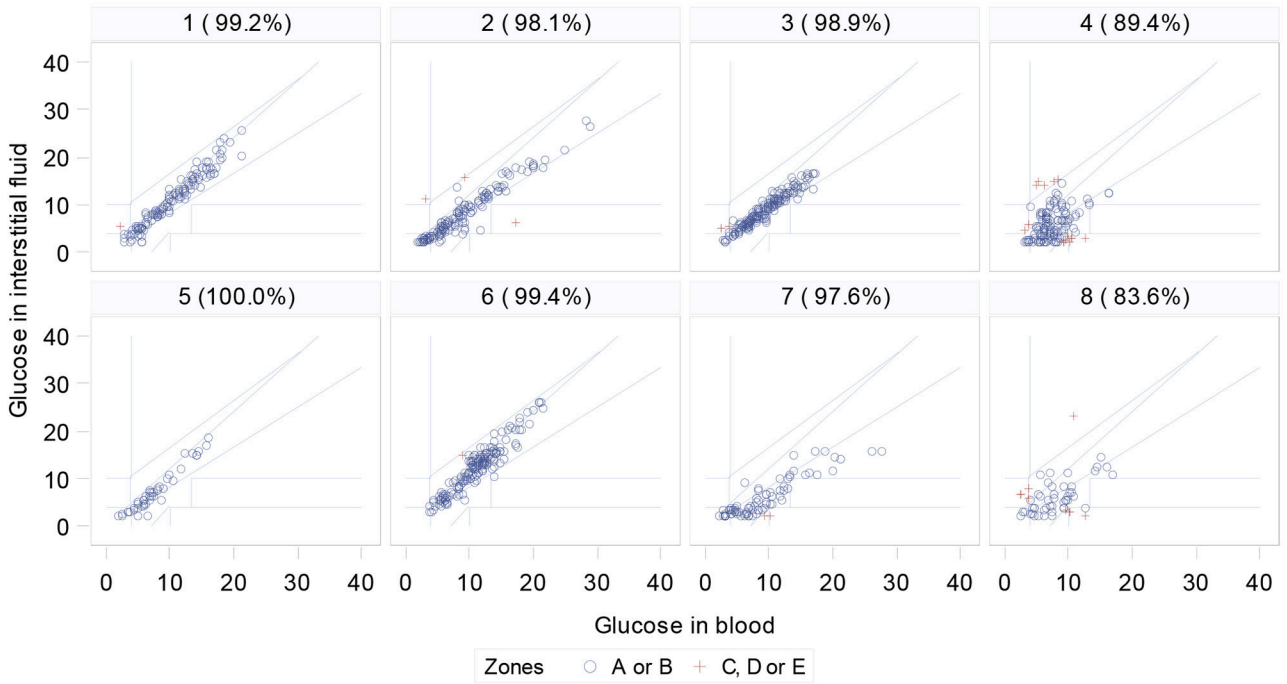

FIGURE 3 | Clarke Error grids for each participant, comparing FreeStyle Libre FGMS with blood test results (% is percentage of data in zones A or B. Red crosses are data points outside these zones).

between devices were not significantly associated with measured DAD performance (**Figure 4**).

Owner Response to DAD alerts

Participant Two and Five showed a 100% adherence to training protocol by appropriately responding to all their DAD's alerts. Five of the eight participants ignored alerts on at least one occasion. Two of the eight participants rewarded their DAD prior to testing blood glucose levels on at least one occasion (**Table 3**).

Instructor Ratings

Sensitivity tended to be higher in partnerships with higher scores for *Client's Confidence in the Dog's Ability*, *Dog's Motivation and Enjoyment of the Task*, *Strength of Dog's Alert* and a higher observed percentage of alerts followed by a blood test (**Figure 4**). Sensitivity tended to be lower if the observed percentage of alerts ignored was higher (**Figure 4**).

PPV tended to be higher in partnerships with a high score for *Client's Confidence in the Dog's Ability* (**Figure 4**). A longer length of time since accreditation was associated with lower scores for both sensitivity and PPV.

DISCUSSION

This study is the first to demonstrate, using objective measures *in-situ*, that dogs detect episodes of both low and high blood glucose levels. The cohort showed alerts 2.80-fold more often in hypoglycaemic episodes and 2.29-fold in hyperglycaemic episodes compared to when their owner was in-range. Some dogs performed with very high levels of sensitivity and PPV, however substantial variation was seen despite all dogs having been trained by the same institution and following the same protocol for accreditation.

Using CCTV footage and FGMS we found an overall sensitivity to hypoglycaemia of 55.9%, and to hyperglycaemia of 36.4%. PPV (proportion of alerts that were correct) averaged 69.7%. Some dogs were performing with great sensitivity (maximum of 91.7%, Dog Five) and high PPV (maximum of 87.5%, Dog Four). Sensitivity to hyperglycemia was generally lower than that to hypoglycaemia, as would be expected given that dogs are formally trained on hypoglycemic scent only. However, all eight dogs alerted to some hyperglycaemic episodes, with one dog (Dog Two) showing higher sensitivity to hyperglycaemia than to hypoglycaemia. This supports Rooney et al.'s (16) finding that DADs not only can prevent dangerous hypoglycaemic episodes but can also facilitate tighter glycemic control. Measuring intervention effectiveness in terms of hypoglycaemia only [e.g., (30)] has limited value, as a person who is experiencing fewer hypoglycaemic events may be doing so because they are maintaining their glucose levels above target range (9), a practice that confers well-documented health risks (45, 46). Given that dogs are shown to be alerting to hyperglycaemia, categorizing any alerts that occurred outside of hypoglycaemia as "incorrect" would clearly lead to a misleading measure of performance. Our results highlight the importance of considering hyperglycaemic episodes and longer-term HbA1c levels in future when assessing DAD effectiveness.

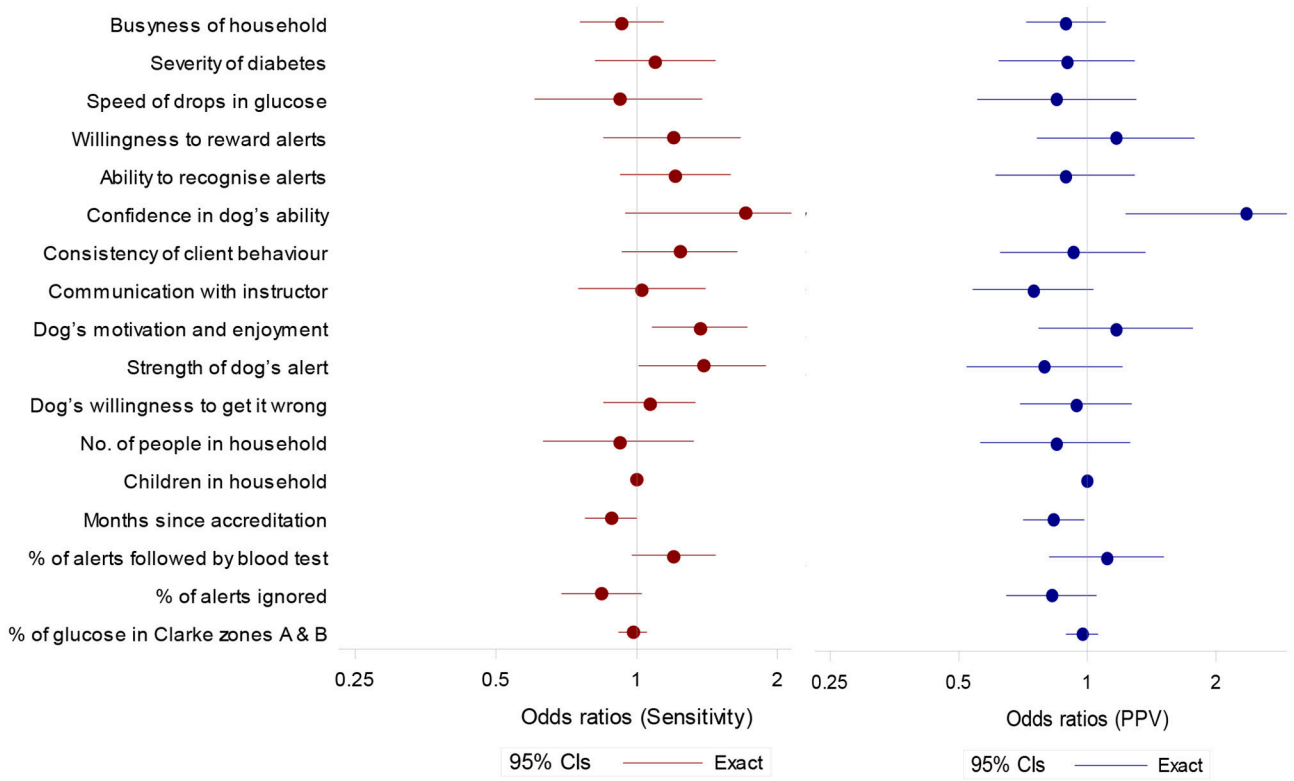

FIGURE 4 | Odds ratios (95% confidence intervals) for potential predictor of sensitivity (to OOR episodes) and positive predictive value. Ratios are for a unit increase in score except for months since accreditation (per year), and % of alerts followed by blood test and percentage of alerts ignored (per 10 percentage point increase).

When performance was calculated using clinical set points for extreme hypoglycaemia (rather than individual ranges) the cohort sensitivity was reduced slightly to 54.2% whereas the PPV to out-of-range episodes reduced from 69.7 to 50.4%. The use of clinical set points has been advocated in previous studies [e.g. (30, 31)] but may not reflect the glucose levels to which the dogs have been trained to respond. Therefore, definitions of hypo- and hyperglycaemia should be considered in future studies assessing DAD performance, especially if the specifications of the dogs' training values are at odds with the values imposed for performance analysis.

Our findings suggest that pre-alerting is perhaps not as common as DAD owners report, but that it does occur, as we find three dogs showing greater sensitivity to lows, and three dogs showing greater sensitivity to highs when we include a 15-min window prior to the first OOR recording. As a cohort, when alerts 15 min prior to the first OOR glucose value are considered incorrect, sensitivity to hypoglycaemic episodes decreases from 55.9 to 51.5%, and hyperglycaemia from 37.3 to 32.9%. Furthermore, when including a ± 0.5 mmol/L margin for the definition of an OOR episode, PPV increases from 69.7 to 76.5%. This suggests that imposing a precise cut-off glucose level may not best represent the DAD's function in alerting to transitioning glucose levels. These comparisons allow us to understand further the effect of methodology on reported performance values and should be considered in future DAD assessment studies.

It is important to consider that no glucose monitoring device will provide identical results to finger-prick blood tests (47). Only two participants reached the Abbott FreeStyle Libre reported 99.7% of readings in zones A and B (35). The FGMS used in this study logs glucose data every 15 min, meaning that readings were compared to the closest temporally to the time of the blood test, which may have affected agreement levels. The agreement for participants Four and Eight is notably below the accepted levels (**Figure 3**). The relative agreement was however not associated with measured performance of the dogs (**Figure 4**). Objective studies using a CGMS system that provides a continual glucose trace would be optimal and are still required.

We saw a number of attributes of the partnership that were associated with better performance, which supports Rooney et al.'s (32) findings. Increased sensitivity was linked to *Client's Confidence in the Dog's Ability, Dog's Motivation and Enjoyment of the Task* and *Strength of Dog's Alert*. Increased PPV was associated with *Client's Confidence in the Dog's Ability* and showed a tendency to be higher with increased *Owner's Willingness to Reward Alerts* and *Dog's Motivation and Enjoyment of the Task* (**Figure 4**). It should be noted that across all analyses we included only unambiguous alerts to ensure a conservative assessment of DAD accuracy. However, there were some instances of

TABLE 3 | Owner responses to DAD spontaneous alerts, and number of response alerts.

	Spontaneous alerts				Response alerts
Partnership	**Number of spontaneous alerts.**	**Percentage of spontaneous alerts in response to which owner tested their blood (as per training protocol).**	**Percentage of spontaneous alerts ignored: i.e., the owner responded with neither a blood test nor a reward. Numbers in brackets are the percentage of ignored alerts that occurred within 15 min of previous alert (repeated alerts).**	**Percentage of spontaneous alerts that owner gives DAD reward without testing blood.**	**Number of alerts occurring immediately after owner carries out routine test.**
1	73	61.6	38.4 (9.6)	0	5
2	18	83.3	11.1	5.6	0
3	20	100	0	0	3
4	40	80	0	20	11
5	22	100	0	0	0
6	44	79.5	20.5 (20.5)	0	4
7	28	96.4	3.6	0	0
8	23	91.3	8.7	0	1

Training protocol states that owners should respond to a spontaneous alert only after a confirmatory blood test, unless the DAD has been rewarded for a correct alert and then repeats the alert shortly after being rewarded (e.g., <15 min).

Green shading denotes "correct" owner response in-line with training protocol. Red denotes owner responses not recommended in training. Blue shading denotes "response alerts" which are distinct from spontaneous alerts as they occur immediately after an owner takes a routine test and thus the alert is likely prompted by the visual cue of the owner testing their blood.

ambiguous attention seeking behaviors that were unclear to both coders and seemingly also to owners. This is of interest given that the DAD's instructor rating of *Strength of Dog's Alert* was associated with increased sensitivity and may point toward a greater emphasis on developing non-ambiguous alerts (e.g., fetch blood testing kit) during the training process. These findings add to our current understanding of what makes a successful partnership and which traits in both dog and owner should be targeted during selection and matching, and further developed during the training process.

Similar to Rooney et al. (32) we saw a decrease in sensitivity and PPV in dogs that had been accredited for longer. This suggests that whilst dogs finish their training period responding reliably to OOR episodes, correct owner responses to alerts in the home environment may not be maintained in all dogs. Once placed, in some cases inconsistent rewarding may, with time, reduce the dogs' sensitivity and specificity to hypoglycaemic episodes. Examination of CCTV footage showed variability in owners' adherence to training protocol when responding to a DAD alert. We found that a higher percentage of alerts followed by a blood test, and a lower percentage of ignored alerts, tended to be associated with increased sensitivity and PPV (**Figure 4**). Participants Three and Five, for example, showed high levels of compliance by testing their blood following 100% of spontaneous DAD alerts, and always testing prior to rewarding (**Table 3**). Their dogs also showed high levels of sensitivity and PPV within the cohort (**Figure 2**). In contrast, owners shown to ignore spontaneous DAD alerts were found to have "poorer performing" dogs (**Figure 4**). Lack of rewarding, as well as rewarding prior to blood testing, are against advised protocol and could lead to the dog become de-trained, since they inadvertently may learn that alerting does not result in a reward. This may begin the process of behavioral extinction, or shape the behavior such that the DAD learns it can gain a reward regardless of the accuracy of their response. While reinforcement training is rigorous during the dog's initial training it is likely that post-accreditation owners vary in their ability to maintain consistent training whilst concurrently managing their diabetes. Incorrect rewarding may occur due to cognitive impairments during glucose fluctuations, or due to owners relaxing their training protocol over time. However, since owners who were observed following training protocol correctly had more successful dogs, this highlights the importance of regular monitoring and continuation training of both dog and owner and the potential value of using CCTV for monitoring. Given the small number of dogs sampled however, this study should be considered as exploratory. The substantial variation seen between these dogs suggests that further investigation is important to fully understanding the mechanisms underlying variation in DAD performance.

CONCLUSION

Owner-independent measures demonstrate that trained dogs can alert their owners to both hypo- and hyperglycaemic blood glucose levels, with variable but significant accuracy. We found that using clinical vs. individual glycemic range values did not have a substantial effect on the reported sensitivity rates of DAD but may impact on calculated PPV if imposing glucose ranges to which the dogs had not been trained to respond. DAD accuracy was affected by aspects of data analysis, such as whether 15-min pre-alerting periods were deemed correct or whether we included a $\pm$ 0.5 mmol/L margin of error around glucose levels. This indicates that methodological factors of analysis can influence reported DAD accuracy levels and should be considered carefully in future assessments.

Whilst DADs clearly have the ability to detect OOR glucose levels, their success relies not only on the quality of their initial training, but also on post-accreditation factors such as their placement environment and reward systems during their working life. Our findings point toward a need for further prospective investigation into factors predicting successful partnerships and close monitoring of owner and dog behavior in order to maintain performance post-accreditation. This study supports the idea that DADs can function as an important additional tool and component of a diabetes plan to facilitate tightened glycemic control, and should complement developing diabetes technology, rather than replace it. Results presented here could inform strategies to optimize the relationship between owners and their dogs, training programmes, and alerting performance in the future.

DATA AVAILABILITY

The datasets generated for this study are available on request to the corresponding author.

ETHICS STATEMENT

This study was carried out in accordance with the recommendations of The University of Bristol Faculty Research Ethics Committee (UB/17/014) and The University of Edinburgh Royal (Dick) School of Veterinary Sciences Human Ethics Research Committee with written informed consent from all subjects. All subjects gave written informed consent in accordance with the Declaration of Helsinki. The protocol was approved by The University of Bristol Faculty Research Ethics Committee (UB/17/014) and The University of Edinburgh Royal (Dick) School of Veterinary Sciences Human Ethics Research Committee. This approval covered ethical consideration of human and animal participants.

AUTHOR CONTRIBUTIONS

CW carried out the majority of the data collection and video coding, parts of the analysis and jointly drafted the paper. NR designed the study, jointly drafted the manuscript, and will act as guarantor for the content to the paper. SM carried out the main statistical analyses and commented on the draft manuscript. SK carried out video coding for two of the partnerships' CCTV footage and second coded two further participants' footage. CG fed into the study design at numerous stages and commented on the draft manuscript. CP was integral in facilitating data collection, teaching CW how to administer FGMS devices to participants, fed into the study design and helped with interpretation of the data and commented on the final manuscript.

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The remaining author declares that the research was conducted in the absence of any commercial or financial relationships that could be construed as a potential conflict of interest.

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Psychiatric Assistance Dog Use for People Living With Mental Health Disorders

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A psychiatric assistance dog (PAD) is a service dog that is trained to assist its handler (owner) who has been diagnosed with a mental health condition such as post-traumatic stress disorder (PTSD), schizophrenia, depression, anxiety, or bipolar disorder. Literature searches reveal that little is known about the population of people who own PADs, the types of dogs used or the functions they provide. One third ($n = 199$) of PAD owners in Australia registered with the charity "mindDog" participated in an online survey designed to better understand the person and dog team. Participants learned about PADs through the internet (37%), health care practitioners (32%), or family/friends (30%). The dogs in the sample were of varying age, gender and breed. The most common reasons for people to choose a dog to be a PAD were temperament (60%) and size/weight (48%). Just under half (48%) of the dogs had been acquired by the owner specifically to be trained as a PAD, and the rest were existing pets. All the dogs were trained by the owner or a combination of the owner and a qualified trainer; none were trained exclusively by assistance/service dog provider organizations. The median age of the participants at the time of data collection was 47 years, ranging from 10 to 75 years. Most (77%) identified as female. Depression (84%), anxiety (social 61%; generalized 60%), PTSD (62%), and panic attacks (57%) were the most reported mental health diagnoses. Tasks the dogs performed for their owners included: reduction of anxiety through tactile stimulation (94%); nudging/pawing to bring back to the present (71%); interrupting undesirable behavior (51%); constant body contact (50%); deep pressure stimulation (45%) and blocking contact from other people (42%). PAD usage decreased (46%), increased (30%) or did not change (24%) participants' use of psychiatric or other health care services. Decrease in service use was mainly due to reduced suicide attempts, and less requirement for hospitalization and medication; increased use was mainly due to enhanced ability to attend appointments. Results of this study show that PAD owners have differing mental health diagnoses, and their dogs perform different tasks to support them in daily life. Every participant described the relationship with his/her PAD as positive, suggesting that a successful working partnership does not require the dog to have been bred or raised specifically for the role. A better understanding of this population and the person-dog relationship will inform the appropriate choice, training and use of PADs for people living with mental health problems.

Keywords: assistance dogs, disability, human-animal bond, human-animal relationships, mental health, psychiatric assistance dogs, service dogs

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INTRODUCTION

Dogs and other animals have been helping people with physical disabilities and providing emotional support for centuries, with the first therapeutic use reported in the ninth century (1). Nowadays, assistance dogs (or service dogs) are trained to perform tasks to mitigate a range of physical, psychiatric, or intellectual disabilities for their handlers (owners) (2) as well as being trained for public access. A psychiatric assistance dog (PAD) is a specific type of service dog that is trained to assist its owner who has been diagnosed with a mental health condition, such as post-traumatic stress disorder (PTSD), schizophrenia, depression, anxiety, or bipolar disorder. In Australia, PADs, like other assistance dogs including guide dogs and hearing dogs, are covered under the Commonwealth Disability Discrimination Act 1992 that guarantees public access for all dogs trained as assistance dogs. PADs are distinct from emotional support dogs (ESDs) (sometimes called therapy dogs). An ESD (or other animal) is a pet that provides emotional support to an individual to relieve various disabling conditions. However, the animal is not necessarily *trained* to do so, and service dog legislation in Australia does not permit an ESD to access public areas where dogs are normally prohibited.

PADs can be of any breed or size suitable for the intended purpose of helping people to access public places, travel on public transport and take part in social activities that are "closed off" to them. PADs can be trained by the person who will become the dog's handler (owner-trainer) or in combination with a qualified trainer, while others are trained exclusively by assistance/service dog provider organizations. In Australia, anyone who has been diagnosed with a mental health condition by a medical doctor or other suitable health care professional is eligible to apply to accredit such a dog. However, literature searches reveal that little is known about the population of people who own PADs inclusive of mental health diagnoses, origins and types of dogs used or the functions they provide. A better understanding of peoples' needs and the relationship between owners and their dogs will help inform the appropriate choice, training and use of assistance dogs for people living with mental health issues. Hence, PAD owners (clients) registered with the charity "mindDog" were invited to participate in an anonymous on-line survey to explore these matters.

mindDog is an Australian not-for-profit organization that helps people who have been diagnosed with a mental health condition/s procure, train and accredit PADs. Information on the mindDog accreditation process can be found in **Box 1** (the application form) and **Figure 1** (assessment, training and follow-up of the person-dog team). More information on mindDog, including the training standard and the Public Access Test (PAT), can be found at www.minddog.org.au/.

MATERIALS AND METHODS

All active clients ($N = 600$) registered with mindDog in February 2018 were invited to participate in an anonymous survey via SurveyMonkey cloud-based software. Questions were forced-choice, multiple-choice, "other" (for free-text to be inserted) or binary (yes/no). Comments on peoples' relationships with their dogs were also sought. Chi-square tests for independence were performed to assess potential associations between owner diagnosis and: the tasks the dog performed, the type of dog used, and the likelihood of changes to health service utilization.

The descriptive results of the survey are presented below. The data obtained from the open-ended (comments) section on peoples' relationships with their dogs was coded into categories and themes, as per Wang and Park [(3), p. 224] process of qualitative coding. While a full thematic analysis is outside the scope of this article, and will be published elsewhere, a synopsis of this preliminary data is presented below.

RESULTS

Owner Demographics

One third ($n = 199$; 33%) of eligible people ($N = 600$) completed the survey. The median age of the participants at the time of data collection was 47 years, and age ranged from 10 to 75 years. The majority of the sample (77%) identified as female, and most (58%) lived in suburban areas. Participants learned about PADs through the internet (37%), their health care practitioner (32%), or family/friends (30%).

Depression (84%), anxiety (social 61%; generalized 60%), PTSD (62%) and panic attacks (57%) were the most self-reported mental health diagnoses of this population (**Figure 2**), with many clients citing multiple diagnoses. Frequently reported mental health diagnoses in the "other" category included Obsessive-Compulsive Disorder, Autism Spectrum Disorder (ASD) and eating disorders.

Dog Demographics

The breed of dogs in the sample varied widely with several dozen purebred and crossbred breeds identified. Age ranged from around 1- > 10-years; gender was evenly distributed. Most dogs were acquired from a registered breeder (48%) followed by an animal shelter (21%) and non-registered breeders (16%).

The most common reasons for people to choose a dog to be a PAD were temperament (60%) followed by size/weight (48%), with only 15% of participants saying that they chose the dog based on its physical appearance. Just under half (48%) of the dogs had been acquired by the owner specifically to be trained as a PAD, and the rest were existing pets.

All the dogs were trained by either the owner or a combination of the owner and a qualified trainer; none were trained exclusively by assistance/service dog provider organizations.

Tasks

All dogs performed multiple tasks for their owners. The most common tasks performed were: reducing anxiety through tactile stimulation (grounding) (94%); nudging or pawing to bring back to the present (71%); interrupting an undesirable behavioral state (51%); constant body contact (50%); deep pressure stimulation (45%); and blocking contact from other people (42%) (**Figure 3**).

The most common tasks listed in the "other category" were: "making" the owner leave his/her bed/house; "reminding" the owner to take his/her medication; keeping the owner

BOX 1 | Summary of the mindDog application form.

The application form for accreditation of a mindDog is in three parts and includes:

Part 1: Details about the applicant and the dog: Ensuring dogs are of an appropriate age, desexed, microchipped, registered, vaccinated, and have access to suitable veterinary care.

Parts 2 & and 3: The opinion of the applicant's health care provider, and other referee, regarding the applicant's ability to care for a dog and how the dog might assist the applicant.

The application form also seeks information on assurance of care for the dog if the owner was unable to do so.

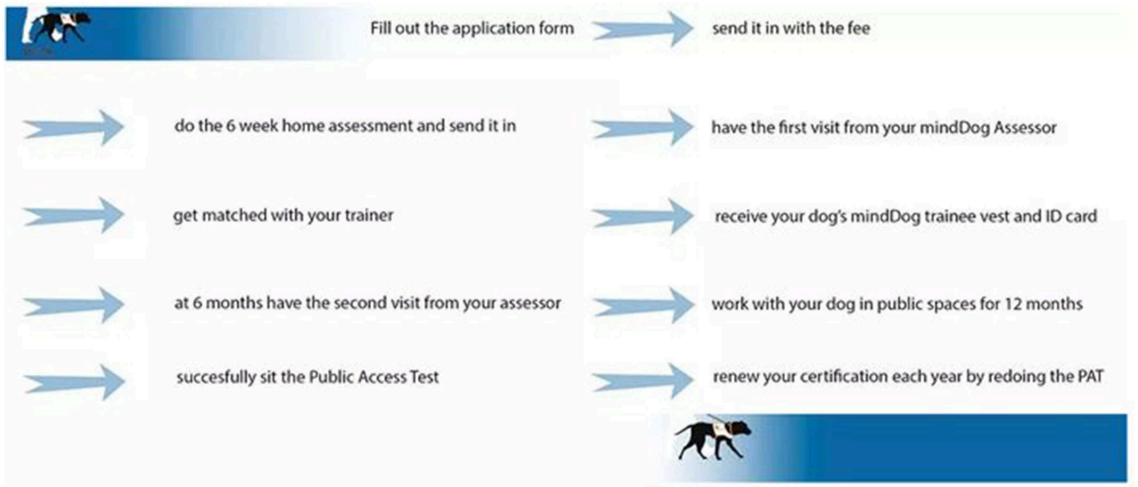

FIGURE 1 | The mindDog accreditation process (www.minddog.org.au/the-process).

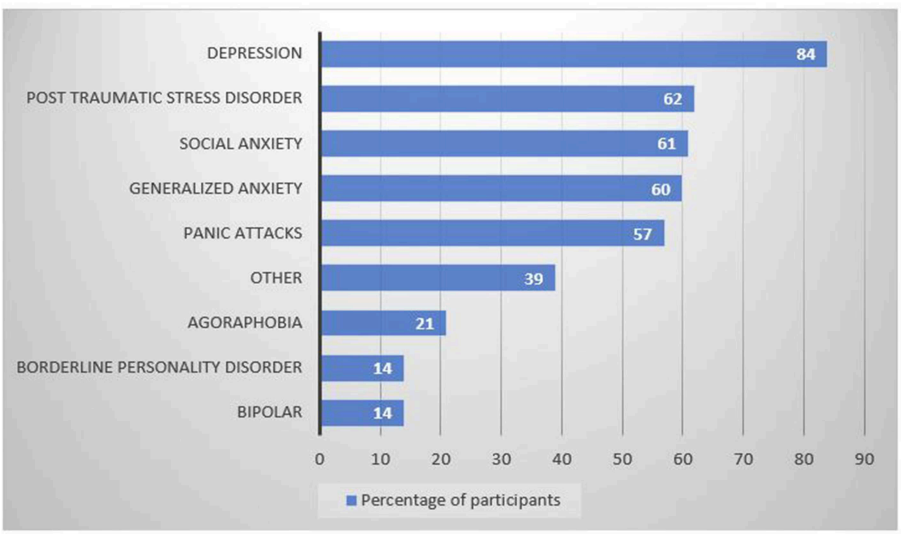

FIGURE 2 | Percentage of participants ($N = 199$) diagnosed with specific mental health conditions.

"safe"; "sensing" owner's emotions and behaviors and thus preventing manifestation of an undesirable behavioral state; and providing a "reality check" from anxiety or dissociation/hallucination.

Outcomes

PAD usage decreased (46%), increased (30%), or did not change (24%) participants' use of psychiatric or other health care services. An analysis of the accompanying narrative pertaining

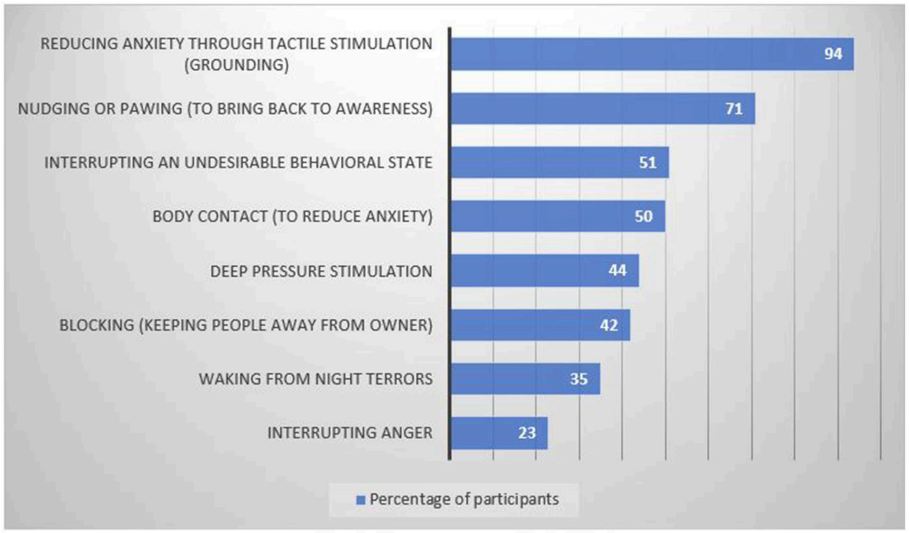

FIGURE 3 | Tasks performed by the psychiatric assistance dogs for the participants ($N = 199$).

to changes in the use of psychiatric or other health care services revealed that reductions in use of services were mainly due to reduced suicide attempts, less need for hospitalizations, and less requirement for medication. Increased service use was mainly due to enhancement of the owners' ability to attend appointments, as the presence of the dog increased peoples' confidence—both in venturing outdoors and in interacting with others.

No statistically significant associations were found between the owners' mental health diagnoses and: the tasks the dog performed, the type of dog used, and the likelihood of changes to health service utilization. No other relationships within the dataset were found.

Owner-Dog Relationship

Several themes emerged from the preliminary thematic analysis of the owner-dog relationship including: Independence; Confidence; Social function; Companionship; Safety and Hope. Every pertinent response ($n = 198$) to the question: "What does your mindDog mean to you?" indicated a positive partnership, as exemplified by the following [de-identified] quotes:

> "Before I had [my dog] I was so anxious I couldn't even leave the house and I had never had someone to look after before. She has changed my life so much; everyone I know says it and my psychiatrist thinks she's amazing. Once [my dog] became qualified as a minddog I have been able to travel to so many more places and be able to do things independently. I don't think I could have done that without her. This also means that I can do things on my own now that in the past I would have needed more help with or been in hospital. But I still definitely need also other health services to help me. She is very good but she can't replace everyone! But I really hope your research shows how great they are because I don't know how I would cope without her."

> "My assistance dog has allowed me to become more social and allowed me to do some of the most basic life necessities ie: go shopping, leave the house, do university, feel safe when out and about and reduce my anxiety and panic attacks. By having my dog, I have managed to reduce my mental health inpatient stays to just stabilisation admission rather than crisis admission. I can now go out and be active with my children and live a fairly normal life."

Other data showed that the publics' attitude could be a cause of stress for the owner:

> "When I'm with her I don't worry that I'm out, because it's like I have my home with me so it's okay. So I can only say that I am so grateful that psychiatric dogs are now recognised and I hope it only spreads more. That being said, sometimes I find having her with me stressful because sometimes other people start challenging me about having her, even though I have all her certification and ID and vest, and that's really stressful for me when people pay attention to me in such a negative way. So I hope it becomes more widely accepted and less criticised by other people who don't really understand."

DISCUSSION

The results of the present study indicate that PADs assist people of all ages, including children, with a range of mental health problems, whose lives are often severely compromised by anxiety and fear, to access public places, travel on public transport and take part in social activities that may have been closed off to them. Although the study was a self-report measure and therefore limited by selection-bias and subjectivity, every relevant comment ($n = 198$) regarding the meaning of the person-dog relationship (i.e., response to the question: "What does your mindDog mean to you?") was positive. Thus, suggesting that sound conclusions can be drawn about their efficacy.

A plethora of dog breeds were used by the participants in this study—from the Chihuahua to the Irish Wolfhound, illustrating that a PAD does not need to be a certain size or breed (or gender). Indeed, only 15% of participants chose a dog based on its physical appearance. Because PADs come in many shapes and sizes, they can look different to other assistance/service dogs such as the Labrador or Golden retriever commonly used as guide dogs (4). As indicated in the present study, this can lead to stress-provoking attention from the public, as unlike some people who are blind or vision-impaired or have mobility issues, there may be no outward sign of disability. Mental illness frequently carries a heavy social (and self-) stigma (5), and the owner may be reluctant to explain the dog's role. Public education regarding the expanding roles of contemporary service dogs and associated etiquette would help to alleviate social issues with accessibility.

It is noteworthy that over a fifth (21%) of dogs in the study were acquired from an animal shelter suggesting that "rescue" dogs can be an important source of successful PADs. Sourcing dogs from animal rescues or shelters is beneficial in reducing the number of animals killed due to overcrowding and opens up shelter space for another animal who might desperately need it.

The authors hypothesized that there might be an association between the owners' mental health diagnoses and the tasks the dogs performed, but no relationship was found. This is likely due to the variables "diagnosis" and "tasks" being highly confounded as, for example, the majority of people (84%) identified as being diagnosed with depression, and almost all (94%) dogs performed the task of "grounding" for their owners. Future research with only open-ended questions for these variables, rather than forced-choice options as per the present study, which can lead participants to make certain choices, would be valuable. While it is not yet understood what cues, whether behavioral, olfactory, or other, PADs may be responding to when performing tasks, it is clear that the relationship between individual owners and his/her dog is a personal one, influenced by each owner's diagnosis and needs.

As part of the mindDog application process (**Box 1**), the applicant's health care practitioner completes a form that expresses how the practitioner expects a mindDog might assist the applicant. However, some health care practitioners may not be aware of the roles the dogs can provide, and it is likely that the functions are greater and more varied than are those predicted. Findings from the present study supports the view of the Psychiatric Service Dog Society (PSDS) in the US (6) that PADS be used as an adjunct to ongoing standard-of-care mental health treatments, and not as a substitution. These findings can be used to inform medical doctors and other health care providers, who play a pivotal role in their patients' application process for a "mindDog," about how the dogs may be of assistance.

A review on the effectiveness of a range of assistance animals (AA) for Australia's National Disability Insurance Agency (NDIA) (7) concluded that there may be large economic benefits to AA ownership, including the ability to work, attend school and concerning services no longer required (e.g., a non-verbal child with ASD who now speaks). Although evidence is limited, the results of the present study support this conclusion in that nearly half (46%) of participants said that their use of psychiatric and other health services had decreased—mainly due to reduced suicide attempts, and less requirement for hospitalization and medications. Public hospital spending in Australia has been the single fastest growing area of government spending over the past decade or so (8). From a health economic perspective, judicious decreased use of services and hospitalizations/use of medications is likely to save money.

Howell et al. (7) also recommended that should AAs be provided by the NDIA, the standard for assistance dog training (inclusive of PADs) should adopt the model of the AA provider organization selecting/breeding and training dogs for AA roles—a process that typically takes around 2 years. However, the findings of the present study suggests that successful working partnerships does not require the PAD to have been bred and/or raised specifically for the role, as every participant considered their personal and working relationship with their dog to be effective despite no dogs being acquired/trained by this method. The so-called "human-animal bond" is the dynamic relationship between people and animals that influences the psychological and physiological states essential to the health and well-being of both (9). Unlike many service dog organizations, mindDog works with existing pets so a strong owner-dog bond is likely to be already in place. Thus, it is the authors' opinion that while many assistance dogs (such as guide dogs, hearing dogs and others trained to assist individuals and their families impacted by disability) be exclusively acquired and trained by AA provider organizations, this approach may not be necessary for PADs. This could have far-reaching consequences for people who wish to use such a dog as waiting times and financial costs for a trained dog could be dramatically reduced.

There appears to be a growing need for PADs to help individuals with psychiatric disabilities. A recent study by Walther et al. (10) showed that PADs placed fourth in North American accredited placements of various assistance dogs, surpassing the number of hearing dogs placed. Indeed, the number of applicants to mindDog has doubled at the time of writing this article (9-months since gathering the data), resulting in the organization having to limit when it can accept applications. When thinking about the direction the field may take in the future it seems unlikely that PAD activities are likely to end, therefore steps must be taken to ensure the well-being of the dogs as well as the handler in this remarkable example of the human-animal bond in action. Responsible pet ownership requires a commitment to provide for all the requirements of one's pet—food, exercise, housing, reward-based training, love and affection, grooming, and veterinary care. While mindDogs only works with positive force-free training methods [as recommended by (11)], it is imperative for all owners to understand how animals communicate and learn, and to thoroughly research the basics of pet care before acquiring any new pet to ensure she/he has the capacity to meet the physiological, behavioral and social needs of the animal. Future research should focus on Shubert's (2) advice whereby handlers (and trainers) become adept in canine body language, recognize signs of stress in dogs, have realistic expectations, and ensure only dogs with the appropriate temperament be trained as PADs.

CONCLUSION

This study has contributed to the small but growing body of research on PADs including the demographics of people who use these dogs in Australia, the origin and type of dogs used and the functions the dogs provide. PADs can be all shapes and sizes and perform a plethora of roles that provide substantial benefits to a broad range of people. In addition to training, it appears that for a satisfactory relationship, PADs do not require to have been bred or raised specifically for the role, but that success hinges on the human-animal bond. An understanding of the relationship between owners and their dogs will help inform the appropriate choice of dog, training and use of assistance dogs for people living with mental health issues to better support the needs of both species.

ETHICS STATEMENT

The study was carried out in accordance with the recommendations of James Cook University Human Ethics Committee (Ethics Approval Number H7210) with informed consent from all subjects. The participants in the study were clients of mindDogs, and had been diagnosed with a mental health condition by a qualified health professional.

AUTHOR CONTRIBUTIONS

JaL, LJ, and JuL contributed to the design, delivery and analyses of this work. JaL wrote the article with the approval of LJ and JuL, who have critically revised the content. JaL, LJ, and JuL agree to be accountable for the content.

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Conflict of Interest Statement: LJ is a board member of the charity mindDog.

The remaining authors declare that the research was conducted in the absence of any commercial or financial relationships that could be construed as a potential conflict of interest.

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Professionally- and Self-Trained Service Dogs: Benefits and Challenges for Partners With Disabilities

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It has been widely reported that service dogs offer benefits to their human partners, however, it is unclear whether the expanding methods of training and roles of service dogs for their partners with various disabilities also provide similar benefits. This study aimed to investigate the self-reported experience of service dog partners to understand whether three different factors influence the benefits and drawbacks associated with partnering with a service dog: (1) different methods of training service dogs; (2) different severities of human partners' disabilities; (3) different roles of service dogs. Partners of service dogs were recruited to the web survey through service dog facilities and networking groups. Answers from 19 men and 147 women participants (91.8% living in the U.S.) were analyzed in this study. Participants experienced the expected benefits of service dogs, including increased independence, social relationships, self-esteem, and life satisfaction, and decreased anxiety, stress, and loneliness. However, the perceived benefits, concerns, and burdens differed depending on the partners' disabilities and the training history of the dogs. When first living with their service dogs, people who had self-trained their service dogs experienced more burdens than those living with professionally trained service dogs. No major reduction in expenses for assistance after acquiring a dog was reported. Personalized team training based on each person's disabilities and situation is required to optimize the benefits and minimize the burdens and concerns of living with service dogs.

Keywords: service dogs, self-trained, professionally-trained, family members, mobility, medical, psychiatric

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INTRODUCTION

Assistance dogs are now frequently seen working in the U.S., where the U.S. Department of Justice uses "service dogs" or "service animals" as the inclusive term (1). However, internationally, "assistance dogs" is the inclusive term used by Assistance Dogs International (ADI) (2): a general term for dogs that support their human partners with various disabilities. The three major ADI classifications of assistance dogs are: guide dogs for people with visual disabilities, hearing dogs for people with hearing disabilities, and service dogs for people with any disabilities other than visual or hearing disabilities (2). Various types of service dogs perform tasks to support people

with many different disabilities. After Bonita Bergin first demonstrated the concept of service dogs for mobility support in 1975, new roles were created for service dogs, such as service dogs for people with psychiatric disorders or autism, and for detection of seizures associated with epilepsy or hypoglycemia with diabetes. Prior to 1980, roles of assistance dogs were primarily guide dogs, hearing dogs, and service dogs for mobility support. The abovementioned new roles of service dogs expanded widely especially after 2001 (3). Therefore, in this paper "traditional assistance dogs" or "traditional assistance dog training facilities" are used to indicate types of assistance dogs which roles had been already established prior to 1980 or training facilities which train such assistance dogs. Service dogs with new roles are referred to here as "new roles/types of service dogs."

Beneficial effects of assistance dogs have been reported for the human partners with disabilities, including increased independence, frequency of leaving the house, and social interactions, as well as decreased paid and unpaid assistance (4–10). Acquisition of assistance dogs also leads to psychological benefits for the partners, such as increased self-esteem and confidence, and decreased anxiety and stress (5, 8, 10). Members of the public commonly understand there are benefits from assistance dogs for their partners, and the popularity of assistance dogs is growing (11). However, the current permissive U.S. situation with assistance dogs raises concerns about too readily assuming that the effects of assistance dogs are inevitably beneficial.

The above mentioned benefits of assistance dogs, especially with guide dogs and service dogs, were usually documented in studies focusing on dogs which had been trained by the traditional assistance dog training facilities (4, 5, 9, 10); usually these were puppies of Labrador or Golden Retrievers or mixed breeds of Labrador and Golden Retrievers. These facilities place the puppies with volunteer caretakers for the first 1–2 years, and then train the dogs at the facility for several months to a year. Persons with disabilities are then assigned dogs and given team training to teach the partners strategies for living with the dogs.

The U. S. has no governmental or federal system for registration or qualification of assistance dogs, nor are any required procedures or certain facilities specified for training of the dogs (1, 12, 13). Further, under the U.S. Code Title 42, disabilities are very broadly defined to offer maximal "reasonable accommodation" to those having disabilities (14), while also protecting the person's privacy regarding the disabilities. This legal context of U.S. laws and regulations means that people can create their personalized assistance dogs as they choose, without any assessment of their dogs' quality or the person's eligibility to be partnered with an assistance dog. This means that assistance dogs in the U.S. sharply differ from each other, having many types of training histories and other characteristics: specific assisting tasks, and sources, sizes, and breeds of the dogs (3). The severity of the partners' disabilities also varies and some people have multiple disabilities, which often change over their life course. Further, increasingly people in the U.S. train their own assistance dogs, especially service dogs (3, 11). It is unknown whether the previously reported benefits from traditional assistance dogs are similar with the new types of service dogs.

This research aimed to investigate the self-reported experiences of service dog partners to understand whether three different factors influence the benefits and drawbacks associated with being partnered with a service dog: (1) methods of training of dogs: self-trained by the partners, or professionally trained by service dog facilities or private trainers; (2) severities of disabilities among partners living with service dogs for mobility assistance: slight/independent, moderate, or severe mobility disabilities; (3) roles/types of assistance by service dogs: mobility, psychiatric or medical assistance. These three factors were selected because they had not previously been well-studied.

Partnering with a service dog does not always improve life for a person with disability. The outcomes are inconsistent among different pairs of service dogs and their human partners. The dogs and humans are both living creatures and the interaction of the two develops into a unique relationship which can have both good and bad aspects. Predicting the outcomes of partnering a service dog has become more difficult than before as new roles of service dogs have been created and these new types of service dogs are little-studied. However, studying currently working service dogs and their partners may provide useful information to gain a better understanding on the relationship of service dogs and their partners and minimize the possible problems.

Persons whose disabilities were most severe were expected to be less likely to embark on self-training a service dog. Self-training seemed likely to pose greater challenges for the partner in achieving useful service support from the dog. Thus, persons electing to train their own dogs, either alone or with assistance from a trainer, were hypothesized to differ in their profiles of disabilities, demographic traits and their experiences of benefits and challenges with the dogs.

METHODS

Subject and Data Collection

This study focused only on service dog partners; people living with guide dogs and hearing dogs were not included. Guide dogs and hearing dogs were not included in this study because a considerable research literature on them already exists, however there is scarce information on the expanding roles of service dogs. In addition, while the assisting tasks of guide dogs and hearing dogs are fairly conventional and consistent, the assisting tasks of service dogs vary and depend on the particular disabilities of their human partners. The partners' range of disabilities included: mobility disabilities, such as using a wheelchair; psychiatric disorders, such as living with posttraumatic stress disorder (PTSD) and anxiety; and medically related disabilities, including diabetes and epilepsy.

This study was conducted using an online web survey. For recruitment, the study announcement was sent to service dog partners through the International Association of Assistance Dog Partners, service dog training facilities,

Abbreviations: ADI, Assistance Dogs International; ADL, Activities of Daily Living; MCS, mental component summary; SD, service dogs; PCS, physical component summary; ProSD, professionally trained service dogs; PTSD, posttraumatic stress disorder; SelfSD, self-trained service dogs.

and social networking groups related to service dog partners. Participation was anonymous and voluntary, and was approved by the University of California, Davis, Institutional Review Board Protocol #340095-2.

Questionnaire

The questionnaire included standardized surveys to assess the participants' physical and psychological health, physical activity, and level of independence. Additional questions concerned participants' demographic details and their experiences with their service dogs.

1. Physical and Mental Health, Physical Activity, and Independence

   The participants' physical and mental health status was assessed using the Medical Outcomes Study 36-Item Short-Form Health Survey (SF-36), which is a widely used measure of health-related quality of life (15). SF-36 has 36 questions and provides physical and mental health summary scores and does not specify whether the respondents have disabilities or not, nor does it address types of disabilities. It uses norm-based scoring algorithms for the physical and mental health summary scores (T-score transformation with mean of 50 ± 10 [SD] in the general US population). The Physical Activity Scale for Individuals with Physical Disabilities was used to assess the participants' physical activity (16). This scale consists of 13 items, concerning leisure time, household, and work-related activities. The questionnaire asks the number of days (during the past 7 days) and hours (per day) a respondent engaged in each activity. The total score is calculated by multiplying the average hours per day for each activity by a metabolic equivalent value associated with the intensity of the activity (range 0–182). To obtain the severity of disabilities in terms of physical independence (Activities of Daily Living: ADL), we used the Barthel Index (17). Higher scores on these instruments indicate better status in health, physical activity, or independence.

   The scores of the Barthel Index range between 0 and 100, indicating the different levels of independence: 0–20: total dependence; 21–60: severe dependence; 61–90: moderate dependence; 91–99: slight dependence; and 100: independent (18). For our analyses, we simplified groupings into three severity levels of physical disabilities: severe: 0–60; moderate: 61–90; and slight/independent: 90–100.
2. Demographic

   This section included questions on the participant's age, gender, diagnosed disability, year first having the disability, whether having a progressive disability or not, type of walking device if applicable, working status, and geographic location.
3. Experiences Related to Acquiring the Service Dog

   Participants reported their experiences in living with the current and past service dog(s) if they had lived with two or more service dogs. Items in the parenthesis were offered, and otherwise they were asked to write their answers: years of living with service dogs (less than 1 year, 1–2 years, 3–4 years, 5–7 years, 8–10 years, 11–15 years, 16–20 years, and more than 20 years) and current service dog (<6 months, 6–11 months, 1–2 years, 3–4 years, 5–7 years, 8–10 years, and > 10 years); the breed and weight of the current service dog (small: up to 22 lbs, medium: 23–40 lbs, large: over 41 lbs); the training history for the current dog (service dog training facility, private dog trainer, I trained my dog under the instruction of a service dog training facility, I trained my dog under the instruction of a private dog trainer, I trained my dog by myself, and other); whether acquiring the dog included a team–training (yes, and no); anxiety before acquiring the first service dog (none, taking care of a dog, expense for a dog, space for house, handling of a dog, team training, family members, neighborhood, finding a suitable agency, school/work, public access, housing, and other); the duration after acquiring the dog or deciding to train their own dog until the current dog started to perform the expected assisting tasks (<1 month, 1–2 months, 3–6 months, 7–11 months, >1 year, and the dog has not become to perform tasks that I require yet); the person with responsibility for supervising the current dog (mainly the service dog partner, half and half with an assisting person and the service dog partner, mainly an assisting person, and other); and the person who takes care of the dog [you, my family member(s), my friend(s), specially organized volunteer(s) for me, paid assistant(s), and other]. The question on responsibility was included because, when a person has severe disabilities, a family member may assume responsibility for the service dog's care. Also, the working environment of the current service dog was characterized (mainly inside the house, mainly outside of the house, and both inside and outside of the house).
4. Retrospective Ratings of Social and Psychological Aspects

   Participants rated any perceived changes in the following variables after acquiring their first service dog (increased, decreased, no changes): their frequencies of going to school or work, going out of the house, participating in public activities, meeting friends, making new friends, their required hours of paid and unpaid assistance, financial cost of assistance, and their psychological experiences, including self-esteem, social networks, relationships with other persons, independence, life satisfaction, social acknowledgment, stress, anxiety, loneliness, and depression. In addition, the participants were asked whether they experienced discomfort when meeting strangers outside of the house (yes, and no); for those who experienced it, they were asked to rate the extent to which they feel their discomfort was alleviated by the presence of their dog (never, rarely, occasionally, frequently, and often).
5. Burdens Experienced When Living With a Service Dog

   Participants rated whether they experienced specific burdens from living with their service dogs (not applicable; no; yes, I feel a little; yes, I feel moderately; and yes, I feel a lot); 20 individual items inquired about interactions with their dogs and other people in public. The items included: caring for daily needs, physically maintaining, expense for your dog, house cleaning, travel arrangements, responsibility for your dog, disease of your dog, adjustment period of being a partner with your dog, team training, daily training, any behavior problems, poor match between you and the dog, lack of skills as your service dog, refusal to obey certain commands, public

people's petting interferes, challenges to access, unwanted attention, negative effect on your family relationship, causing asthma and/or allergic rhinitis to people, and facing the death of dog.

6. Effects of Service Dogs for Family Members

Participants rated their family members' experiences after they acquired their service dogs: whether the frequency of their family members going out of the house increased, whether they were satisfied with the service dog, whether they relaxed more, and whether they felt burdened with taking care of the dog (no; yes, a little; yes, moderately; and yes, a lot).

Inclusion and Exclusion Criteria

This study targeted any people who lived with service dogs. There were no exclusion criteria on the types of service dogs, the human partners' disabilities, and whether they had single or multiple disabilities. However, for this paper we only focused on people with a single category of disability (one of the following: mobility disability, psychiatric disability, or medical disability) who lived with a service dog which had a single role for the partner's disability (one of the following: mobility support, psychiatric support, or medical support). Roles of service dogs vary greatly and some dogs perform multiple roles for their human partners. People with multiple disabilities beyond the single categories may have more varied physical and mental conditions compared to people with a single category of disability. The diversity among service dogs with multiple roles and human partners with multiple disabilities may make it difficult to specify the differences among different types of service dogs. Therefore, in this study we only included service dogs with a single role living with a person with a single category of disability. People with multiple disabilities beyond a single category of disability and service dogs with multiple roles were not included in this: for example, a service dog partner who had amputation of parts of body (mobility disability) and diabetes (medical disability), a service dog partner who had cerebral palsy (mobility disability) and PTSD (psychiatric disability), and a service dog whose roles were mobility and psychiatric supports. Responses from these partners will be reported in a subsequent paper.

Categories of Assistance Dogs and Partners for Comparisons of Groups

Firstly, the 19 men and 147 women participants were classified into three disability groups according to their diagnosed disabilities: solely mobility (e.g., spinal cord injury, rheumatism, and cerebral palsy); psychiatric (e.g., PTSD, anxiety, autism, and depression); and medical (e.g., diabetes and epilepsy) disabilities. Secondly, the service dogs were classified into three types: for mobility, psychiatric, and medical assistance.

Based on the participants' reported disabilities and types of service dogs, three categories of service dog teams were extracted, in all cases where only one type of disability was involved: partners with only an orthopedic disability(ies), living with mobility service dogs (mobility SD); partners with only psychiatric disability(ies) living with psychiatric service dogs (psychiatric SD); and partners with medical disability(ies) living with medical service dogs (medical SD). Using these three categories, we studied the following comparisons.

Comparison 1: Training Background of Dogs

The disabilities and experiences of the human partners with their dogs were compared as related to the dogs' specific training histories: self-trained service dogs (SelfSD: these dogs were trained by the partners themselves, or trained by partners guided by service dog facilities or private trainers), and professionally trained service dogs (ProSD: these dogs were trained by trainers within service dog facilities or private dog trainers). Typically, professionally trained service dogs are placed with their human partners when they are around 2 years old after completing training to be service dogs. Therefore, SelfSD partners who have lived with their current service dogs less than 2 years may be still in training. To assess the SelfSD partners' experiences with service dogs, participants were partitioned into those living with their SelfSD less than 2 years (immature SelfSD partners), and those living with their dogs for 2 or more years (mature SelfSD partners). Data were analyzed among ProSD ($n = 73$, 44.0% of total participants), immature SelfSD ($n = 33$, 19.9%), and mature SelfSD partners ($n = 43$, 25.9%). Data of those living with their first service dog were also separately analyzed.

Comparison 2: Severity of Mobility Disabilities

Here differences were assessed in responses associated with the severity of the partners' mobility disabilities. This included only people who have solely mobility disabilities and live with mobility service dogs. The severity of partners' disabilities was classified in three levels: severe (Barthel Index of 0–60, $n = 30$, 18.1%), moderate (61–90, $n = 44$, 26.5%), and slight/independent (91–100, $n = 29$, 17.5%).

Comparison 3: Types of Service Dogs

Differences were investigated in responses among partners with three types of service dogs: partners who have only mobility disabilities living with mobility service dogs ($n = 103$, 62.0%), partners who have only psychiatric disabilities living with psychiatric service dogs ($n = 38$, 22.9%), and partners who have only medical disabilities living with medical service dogs ($n = 25$, 15.1%).

Statistical Analyses

Surveys with more than one third of answers missing were not included in the final analyses that included 19 male and 147 female participants. Statistical analyses included the Chi-square test, Mann-Whitney U-test, and Kruskal-Wallis test to investigate the differences between/among the specific groups ($p < 0.05$). When the Chi-square test was significant, adjusted standardized residuals were checked. Also, when the Kruskal-Wallis test for the comparisons among three groups were significant, the Mann-Whitney U-test with Bonferroni test ($p < 0.0166$) was used, to assess the differences between the groups. Only when the second test was significant was it shown in the results. The denominators differ for each analysis as some participants' answers were missing.

RESULTS

The results from comparisons of dogs with different training histories are presented first: Comparison 1. The results from the comparisons related to the partners' severity of mobility disabilities, and the different types of service dogs are presented next: Comparisons 2 and 3. **Table 1** shows the demographic information on participants for each comparison group. A chi-squared test showed some significant associations between each comparison group and some demographic items. ProSD partners had lived longer with their disabilities than the immature SelfSD partners. ProSD partners used their wheelchairs significantly more and immature SelfSD partners used wheelchairs significantly less than expected. Mobility SD partners having severe disabilities used their wheelchairs significantly more and those with slight disabilities or independent in ADL used wheelchairs significantly less than expected. Similarly, mobility SD partners used wheelchairs significantly more and medical SD and psychiatric SD partners used wheelchairs significantly less than expected. Mobility SD partners had progressive disabilities significantly more and psychiatric SD partners had progressive disabilities significantly less than expected. The ADL scores were significantly lower for the ProSD partners than in the mature SelfSD partners. Similarly, mobility SD had significantly lower ADL scores than medical SD and psychiatric SD partners. On the other hand, the scores of the mental component summary in the SF-36 were significantly lower in the immature and mature SelfSD partners than the ProSD partners.

Most dogs of each group were large dogs weighing 18 kg (41 lb) or more, with members of the ProSD group living with large dogs significantly more and those in the mature SelfSD group living with large dogs significantly less than expected (**Table 1**).

The average duration of living with service dogs was longer for mobility SD partners [median years: I (severe): 8–10; II (moderate): 5–7; III (slight/independent): 5–7; mobility SD: 5–7; medical SD: 3–4; psychiatric SD: 3–4], but these were not statistically significant differences.

A strong majority of members of all groups had participated in team training. Among those not self-training their dogs, mobility SD partners with severe disabilities more often tended to have a team training, but this trend was not significant (I: 96.0%, $n = 24$; II: 93.5%, $n = 29$; III: 72.7%, $n = 8$, $p = 0.063$, Cramer's $V = 0.29$). There were also no differences for participating in team training among the other comparison groups (mobility SD: 91.0%; medical SD: 80.0%; psychiatric SD: 87.5%).

Comparison 1: Training Background of Dogs (Self-Trained or Professionally Trained)

With almost equal numbers, 76 partners lived with self-trained service dogs (immature SelfSD partners: $n = 33$; mature SelfSD partners: $n = 43$), and 73 partners lived with professionally trained service dogs (ProSD). A majority of ProSD ($n = 67$) were trained by service dog training facilities and only 6 dogs were trained by private trainers.

Both immature and mature SelfSD partners reported it taking significantly longer durations for their dogs to perform expected tasks reliably compared to ProSD partners (more than 1 year–immature SelfSD: 28.6%, $n = 6$; mature SelfSD partners: 35.7%, $n = 15$; ProSD partners: 5.5%, $n = 3$, between ProSD and immature SelfSD: $U = 148$, $p < 0.001$, $r = -0.57$; ProSD and mature selfSD: $U = 2070$, $p < 0.001$, $r = -0.71$; immature SelfSD and mature SelfSD: $p > 0.05$). For this analysis, 16 ProSD partners and 11 immature SelfSD partners who had partnered with their service dog <1 year were not included, because they may have chosen "the dog has not become to perform tasks that I require yet" only because their relationship was still developing.

Mobility SD with severe disabilities acquired professionally trained service dogs significantly more and mobility SD with slight disabilities or independent in ADL trained their service dogs significantly more than expected [I: 16.7%, $n = 5$; II: 29.5%, $n = 13$; III: 62.1%, $n = 18$; $X^2(2) = 14.8$, $p < 0.001$, Cramer's $V = 0.39$, R_{adj}: I-ProSD (2.7); I-SelfSD (−2.7); III-ProSD (−3.6); III-SelfSD (3.6)]. Also, psychiatric SD partners self-trained their dogs (78.9%, $n = 30$) significantly more and mobility SD partners acquired professionally trained service dogs significantly more than expected [40.8%, $n = 42$; $X^2(2) = 23.6$, $p < 0.001$, Cramer's $V = 0.39$, R_{adj}: mobility-ProSD (3.8); mobility-SelfSD (−3.8); psychiatric-ProSD (−4.8); psychiatric-SelfSD (4.8)].

Perceived Changes After Acquiring Their Service Dogs

This section explains the partners' retrospective ratings of social and psychological aspects: what changes they experienced in each aspect after acquiring a service dog. It should be remembered that it is not a comparison of the partners' status before and after acquiring a service dog.

Perceived positive changes in leaving home, making new friends, independence, life satisfaction, and loneliness after acquiring their service dogs, were reported by more than 70% of partners with all training backgrounds of dogs. On the other hand, no perceived changes in school/job attendance, and hours of paid and unpaid assistance after acquiring their service dogs were reported by more than 50% of partners with all training backgrounds of dogs. Overall, perceived changes after acquiring their service dogs were similar among the partners with each training background of dogs. However, a chi-squared test showed that there were significant associations between training backgrounds of dogs and self-esteem and depression. Immature SelfSD partners perceived no change in self-esteem significantly more and mature SelfSD partners perceived increased self-esteem significantly more than expected. Also, mature SelfSD partners perceived decreased depression significantly more than expected (**Table 2**).

Alleviating Discomfort in Meeting Strangers

There was a significant association between training background of dogs and experienced alleviation of discomfort in meeting strangers. Immature SelfSD partners perceived no alleviation of discomfort significantly more than expected [experienced alleviation of discomfort: ProSD: 93.5%, $n = 43$; mature SelfSD: 93.9%, $n = 31$; immature SelfSD: 71.0%, $n = 22$; $X^2(2) = 10.3$,

TABLE 1 | Demographic of service dog partners.

Comparisons	1. Training background Self/professional				2. Level of disabilities (mobility service dog) ADL scores I/II/III				3. Types of service dogs Mobility/medical/psychiatric service dogs			
	Pro	Self			Activity of Daily Living (ADL) Score				Mobility SD/only mobility disability ($n = 103$)	Medical SD/only medical disability ($n = 25$)	Psychiatric SD/only psychiatric disability ($n = 38$)	p
	($n = 73$)	Immature ($n = 33$)	Mature ($n = 43$)	p	I: 0–60 ($n = 30$)	II: 61–90 ($n = 44$)	III: 91–100 ($n = 29$)	p				
Age (median, years old)	41–50	31–40	41–50	–	41–50	41–50	41–50	–	41–50	41–50	31–40	–
Female (%)	91.3	84.8	95.3	–	76.7	90.9	96.6	–	88.3	92.0	86.8	–
Years having disabilities (median, years)	>20	6–10	>20	a	>20	>20	16–20	–	>20	>20	11–15	–
Having progressive disabilities (%)	54.8	48.5	58.1	–	56.7	61.4	72.4	–	63.1	36.0	31.6	i
Main walking aid: wheelchair (%)	41.1	6.1	21.2	b	86.7	54.5	0.0	f	50.5	0.0	0.0	j
Employment status: paid full/part-time or self-employed (%)	34.2	30.3	39.5	–	43.3	45.5	44.8	–	44.7	56.0	28.9	–
ADL (median, score)	80	95	95	c	40	77.5	95	g	75	100	100	k
SF-36												
Physical component summary (mean ± SD)	38.1 ± 11.9	37.7 ± 13.7	36.9 ± 11.3	–	29.1 ± 7.1	34.0 ± 9.1	34.0 ± 7.0	h	32.6 ± 8.2	48.3 ± 9.7	47.2 ± 10.4	l
Mental component summary (mean ± SD)	46.5 ± 11.7	35.9 ± 13.2	39.6 ± 11.3	d	46.0 ± 10.8	47.6 ± 12.3	44.9 ± 10.6	–	46.4 ± 11.3	43.0 ± 11.3	29.6 ± 10.4	m
Physical activity score (mean ± SD)	15.3 ± 15.9	14.6 ± 15.1	11.0 ± 11.1	–	10.7 ± 9.6	16.8 ± 16.9	17.9 ± 16.9	–	15.3 ± 15.3	19.2 ± 14.4	14.4 ± 13.3	–
Size of dogs: large (over 41 lbs or 18 kgs, %)	98.6	81.8	79.1	e	90.0	95.5	79.3	—	89.3	80.0	81.6	–

a: Pro-immature SelfSD: $U = 1{,}721$, $p < 0.001$, $r = 0.36$; immature SelfSD-mature SelfSD: $U = 405$, $p = 0.0014$, $r = 0.37$.
b: $X^2(2) = 14.83$; $p < 0.001$, Cramer's $V = 0.33$, R_{adj}: ProSD-wheelchair (3.6); ProSD-others/no aids (−3.6); immature SelfSD-wheelchair (−3.2); immature SelfSD-others/no aids (3.2)
c: ProSD-mature SelfSD: $U = 2{,}067$, $p = 0.004$, $r = 0.26$.
d: ProSD-immature SelfSD: $U = 666$, $p < 0.001$, $r = -0.36$; ProSD-mature SelfSD: $U = 1{,}058$, $p = 0.003$, $r = -0.27$
e: $X^2(4) = 14.1$; $p = 0.007$, Cramer's $V = 0.22$, R_{adj}: ProSD-large (≥41 lbs) (3.6); ProSD-medium (40–23 lbs) (−2.6); ProSD-small (≤ 22 lbs) (−2.5); mature SelfSD-large (−2.6); mature SelfSD-medium (2.3)
f: $X^2(2) = 49.9$; $p < 0.001$, Cramer's $V = 0.55$, R_{adj}: I-wheelchair (5.4); I-others/no aids (−5.4); III-wheelchair (−6.3); III-others/no aids (6.3)
g: I–II: $U = 0$, $p < 0.001$, $r = -0.84$; I-III: $U = 0$, $p < 0.001$, $r = -0.86$; II–III: $U = 0$, $p < 0.001$, $r = -0.84$
h: I–III: $U = 271$, $p = 0.013$, $r = 0.32$
i: $X^2(2) = 14.0$; $p < 0.001$, Cramer's $V = 0.29$, R_{adj}: mobility-having progressive disability (3.7); mobility-not having progressive disability (−3.7); psychiatric-having progressive disability (−2.8); psychiatric-not having progressive disability (2.8)
j: $X^2(2) = 44.9$; $p < 0.001$, Cramer's $V = 0.61$, R_{adj}: mobility-wheelchair (6.7); mobility-others/no aids (−6.7); medical-wheelchair (−3.6); medical-others/no aids (3.6); psychiatric-wheelchair (−4.7); psychiatric-others/no aids (4.7)
k: Mobility-medical: $U = 2{,}327$, $p < 0.001$, $r = 0.55$; mobility-psychiatric: $U = 3{,}349$, $p < 0.001$, $r = 0.54$
l: Mobility-medical: $U = 2{,}301$, $p < 0.001$, $r = 0.54$; mobility-psychiatric: $U = 3{,}394$, $p < 0.001$, $r = 0.56$
m: Mobility-psychiatric: $U = 512$, $p < 0.001$, $r = -0.57$; medical-psychiatric: $U = 776$, $p < 0.001$, $r = 0.53$.

TABLE 2 | Perceived changes after acquiring service dogs.

Comparisons	Training background Self/professional				Level of disabilities (mobility service dog) ADL scores I/II/III				Types of service dogs Mobility/medical/psychiatric service dogs			
	Pro	Self			Activity of daily living (ADL) score				Mobility SD/only mobility disability	Medical SD/only medical disability	Psychiatric SD/only psychiatric disability	
	(*n* = 73)	Immature (*n* = 33)	Mature (*n* = 43)	*p*	I: 0–60 (*n* = 29)	II: 61–90 (*n* = 40)	III: 91–100 (*n* = 28)	*p*	(*n* = 97)	(*n* = 25)	(*n* = 38)	*p*
School/job attendance	28.2 (4.2)	16.1 (6.5)	31.6 (2.6)	–	31.0 (0.0)	35.0 (5.0)	50.0 (7.1)	–	38.1 (4.1)	16.0 (4.0)	60.5 (7.9)	d
Leaving home	76.1 (1.4)	74.2 (3.2)	78.6 (4.8)	–	82.8 (0.0)	75.0 (2.5)	67.9 (0.0)	–	75.3 (1.0)	44.0 (12.0)	86.8 (2.6)	e
Public activities	56.3 (4.2)	48.4 (0.0)	71.4 (2.4)	–	62.1 (3.4)	65.0 (7.5)	60.7 (0.0)	–	62.9 (4.1)	56.0 (8.0)	65.8 (2.6)	–
Meeting friends	47.9 (4.2)	51.6 (3.2)	54.8 (2.4)	–	55.2 (3.4)	55.0 (0.0)	57.1 (0.0)	–	55.7 (1.0)	48.0 (4.0)	65.8 (7.9)	–
Making new friends	80.3 (0.0)	77.4 (0.0)	76.2 (2.4)	–	86.2 (0.0)	75.0 (0.0)	71.4 (0.0)	–	77.3 (0.0)	76.0 (8.0)	86.8 (2.6)	f
Hours of paid assistance	7.0 (4.2)	6.5 (3.2)	4.8 (0.0)	–	13.8 (6.9)	10.0 (5.0)	14.3 (3.6)	–	12.4 (5.2)	0.0 (0.0)	7.9 (5.3)	–
Hours of unpaid assistance	15.5 (8.5)	19.4 (3.2)	4.8 (4.8)	–	24.1 (17.2)	22.5 (2.5)	28.6 (10.7)	–	24.7 (9.3)	4.0 (4.0)	10.5 (7.9)	–
Money consumption	12.7 (42.3)	9.7 (32.3)	16.7 (35.7)	–	20.7 (20.7)	27.5 (32.5)	14.3 (21.4)	–	21.6 (25.8)	4.0 (48.0)	24.3 (29.7)	–
Self-esteem	83.1 (4.2)	67.7 (0.0)	92.9 (0.0)	a	82.8 (6.9)	85.0 (0.0)	75.0 (3.6)	–	81.4 (3.1)	68.0 (8.0)	89.5 (0.0)	–
Social network	74.6 (4.2)	58.1 (0.0)	78.6 (0.0)	–	79.3 (3.4)	82.5 (5.0)	60.7 (0.0)	–	75.3 (3.1)	68.0 (4.0)	73.7 (0.0)	–
Relationships with other persons	63.4 (1.4)	61.3 (0.0)	73.8 (0.0)	–	69.0 (3.4)	72.5 (5.0)	67.9 (0.0)	–	70.1 (3.1)	52.0 (4.0)	76.3 (0.0)	–
Independence	90.0 (1.4)	87.1 (0.0)	90.5 (0.0)	–	89.7 (3.4)	97.5 (0.0)	89.3 (0.0)	–	92.8 (1.0)	88.0 (4.0)	81.6 (0.0)	–
Life satisfaction	93.0 (0.0)	90.3 (0.0)	92.9 (0.0)	–	96.6 (3.4)	87.5 (0.0)	100.0 (0.0)	c	93.8 (1.0)	92.0 (0.0)	81.6 (0.0)	–
Social acknowledgment	74.6 (1.4)	67.7 (0.0)	81.0 (0.0)	–	82.8 (3.4)	85.0 (0.0)	71.4 (0.0)	–	80.4 (1.0)	52.0 (4.0)	73.7 (0.0)	g
Stress	74.6 (7.0)	67.7 (6.5)	78.6 (11.9)	–	62.1 (17.2)	85.0 (7.5)	85.7 (3.6)	–	78.4 (9.3)	68.0 (4.0)	73.7 (13.2)	–
Anxiety	71.8 (2.8)	67.7 (3.2)	83.3 (9.5)	–	58.6 (17.2)	77.5 (5.0)	85.7 (0.0)	–	74.2 (7.2)	64.0 (4.0)	86.8 (7.9)	–
Loneliness	74.6 (7.0)	71.0 (3.2)	81.0 (7.1)	–	75.9 (13.8)	82.5 (7.5)	78.6 (3.6)	–	79.4 (8.2)	64.0 (4.0)	76.3 (2.6)	–
Depression	59.2 (2.8)	54.8 (0.0)	81.0 (4.8)	b	62.1 (13.8)	62.5 (2.5)	71.4 (0.0)	–	64.9 (5.2)	40.0 (4.0)	78.9 (2.6)	h

The numbers show the percentages of partners who experienced positive changes in each item. The numbers in parenthesis show percentages of partners who experienced negative changes in each item. The remaining percentages of partners which are not indicated in the table experienced no changes in each item. The p-value is not reported if > 0.05.

a: $X^2(4) = 12.4$, $p = 0.014$, Cramer's $V = 0.21$, R_{adj}: immature SelfSD-no change (3.0); immature SelfSD-increased (−2.5); mature SelfSD-increased (2.1)

b: $X^2(4) = 10.4$, $p = 0.034$, Cramer's $V = 0.19$, R_{adj}: mature SelfSD-no change (−3.0); mature SelfSD-decreased (2.6)

c: $X^2(4) = 9.8$, $p = 0.044$, Cramer's $V = 0.22$, R_{adj}: II-no change (2.7); II-increased (−2.2)

d: $X^2(4) = 15.3$, $p = 0.004$, Cramer's $V = 0.22$, R_{adj}: medical-increased (−2.7); medical-no change (2.7); psychiatric-increased (3.0); psychiatric-no change (−3.3)

e: $X^2(4) = 18.7$, $p < 0.001$, Cramer's $V = 0.24$, R_{adj}: medical-increased (−3.6); medical-no change (2.6); medical-decreased (2.8); psychiatric-increased (2.2); psychiatric-no change: (−2.2)

f: $X^2(4) = 9.6$, $p = 0.048$, Cramer's $V = 0.17$, R_{adj}: mobility-decreased (−2.2); medical-decreased (2.5)

g: $X^2(4) = 9.5$, $p = 0.049$, Cramer's $V = 0.17$, R_{adj}: mobility-increased (2.2); mobility-no changes (−2.1); medical-increased (−2.8); medical-no change (2.5)

h: $X^2(4) = 10.9$, $p = 0.027$, Cramer's $V = 0.18$, R_{adj}: medical-no change (2.9); medical-decreased (−2.8); psychiatric-no change (−2.0); psychiatric-decreased (2.1).

$p = 0.006$, Cramer's $V = 0.31$, R_{adj}: immature SelfSD-experienced alleviation (−3.2); immature SelfSD-no experienced alleviation (3.2)].

Dogs' Problem Behaviors and Burdens Experienced While Living With a Service Dog

Immature SelfSD partners experienced behavior problems with their dogs significantly more and ProSD partners experienced no behavior problems with their dogs significantly more than expected [ProSD: 15.5%, $n = 11$; immature SelfSD: 48.4%, $n = 15$; mature SelfSD: 32.5%, $n = 13$; $X^2(2) = 12.4$, $p = 0.002$, Cramer's $V = 0.30$, R_{adj}: ProSD-experienced problem behaviors (−3.2); ProSD-no behavior problems (3.2); immature SelfSD-experienced problem behaviors (3.0); immature SelfSD-no behavior problems (−3.0)].

Experienced burdens of living with a service dog were significantly associated with training backgrounds of dogs. Immature SelfSD partners experienced burdens with "negative effect on family," "behavior problem of their dogs," "travel arrangement," and "unwanted attention" significantly more, and ProSD partners experienced no burdens on "travel arrangement," "behavior problem," and "negative effect on family" significantly more than expected (**Table 3**).

Satisfaction With the Dogs and Impacts on Their Family Members

ProSD partners described that their family members were satisfied with their dogs a lot significantly more, and immature SelfSD partners described that their family members were not satisfied with their dogs or were satisfied with their dogs a little significantly more than expected [Yes (Yes, a lot): ProSD: 97.1%, $n = 67$ (81.2%, $n = 56$); immature SelfSD: 86.7%, $n = 26$ (46.7%, $n = 14$); mature SelfSD: 100%, $n = 39$ (69.2%, $n = 27$); $X^2(6) = 21.9$, $p = 0.001$, Cramer's $V = 0.28$, R_{adj}: ProSD-yes, a lot (2.8); ProSD-yes, a little (−3.2); immature SelfSD-yes, a lot (−3.2); immature SelfSD-yes, a little (2.9); immature SelfSD-no (2.7)].

Comparisons 2 and 3: the Severity of Partners' Mobility Disabilities, and the Types of Service Dogs

Paid and Unpaid Assistance and Expenses

More than 50% of the partners reported no changes after acquiring a dog for the costs of paid and unpaid assistance and related expenses (**Table 2**). Fewer than 15% of the participants in all groups reported a decrease in paid assistance after acquiring a service dog. For unpaid assistance, slightly more partners reported a decrease, about 20%. More mobility SD partners tended to report decreased times for paid and unpaid assistance than others. But overall, no change for the assisting hours was the most common answer for all groups. Also, there were no statistically significant differences between/among the groups.

Participants indicated whether their service dogs caused an increase or decrease of expenses. The reported increased expenses and decreased expenses were in similar proportions for the mobility SD and psychiatric SD partners. On the other hand, medical SD partners reported increased expenses more often than a decrease. However, there were no statistically significant differences between/among the groups, and about half of the participants answered that there were no changes for the related expenses.

Participation in Society and Psychological Aspects

The frequency of school/work attendance and leaving home differed among partners with the various service dogs. Medical SD partners reported no perceived change of school/work attendance and leaving home significantly more than expected.

More than 70% of the participants in all groups answered that their dogs facilitated making new friends. Most participants reported improvements for psychological aspects after acquiring a service dog (**Table 2**). However, mobility SD partners with moderate disabilities reported no perceived changes in life satisfaction significantly more than expected. Furthermore, mobility SD partners perceived increased social acknowledgment significantly more than expected, while medical SD partners perceived no changes in social acknowledgment significantly more than expected. Similarly, psychiatric SD partners perceived decreased depression significantly more than expected, but medical SD partners perceived no changes in depression significantly more than expected.

Concerns Before Acquiring a Service Dog and Getting Teamed-Up With Their Dog

Mobility SD partners with slight disabilities or independent in ADL did not have concerns before acquiring a service dog significantly more than expected [had concern: I: 79.3%, $n = 23$; II: 75.0%, $n = 30$; III: 46.4%, $n = 13$, $X^2(2) = 8.6$, $p = 0.010$, Cramer's $V = 0.30$, R_{adj}: III-no concern (2.9); III-had concern (−2.9)]. Mobility SD partners with severe disabilities had concern on the care of a dog before acquiring a service dog significantly more than expected (I: 41.4%, $n = 12$; II: 20.0%, $n = 8$; III: 14.3%, $n = 4$, $X^2(2) = 6.4$, $p = 0.040$, Cramer's $V = 0.26$, R_{adj}: I-had concern with the care of a dog (2.5); I-no concern with the care of a dog (−2.5)]. In other items for the prior concerns, there were no differences among people with different severities of disabilities; expense of dog (I: 27.6%, 8; II: 27.5%, $n = 11$, III: 17.9%, $n = 5$), space of house (I: 10.3%, $n = 3$, II: 17.5%, $n = 7$; III: 7.1%, $n = 2$), handling of dog (I: 34.5%, $n = 10$; II: 22.5%, $n = 9$; III: 21.4%, $n = 6$), team training (I: 24.1%, $n = 7$; II: 12.5%, $n = 5$; III: 7.1%, $n = 2$), family members (I: 27.6%, 8; II: 25.0%, $n = 10$; III: 21.4%, $n = 6$), neighborhood (I: 0.0%, $n = 0$; II: 5.0%, $n = 2$; III: 3.6, $n = 1$), finding an adequate training facility (I: 24.1%, $n = 7$; II: 17.5%, $n = 7$; III: 7.1%, $n = 2$), their work and school (I: 10.3%, $n = 3$; II: 22.5%, $n = 9$; III: 17.9%, $n = 5$), public access (I: 10.3%, $n = 3$; II: 27.5%, $n = 11$; III: 32.1%, $n = 9$), housing (I: 6.9%, $n = 2$; II: 7.5%, $n = 3$; III: 3.6%, $n = 1$). Among other comparison groups, no significant differences in concerns were confirmed.

Participants reported the duration of time (< 1 month, 1–2 months, 3–6 months, 7–11 months, > 1 year) until their dogs started to perform tasks they required, after the dog came from a training agency, or after the participant decided to train the dog as a service dog. Psychiatric SD partners (median: 3–6 months) took significantly longer durations than mobility SD (median: <1 month, $U = 645$, $p < 0.001$, $r = 0.32$). Among other

TABLE 3 | Experienced burdens living with service dogs in each group.

% people felt burdened at any level (% people felt burdened a lot)	1. Training background Self/professional				2. Level of disabilities (mobility service dog) ADL scores I/II/III				3. Types of service dogs Mobility/medical/psychiatric service dogs			
	Pro	Self			Activity of daily living (ADL) score				Mobility SD/only mobility disability	Medical SD/only medical disability	Psychiatric SD/only psychiatric disability	
	(*n* = 73)	Immature (*n* = 33)	Mature (*n* = 43)	*p*	I: 0–60 (*n* = 30)	II: 61–90 (*n* = 44)	III: 91–100 (*n* = 29)	*p*	(*n* = 103)	(*n* = 25)	(*n* = 38)	*p*
Poor matching	0.0	0.0	0.0	–	4.5 (0.0)	0.0	5.0 (0.0)	–	2.8 (0.0)	5.3 (0.0)	4.3 (0.0)	–
Allergy/asthma	8.3 (0.0)	3.7 (0.0)	10.7 (0.0)	–	9.5 (0.0)	9.1 (0.0)	15.4 (0.0)	–	11.3 (0.0)	15.0 (0.0)	3.2 (0.0)	–
Lack of skill for assistance	8.8 (0.0)	23.1 (0.0)	12.9 (0.0)	–	8.7 (0.0)	6.0 (3.0)	13.0 (0.0)	–	8.9 (1.3)	9.5 (0.0)	26.1 (0.0)	–
Daily care	13.6 (1.5)	3.7 (0.0)	10.8 (0.0)	–	25.0 (0.0)	8.1 (0.0)	11.5 (3.8)	–	14.3 (1.1)	0.0	17.1 (0.0)	–
Responsibility	14.9 (0.0)	16.7 (3.3)	13.9 (2.8)	–	17.9 (3.6)	18.4 (2.6)	7.7 (0.0)	–	15.2 (2.2)	16.7 (0.0)	17.1 (2.9)	–
Team up	26.9 (3.0)	24.1 (0.0)	18.2 (0.0)	–	35.7 (0.0)	16.2 (2.7)	11.5 (3.8)	–	20.9 (2.2)	34.8 (0.0)	34.3 (2.9)	–
Negative effect on family	5.0 (0.0)	31.0 (0.0)	19.4 (3.2)	a	16.0 (4.0)	17.6 (0.0)	24.0 (0.0)	–	19.0 (1.2)	13.6 (4.5)	26.7 (3.3)	–
Ignore commands	13.1 (0.0)	32.0 (0.0)	22.6 (0.0)	–	25.9 (0.0)	20.7 (0.0)	20.0 (0.0)	–	22.2 (0.0)	21.7 (0.0)	25.0 (0.0)	–
Team training	31.3 (9.0)	42.1 (0.0)	25.8 (0.0)	–	38.5 (0.0)	24.2 (9.1)	25.0 (6.3)	–	29.3 (5.3)	25.0 (0.0)	38.9 (5.6)	–
Daily training	26.2 (2.4)	43.3 (0.0)	25.8 (0.0)	–	22.2 (0.0)	28.6 (2.9)	25.0 (0.0)	–	25.6 (1.2)	22.7 (0.0)	44.8 (0.0)	–
Disease	28.0 (4.0)	30.4 (0.0)	6.5 (0.0)	–	58.3 (16.7)	20.7 (6.9)	16.0 (4.0)	f	30.8 (9.0)	31.6 (0.0)	35.5 (6.5)	–
House cleaning	25.0 (1.7)	14.3 (0.0)	40.5 (2.7)	–	24.0 (0.0)	42.9 (2.9)	28.0 (0.0)	–	32.9 (1.2)	30.4 (4.3)	18.2 (0.0)	–
Behavior problems	18.6 (0.0)	53.8 (0.0)	19.4 (0.0)	b	25.0 (0.0)	31.4 (0.0)	20.8 (0.0)	–	26.5 (0.0)	40.9 (0.0)	41.9 (0.0)	–
Physical maintenance	33.9 (6.5)	34.5 (0.0)	30.6 (2.8)	–	38.5 (3.8)	41.7 (2.8)	34.6 (3.8)	–	38.6 (3.4)	29.2 (0.0)	28.6 (0.0)	–
Travel arrangement	34.4 (3.3)	66.7 (6.7)	57.1 (2.9)	c	42.3 (0.0)	38.2 (2.9)	40.7 (7.4)	–	40.2 (3.4)	52.2 (8.7)	54.5 (0.0)	–
Expense	42.4 (1.5)	38.7 (0.0)	57.9 (2.6)	–	50.0 (3.6)	43.2 (2.7)	44.4 (3.7)	–	45.7 (3.3)	41.7 (4.2)	61.1 (5.6)	–
Public access	52.3 (0.0)	50.0 (10.0)	70.3 (8.1)	d	46.4 (0.0)	45.9 (5.4)	68.0 (8.0)	–	52.2 (4.4)	66.7 (8.3)	62.9 (8.6)	–
Unwanted attention	53.7 (7.5)	70.0 (6.7)	67.6 (29.7)	e	46.4 (10.7)	60.5 (13.2)	69.2 (15.4)	–	58.7 (13.0)	52.2 (17.4)	83.3 (13.9)	g
Death	65.4 (21.2)	66.7 (25.9)	88.6 (45.7)	–	85.2 (33.3)	65.5 (34.5)	58.3 (37.5)	–	70.0 (35.0)	75.0 (20.0)	77.8 (27.8)	–
Petting by strangers	81.8 (13.6)	80.0 (30.0)	83.8 (27.0)	–	67.9 (14.3)	73.0 (21.6)	84.6 (23.1)	–	74.7 (19.8)	97.0 (13.0)	86.1 (33.3)	—

Numbers show percentages of partners who felt burdened at any level with each item. The numbers in parenthesis show percentages of partners who felt burdened a lot with each item. The p-value is not reported if > 0.05.

a: $X^2(6) = 16.6$, $p = 0.014$, Cramer's V = 0.26, Radj: immature SelfSD-no (−2.8); immature SelfSD-yes, a little (3.3); pro-no (3.1); pro-yes, a little (−2.6)

b: $X^2(4) = 15.2$, $p = 0.004$, Cramer's V = 0.26, Radj: immature SelfSD-no (−3.5); immature SelfSD-yes, a little (2.6); immature SelfSD-yes, a moderately (2.6); pro-no (2.0)

c: $X^2(6) = 15.9$, $p = 0.007$, Cramer's V = 0.25, Radj: immature SelfSD-no (−2.3); immature SelfSD-yes, a little (2.0); mature SelfSD-yes, moderately (2.7); pro-no (3.0); pro-yes, moderately (−2.5)

d: $X^2(6) = 14.2$, $p = 0.027$, Cramer's V = 0.23, Radj: immature SelfSD-yes, a little (−2.0); mature SelfSD-no (−1.95); pro-yes, a lot (−2.5); pro-yes, a moderately (−2.0)

e: $X^2(6) = 18.0$, $p = 0.006$, Cramer's V = 0.26, Radj: immature SelfSD-yes, moderately (2.2); mature SelfSD-yes, a lot (3.4); pro-yes, a lot (−2.0)

f: $X^2(6) = 16.3$, $p = 0.012$, Cramer's V = 0.40, Radj: I-yes, a lot (−3.5); I-yes, moderately (3.3)

g: $X^2(6) = 14.7$, $p = 0.023$, Cramer's V = 0.22, Radj: psychiatric-no (−2.8); psychiatric-yes, moderately (3.1).

comparison groups, no significant differences in these durations were confirmed.

Responsibility and Care for the Dog

Most participants had responsibility for their dogs (I: 82.8%, $n = 24$; II: 94.9%, $n = 37$; III: 96.4%, $n = 27$; mobility SD: 91.7%, $n = 88$; medical SD: 100%, $n = 25$; psychiatric SD: 89.2%, $n = 33$) and took care of them by themselves (I: 17.2%, $n = 5$; II: 50.0%, $n = 20$; III: 60.7%, $n = 17$; mobility SD: 43.3%, $n = 42$; medical SD: 72.0%, $n = 18$; psychiatric SD: 59.5%, $n = 22$). However, mobility SD with severe disabilities took care of their dogs by themselves significantly less than expected, and they more often shared the care with other people or totally depended on others for the care [$X^2(2) = 12.2$, $p = 0.002$, Cramer's $V = 0.36$, R_{adj}: I-taking care of the dog by themselves (−3.4); I-sharing the care with other people/totally depending on others for the care (3.4); III-taking care of the dog by themselves (2.2); III-sharing the care with other people/totally depending on others for the care (−2.2)].

Dogs' Tasks and Working Environments

The tasks performed by the service dogs differed depending on the severity of the disabilities among their mobility SD partners. Those with severe disabilities mentioned the following tasks significantly more than expected: barking on command [I: 20.7%, $n = 6$; II: 10.0%, $n = 4$; III: 0.0%, $X^2(2) = 6.6$, $p = 0.037$, Cramer's $V = 0.26$, R_{adj}: I-yes (means the SD performed the task) (2.2); I-no (means the SD did not perform the task) (−2.2); III-yes (−2.1); III-no (2.1)], calling someone [I: 31.0%, $n = 9$; II: 15.0%, $n = 6$; III: 3.6%, $n = 1$, $X^2(2) = 7.9$, $p = 0.019$, Cramer's $V = 0.29$, R_{adj}: I-yes (2.5); I-no (−2.5); III-yes (−2.2); III-no (2.2)], helping to take off clothes [I: 37.9%, $n = 11$; II: 30.0%, $n = 12$; III: 3.6%, $n = 1$, $X^2(2) = 10.0$, $p = 0.007$, Cramer's $V = 0.32$, R_{adj}: I-yes (2.0); I-no (−2.0); III-yes (−3.1); III-no (3.1)], opening/closing doors [I: 75.9%, $n = 22$; II: 50.0%, $n = 20$; III: 21.4%, $n = 6$, $X^2(2) = 16.9$, $p < 0.001$, Cramer's $V = 0.42$, R_{adj}: I-yes (3.4); I-no (−3.4); III-yes (−3.5); III-no (3.5)], retrieving dropped objects [I: 89.7%, $n = 26$; II: 95.0%, $n = 38$; III: 75.0%, $n = 21$, $X^2(2) = 6.2$, $p = 0.044$, Cramer's $V = 0.25$, R_{adj}: III-yes (−2.4); III-no (2.4)], and retrieving objects out of reach [I: 72.4%, $n = 21$; II: 55.0%, $n = 22$; III: 35.7%, $n = 10$, $X^2(2) = 7.7$, $p = 0.021$, Cramer's $V = 0.28$, R_{adj}: I-yes (2.3); I-no (−2.3); III-yes (−2.4); III-no (2.4)]. In contrast, mobility SD partners with slight disabilities or independent in ADL chose the following tasks significantly more than expected: helping to stand up [I: 6.9%, $n = 2$; II: 35.0%, $n = 14$; III: 53.6%, $n = 15$, $X^2(2) = 14.6$, $p < 0.001$, Cramer's $V = 0.39$, R_{adj}: I-yes (−3.5); I-no (3.5); III-yes (2.9); III-no (−2.9)], and supporting balance [I: 13.8%, $n = 4$; II: 42.5%, $n = 17$; III: 89.3%, $n = 25$, $X^2(2) = 33.2$, $p < 0.001$, Cramer's $V = 0.59$, R_{adj}: I-yes (−4.3); I-no (4.3); III-yes (5.3); III-no (−5.3)]. Furthermore, mobility partners with moderate disabilities chose pulling my wheelchair significantly more than expected [I: 6.9%, $n = 2$; II: 25.0%, $n = 10$; III: 7.1%, $n = 2$, $X^2(2) = 6.2$, $p = 0.046$, Cramer's $V = 0.25$, R_{adj}: II-yes (2.5); II-no (−2.5)]. The tasks of carrying objects (I: 48.3%, $n = 14$; II: 45.0%, $n = 18$; III: 46.4%, $n = 13$) were frequently chosen by each group of mobility SD partners.

Medical SD partners frequently mentioned tasks of: alerting to a problem with blood sugar (64.0%, $n = 16$), alerting to seizures, calling someone, and retrieving objects out of reach (each 20.0%, $n = 5$). Psychiatric SD partners often reported the following tasks: giving tactile stimulation for psychiatric symptoms (83.8%, $n = 31$), alerting to incipient anxiety or panic attack (78.4%, $n = 29$), reminding to take medication, and helping to stand up (each 24.3%, $n = 9$).

Concerning their dogs' working environments, most participants answered that tasks both inside and outside of the house were important (I: 93.1%, $n = 27$; II: 90.0%, $n = 36$; III: 82.1%, $n = 23$; mobility SD: 88.7%, $n = 86$; medical SD: 88.0%, $n = 22$; psychiatric SD: 76.3%, $n = 29$). Very few participants considered only the tasks inside of the house as being important (I: 6.9%, $n = 2$; II: 5.0%, $n = 2$; III: 3.6%, $n = 1$; mobility SD: 5.2%, $n = 5$; medical SD: 4.0%, $n = 1$; psychiatric SD: 0.0%).

Alleviating Discomfort in Meeting Strangers

More than half of the participants in all groups but medical SD partners experienced discomfort when they meet strangers outside of the house (I: 58.6%, $n = 17$; II: 72.5%, $n = 29$; III: 60.7%, $n = 17$). Psychiatric SD partners reported this significantly more than expected [mobility SD: 64.9%, $n = 63$; medical SD: 48.0%, $n = 12$; psychiatric SD: 100%, $n = 37$, $X^2(2) = 23.0$, $p < 0.001$, Cramer's $V = 0.38$, R_{adj}: medical-yes (−2.7); medical-no (2.7); psychiatric-yes (4.5); psychiatric-no (−4.5)]. More than half of the people who experienced discomfort felt it was alleviated frequently or often with the presence of their dog (I: 82.4%, $n = 14$; II: 79.3%, $n = 23$; III: 76.5%, $n = 13$; mobility SD: 51.5%, $n = 50$; medical SD: 58.3%, $n = 7$; psychiatric SD: 89.2%, $n = 33$). There were no statistically significant differences about this among/between the groups.

Dogs' Problem Behaviors and Burdens Experienced When Living With a Service Dog

The problem behaviors of dogs experienced did not differ between or among the groups. Those having problem behaviors of their dogs at the time of the survey were: I: 6.9%, $n = 2$; II: 12.5%, $n = 5$; III: 10.7%, $n = 3$; mobility SD: 10.3%, $n = 10$; medical SD: 16.0%, $n = 4$; psychiatric SD: 13.5%, $n = 5$; and earlier had experienced problem behaviors: I: 17.2%, $n = 5$; II: 17.5%, $n = 7$; III: 10.7%, $n = 3$; mobility SD: 15.5%, $n = 15$; medical SD: 20.0%, $n = 5$; psychiatric SD: 27.0%, $n = 10$.

Table 3 summarizes the burdens each group reported, listed from least to most frequently reported. Mobility SD partners with severe disabilities felt burdened moderately with diseases of their dogs significantly more than expected. Psychiatric SD partners felt burdened with unwanted attention from others significantly more than expected. No statistically significant differences were seen between/among other comparison groups.

Satisfaction With the Dog and Impacts on Their Family Members

Participants rated their levels of satisfaction with their dogs, selecting from 0, 25, 50, 75, and 100%. Most participants answered that they were satisfied with their dog at 100% (I: 86.2%, $n = 25$; II: 87.5%, $n = 35$; III: 89.3%, $n = 25$; mobility

SD: 87.6%, $n = 85$; medical SD: 83.3%, $n = 20$; psychiatric SD: 77.8%, $n = 28$). No statistically significant differences were seen between/among the groups.

The participants rated the impacts of their dogs for family members. Concerning the family's satisfaction with their dogs, most of the participants answered that their family members felt somewhat satisfied with their dogs, which was most commonly reported by the mobility SD partners with severe disabilities (I: 100%, $n = 29$; II: 95.0%, $n = 38$; III: 96.4%, $n = 27$; mobility SD: 96.9%, $n = 94$; medical SD: 95.8%, $n = 23$; psychiatric SD: 88.9%, $n = 32$). For the family's burden on taking care of dogs, some of the participants indicated that their family members felt somewhat burdened; mobility SD partners with severe disabilities also most commonly reported this burden (I: 31.0%, $n = 9$; II: 25.0%, $n = 10$; III: 21.4%, $n = 6$; mobility SD: 25.8%, $n = 25$; medical SD: 16.7%, $n = 4$; psychiatric SD: 19.4%, $n = 7$). Furthermore, more than 60% of the participants answered that their family members relaxed more than before they acquired the dog: again most often reported by the mobility SD partners with severe disabilities (I: 89.7%, $n = 26$; II: 77.5%, $n = 31$; III: 67.9%, $n = 19$; mobility SD: 78.4%, $n = 76$; medical SD: 87.5%, $n = 21$; psychiatric SD: 77.8%, $n = 28$). About the frequency of family going out of the house, some of the participants reported that their family members went out of the house more frequently than before: also most often reported by the mobility SD partners with severe disabilities (I: 55.2%, $n = 16$; II: 32.5%, $n = 13$; III: 39.3%, $n = 11$; mobility SD: 41.2%, $n = 40$; medical SD: 29.2%, $n = 7$; psychiatric SD: 52.8%, $n = 19$). However, there were no statistically significant differences between/among the groups.

DISCUSSION

Clarifying the expanded roles of service dogs in the U.S., service dog partners with various backgrounds and disabilities, dogs' training backgrounds, and types of service dogs described their experiences. Results on comparisons of dogs with different training backgrounds are discussed first (Comparison 1), and then results from the comparisons related to the person's severity of mobility disabilities and the different types of service dogs (Comparisons 2 and 3).

Comparison 1: Training Background of Dogs (Self-Trained and Professionally Trained)

Partners' experiences with service dogs differed depending on the training backgrounds: training by their partners, or professional trainers. The time required for dogs to start performing the expected tasks was longer with self-trained service dogs (SelfSD) than professionally trained service dogs (ProSD). This was a natural result of ProSD being placed with their human partners after they already had completed their training as service dogs.

Demographic Differences

The demographics differed between the SelfSD and ProSD; SelfSD partners had more psychiatric disabilities and fewer mobility disabilities compared to ProSD partners. Thus, the SelfSD partners had higher ADL scores, but lower scores on the mental component summary in the SF-36 than the ProSD partners. People with psychiatric disorders may prefer to train their service dogs by themselves, as was recommended by Dr. Joan Esnayra, the founder of the Psychiatric Service Dog Society. This organization formerly provided useful information about training and utilization of psychiatric service dogs. She presented some advantages of self-training one's own service dog: people can choose a favorite breed and strengthen a relationship by raising the dog from a puppy; and dogs learn the partners' physical and behavioral characteristics through this process (19). However, there are also some disadvantages of training one's own service dog. For example, the failure rate of service dogs with self-training is very high. Another concern is that it is hard to decide that one's own dog is not suitable as a service dog because of being too emotionally invested to make a decision (20). But in some cases, people may decide to train their pet dogs after they have demonstrated a suitable temperament or even exhibited helpful behaviors for supporting disabilities. SelfSD included more small dogs compared to ProSD; service dog training facilities often use large breeds like Labrador Retrievers and Golden Retrievers. Furthermore, the self-training was more frequent in mobility SD partners with slight disabilities or independent in ADL than mobility SD partners with severe and moderate disabilities. As discussed later, service dogs that are not fully trained are more likely to show behavior problems; thus, the partners of self-trained dogs experienced more burdens with behavior problems than trained service dogs. Therefore, people with more severe physical disabilities may not choose self-training.

Perceived Changes After Acquiring Their Service Dogs, Including Alleviating Discomfort in Meeting Strangers

A majority of partners in the three groups experienced positive changes in leaving home, making new friends, independence, life satisfaction, and loneliness after they acquired their service dogs, indicating that the training background of service dogs does not preclude the experienced benefits for service dog partners. However, although mature SelfSD partners experienced increased self-esteem significantly more, immature SelfSD partners experienced no changes significantly more than expected. Furthermore, immature SelfSD partners experienced less benefit of their dogs alleviating discomfort in meeting strangers compared with ProSD and mature SelfSD partners. Therefore, more positive changes can be acquired after service dogs are fully trained. Marshall (19) also reported that the number of diagnosis-specific tasks performed by psychiatric service dogs was associated with significantly decreased partners' use of psychiatric medications for partners with major depressive disorder and PTSD. Although many studies have shown psychological benefits of service dogs (5, 8, 21–26), it was not clear whether these psychosocial benefits are due specifically to the dogs' assistance as service dogs, or whether companion animals would have similar effects. These results of less benefit with immature SelfSD suggest that companion

animals provide fewer psychosocial benefits than well-trained service dogs.

Dogs' Problem Behaviors and Burdens of Living With a Service Dog

Consistently, ProSD partners experienced significantly less burdens compared to immature and/or mature SelfSD partners with behavior problems, travel arrangement, unwanted attention, and negative effects on family members. These different levels of perceived burdens may result from SelfSD not being fully trained yet, so there may have been some difficulties in handling the less-trained dogs. This indicates that SelfSD partners experienced more burdens in the first few years, whereas ProSD partners avoided some of these burdens by receiving fully-trained service dogs. Also, it was shown that ProSD partners lived with large dogs more often than the immature and mature SelfSD partners. Traditional service dogs are usually large breeds, like Labrador Retrievers and Golden Retrievers; many large service dog training facilities use these breeds. Members of the public may look at smaller SD skeptically because of the recent increase in fake service dogs. Awareness of fraudulent service dogs may cause difficulties when SelfSD partners take their dogs in public settings.

Satisfaction With the Dogs and Impacts on Their Family Members

ProSD partners reported their family members as satisfied with their service dogs significantly more than expected. Similar to the partners' experienced benefits, family members experienced less benefit when their SDs were not fully trained.

Comparisons 2 and 3: The Severity of Partners' Mobility Disabilities, and the Types of Service Dogs

Overall, the various categories of service dog partners experienced physical, psychological, and social benefits as reported previously by traditional service dog partners. The common benefits shared by the groups are discussed first, and then the differences among the groups.

Paid/Unpaid Assistance and Expenses

A few studies have examined changes in expenses associated with acquiring service dogs (5, 27); however, the previously reported results are inconsistent. In the randomized clinical trial of Allen and Blascovich, they reported that the presence of a service dog was associated with a decrease of approximately 60 bi-weekly paid assistance hours, 12 months following the acquisition of the service dog. They calculated that the annual reduction of expense would be about $10,000 when the hourly expense was estimated at $8 (27). A retrospective study of Fairman and Huebner found that paid assistance declined by ∼2 h per week after acquiring the service dog, for a reduction of $600 per year (5). Other papers reported that acquiring service dogs increased the financial burden with expenses for the dogs (4, 8). The report by Allen and Blascovich contrasts with the other studies that reported results similar to ours: service dog partners experienced only a small decrease in paid assistance hours after acquiring their dogs.

Interestingly, although participants reported some small reductions of paid/unpaid assisting hours, about half answered that there were no overall changes in expenses when they considered the total combined expenses for paid assistance and dogs. This suggests that the expenses for the dog were somehow balanced or compensated by a reduction in assistance costs. One explanation for some reduced assistance could be increased independence of the service dog partners leading to increased attendance at work as mentioned later. Mobility SD and psychiatric SD partners reported an increase in attending their school/work more often than medical SD partners; similarly among mobility SD and psychiatric SD partners, the reported reduction in total expenses was slightly greater than what medical SD partners reported. This may explain the reduced assistance compensating for the expenses for dogs, or even a reduction of expenses in total. Another possibility is that family members had increased free time caused by the reduction of unpaid assisting hours. The family members then may have been more able to go to work using their increased free time. This indicates that the financial benefits associated with having service dogs may relate to increased employment or working time rather than decreased paid assistance time.

Participation in Society and Psychological Benefits

More than 70% of participants appreciated as a benefit their service dog facilitating them in making new friends. Increased participation in society and interactions with others after the acquisition of their dog were frequently reported; this is consistent with previous studies on assistance dogs (4–9). Individuals who have adequate social relationships, including three major components of a high degree of integration in social networks, social interactions that are intended to be supportive, and beliefs and perceptions of support availability held by the individual, are reported to enjoy a 50% greater likelihood of survival compared to those with poor or insufficient social relationships (28). Service dogs acting as a lubricant of social relationships over time may provide a great impact on the health of people living with them.

It is worth mentioning that 38.1% of mobility SD partners and 60.5% of psychiatric SD partners reported that the frequency of them attending to their school/work increased after the acquisition of their service dog. Reviewing the benefits of assistance dogs, Sachs-Ericsson et al. reported a trend for increased employment among assistance dog partners (23). While our survey did not specify new vs. ongoing employment, our results show an impact of assistance dogs in facilitating the partners going to school/work more frequently.

The psychological benefits experienced by each type of service dog partner were consistent with the benefits reported by traditional mobility service dog partners (5, 8, 9). For the participants who had felt discomfort when meeting others in public, the presence of their dogs helped to alleviate such feelings. All 37 participants with psychiatric service dogs experienced discomfort when meeting people in public; the dog alleviated this discomfort for almost all ($n = 33$), but a strong majority

($n = 30$) still felt burdened by unwanted attention. People with disabilities experience stigma related to their disabilities, and the negative public attitudes for their disabilities can add burdens in their daily lives, making it difficult for them to interact with others and/or participate in social activities (29, 30). Dogs provide the robust benefit of facilitating social interactions for their handlers, such as increased conversations with strangers and positive reactions from others (31). In addition, interactions with dogs have been shown experimentally to reduce the handler's cortisol and increase oxytocin, suggesting that the interactions decreased stress (32, 33). In stressful situations, people with dogs were reported to experience lower anxiety and less negative affect as compared to those without dogs (34). These dogs' layers of benefits—changing the people's reactions in positive ways, alleviating perceived stress psychologically and physiologically—would help in diminishing/decreasing the discomfort when meeting others in public.

Impacts for Family Members

The results indicated that the family members of service dog partners also benefited from the dogs. More than half of the participants answered that their family member went out of the house more frequently than prior to them acquiring the dog. The introduction of a service dog also led to more relaxation for their family members. These benefits are consistent with previous studies based on traditional service dogs (25, 35) and other types of assistance dogs (36) and may reflect some general characteristics of service dogs. Firstly, in emergencies, service dogs operate as a life-line for their partners with disabilities. Some service dogs were trained to call someone, retrieve objects, such as a cell phone that is out of reach, and bark on command, and these special commands were used more frequently by the mobility SD partners with severe disabilities than mobility SD partners with slight or independent in ADL and moderate disabilities. Family members of persons with severe disabilities can gain a secure feeling, knowing that the dogs can help their family members with disabilities when in need, allowing their family members then to leave home easily without having major concerns. Secondly, the increased independence the dogs provide participants would decrease the requirement for unpaid assistance and thus increase the free time of their family members. Thirdly, the acquisition of a dog would naturally have increased the frequency of going outside: dogs need exercise and outdoor toileting. Going outdoors may especially increase for the family members who share the care of the dog with the partners who have disabilities. The mobility SD partners with severe disabilities reported these benefits for family members at the highest level among the groups. The benefits of service dogs for family members may differ, reflecting the severity of the partners' disabilities and how much assistance they require from their family members.

Taking care of service dogs is a negative burden when acquiring service dogs. Davis et al. (4) showed that the family members spent 6.2 h for the dogs' care weekly; 25% of the participants felt burdened by this time expenditure. Mobility SD partners with severe disabilities more frequently than other groups reported that their family members felt the burden of caring for the dogs. Partners with severe disabilities perhaps more often share the care of dogs with others, or even totally depend on others, as compared with participants in other groups. People with severe disabilities in particular need good support and understanding from others.

The following sections discuss results where there were significant differences between/among the groups.

Levels of Disabilities

The mobility SD partners with slight disabilities or independent in ADL trained their dogs by themselves more often than the mobility SD partners with moderate and severe disabilities. Those with more independence may choose to train their dogs by themselves rather than being delayed until a suitable dog is available.

Mobility SD partners with severe disabilities had greater concerns than others about service dogs prior to acquiring their dogs. Providing care for the dogs was a primary concern reported by more than half of them. In a study of Japanese people who had visual, hearing, and orthopedic disabilities and did not live with assistance dogs, the perceptions toward assistance dogs also focused on the concern of care for dogs, particularly by people with visual and orthopedic disabilities more often than people with hearing disabilities (36). The concern for care of the dogs would be a natural reaction for people who have disabilities that restrict their mobility. However, in this study the mobility SD partners with severe disabilities who actually felt burdened by the daily care for a dog was about 25%; this percentage was less than those who had been concerned about the care (52%). The mobility SD partners with severe disabilities often acquired professionally trained service dogs, and then shared the care of the dog with others or totally depended on others more often than other groups. Finding enough support and establishing an effective process for care would have reduced the burden of care for the dogs. The mobility SD partners with severe disabilities experienced moderate burdens with disease of dogs significantly more than expected. When dogs get sick, they may not be able to perform tasks their partners require. Instead, more care for the dogs may be necessary. For mobility SD partners with severe disabilities, who often share the care of their dogs with others or totally depend on others, such situations may be more challenging.

Types of Service Dogs

Psychiatric SD partners trained their dogs by themselves more often than mobility SD and medical SD partners. The psychiatric SD took longer to perform the expected tasks effectively compared to mobility SD; this is expected because more psychiatric SD partners trained their dogs by themselves.

Psychiatric SD partners most often reported their dogs decreasing their discomfort when meeting others. Various types of symptoms occur with psychiatric disorders, including, for some people, feeling anxiety when they interact with others, such as social anxiety disorder that is commonly reported (37).

In the last decade, the U.S. experienced an increase of Emotional Support Animals (ESAs) that support people with psychiatric disabilities but are not required to be trained to

provide tasks (11). Some of the benefits of dogs reported by the psychiatric SD partners might also occur for people living with ESAs. However, psychiatric SD partners most commonly reported the perceived burden of unwanted attention from others. For some people who have challenges in interacting with others, the dog may help to alleviate their discomfort, but at the same time the dog can also increase the interaction with others, including causing unwanted attention. It may be important for people who consider having a psychiatric SD or ESA to understand this attention caused by the presence of a dog that can be experienced as either a benefit or a burden by the partner.

The experienced improvements in social activities, including the frequency of going to school/work and leaving home, after the acquisition of service dogs, were the lowest among the medical SD partners compared to mobility SD and psychiatric SD partners. Although mobility SD support the mobility of the partners and psychiatric SD decrease the discomfort of the partners interacting with others (both of which directly relate to improving the outdoor activities), the tasks performed by medical SD are not specifically related to going out of the house. Also, the disabilities of medical SD partners previously may not have prevented them from leaving their homes as much as the disabilities of mobility SD and psychiatric SD partners. Therefore, although the survey did not track new vs. ongoing employment, medical SD partners already may have been engaged in school/work and leaving home even before acquiring their service dogs, as compared with mobility SD and psychiatric SD partners.

CONCLUSIONS

This study investigated the experiences of service dog partners who have various types and severities of disabilities and live with service dogs filling different roles. Participants with disabilities reported benefits of service dogs for themselves and their family members similar to those reported by the previous studies focusing on traditional service dogs. The basic benefits were consistent across the varied types of partners' disabilities and service dogs. However, the degrees of the benefits, concerns, and burdens slightly differed among/between the groups. In addition, the comparisons among dogs with different training histories showed that the experiences with service dogs differed greatly between ProSD partners and SelfSD partners, especially when their dogs were not fully trained. Therefore, a personalized assessment and plan is required to maximize the benefits and minimize the burdens and concerns of living with service dogs based on each person's disabilities and situation, and the potential outcomes reported in this study.

Since participation in this study was voluntary, people with positive experiences may have been more likely to participate. In addition, the retrospective answers may not accurately reflect their actual experiences with their service dogs. For greater understanding and objective outcomes regarding the new types of service dogs, a prospective study focusing on each specific population may be required.

DATA AVAILABILITY

All datasets generated for this study are included in the manuscript.

ETHICS STATEMENT

The University of California Davis Institutional Review Board Protocol #340095-2 approved the study. Participation was anonymous and voluntary, therefore no written informed consent was given. Participants will not be informed individually about the accepted publication, as this study was conducted anonymously.

AUTHOR CONTRIBUTIONS

MY and LH, the two authors, equally contributed to study conception, design of the questionnaire, and overall study design. MY mainly worked to acquire and analyze the data, and drafted the article. LH offered critical and constructive advice throughout the data collection and drafting the article.

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The Use of Service Dogs for People With Physical Disabilities in Japan in Accordance With the Act on Assistance Dogs for Physically Disabled Persons

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Japan learnt how to promote assistance dogs effectively by deliberating the issues and challenges that surrounded assistance dogs in the USA and Europe and the Act on Assistance Dogs for Physically Disabled Persons was issued in 2002. The aim of this paper is to provide information that may be useful for countries and areas that are seeking ways to regulate assistance dogs, especially in the context of the global problem in which dogs are falsely claimed to assist their partners. First, there is a description of the process through which Japan, where pet dogs have not been accepted in society, established the Act, which overcame the shortcomings of the previous situation. Second, it is shown the ways in which people living with assistance dogs have gained the right to have their dogs accompany them in public. Third, the current challenges faced by people with assistance dogs are documented. Finally, pictures of an example of an assistance dog certificate and of an assistance dog sign reveal how far the regulation of assistance dogs is achieved in Japan.

Keywords: assistance dog, Japan, service dog, guide dog, hearing dog, people with disabilities, act on assistance dogs

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INTRODUCTION

The first guide dog was domestically trained in Japan in 1957, 60 years ago (1). Training for service and hearing dogs began in the 1990s and 1981, respectively (2, 3). Japan adopted the philosophy of training dogs and using them to assist people with disabilities from the USA and other European countries. However, initially it was difficult for assistance dogs to gain acceptance in Japan because historically, people in that country had a different relationship with dogs compared to people in the West. Dogs had not been trained to fit in human society in Japan (4). Generally, people used them as watch dogs; placing them on a leash outside the house. The importance of training friendly, socialized dogs was recognized only relatively recently, in the late 1990s (4). Therefore, there were many obstacles that were unique to Japan that had to be overcome before assistance dogs could be used in Japan. Japan learnt how to promote assistance dogs effectively by deliberating the issues and challenges that surrounded assistance dogs in the USA and Europe. This is evident through the establishment of the Act on Assistance Dogs for Physically Disabled Persons in Japan on May 22, 2002 (5), whose stated goal was to facilitate the growth of the quality of assistance dogs

and the use of public facilities for people with physical disabilities, with a view to contributing to the independence and social participation of such individuals. The act also stipulates the responsibilities of society, assistance dogs training organizations, certifying organizations, and assistance dog partners (**Figure 1**).

Similar to Japan, some countries and states, such as Taiwan and Queensland, Australia, respectively, have established laws that define the standards and certification of assistance dogs (6–8). However, such laws do not exist in most countries. The US and some European countries recognize only the right of people with disabilities to have their assistance dogs accompany them in places where pet dogs are not allowed under the law (9, 10). In countries where regulations regarding assistance dogs or consensus regarding best practices on raising assistance dogs (11–13) do not exist, falsely claimed assistance dogs and assistance dogs of poor quality have become a serious problem (14, 15). This paper describes the process of Japan's establishment of the Act on Assistance Dogs for Physically Disabled Persons. The establishment of this Act overcame the shortcomings of previous situations, and people living with assistance dogs have gained the right to have their dogs accompany them in public. However, these people still face challenges. The aim of this paper is to provide information that may be useful for countries and areas that are seeking ways to regulate assistance dogs.

Prior to the issue of the Act on Assistance Dogs for Physically Disabled Persons, assistance dogs other than guide dogs were treated in the same way as pet dogs. Moreover, assistance dogs were not allowed in public. The public access of guide dogs and their partners was protected under the official notices of several government ministries, including the Ministry of Transport, the Ministry of Construction (currently merged in the Ministry of Land, Infrastructure, Transport and Tourism), the Ministry of the Environment, and the Ministry of Health and Welfare (16). However, these official notices did not have the force of law, and some people with guide dogs were still prevented from entering facilities (16). The Act on Assistance Dogs for Physically Disabled Persons has greatly improved this situation.

Before the act was established, pet dogs were not accepted (4). Hence, assistance dog owners lobbied to gain the right of public access. They submitted strong proposals for fulfilling their responsibilities for ensuring public health by preventing their dogs from spreading zoonotic diseases, destroying things, injuring, and threatening others. Hence, the process of certifying assistance dogs and their human partners was conducted in detail, which is explained later in this paper. People believed that in the certifying process, raising the hurdles would be more difficult than lowering them; therefore, they were set at a high level.

The act guarantees the participation of people with disabilities in Japanese society by specifying that facilities are not permitted to deny access to people who are accompanied by certified guide, service, and hearing dogs. The act can be thought of as disability discrimination legislation. It precedes the Act for Eliminating Discrimination Against Persons with Disabilities Act that was enforced in Japan in April 2016. According to the Act on Assistance Dogs for Physically Disabled Persons in Japan, a service and hearing dog training organization is required to register as a type 2 social welfare services at a local prefectural government. Currently, there are 26 training organizations for service dogs and 21 for hearing dogs, 14 of which train both types of dog (17). Nevertheless, a limited number of training organizations actually provide service and hearing dogs annually. Guide dogs have a longer history than the other two types of dog. Accordingly, they are trained by organizations that are designated by the National Public Safety Commission, of which there are currently 11 nationally (18).

The law also requires that organizations that are designated by the Minister of Health, Labor, and Welfare administer certification examinations to people with disabilities and their service or hearing dogs. Certification results if the examination can confirm that the assistance dog partners are in a position to assume responsibility for the health, hygiene, and behavior of their assistance dog when encountering society. There are seven organizations that certify service dogs and six organizations that certify hearing dogs. Among them are three organizations that also train service dogs and hearing dogs. The certification process does not apply to guide dogs. Appropriate training is given to guide dogs and their partners through the organizations designated by the National Public Safety Commission. After certification, they must carry their certificate on them at all times. The assistance dogs are also required to wear an assistance dog sign when exercising their right to access public and private spaces (**Figure 1**).

DEFINITION AND THE PRESENT CIRCUMSTANCES OF ASSISTANCE DOGS USED TO ASSIST PEOPLE WITH PHYSICAL DISABILITIES IN JAPAN

The Act on Assistance Dogs for Physically Disabled Persons in Japan defines assistance dogs as dogs that are trained with the aim of promoting the independence and social participation of people with disabilities. Three types of assistance dogs in Japan (guide dogs, service dogs, and hearing dogs) are used to aid people with visual impairment, impaired mobility, and hearing impairment, respectively. The disability of the assisted person is indicated on a physical disability certificate. The Japanese certificate adheres to the stipulations cited in the Law for the Welfare of People with Physical Disabilities. It is issued by a prefectural governor provided that a governor-certified medical doctor has determined that a person has met the diagnostic criteria and is thus eligible to be certified. Therefore, the certificate functions in a similar way to a passport because it proves that the certificate holder is entitled to receive several social welfare benefits, including medical expense subsidies, prosthetic devices, housing renovation costs to improve his or her living environment, a reduction in income tax, and discounted public transportation. The physical disability certificate identifies those who have a disability and those who are eligible to receive social welfare benefits. The Act on Assistance Dogs for Physically Disabled Persons is also based on this law, and it defines those who are eligible to own an assistance dog. The physical disability certificate supports the act. Some people with false assistance dogs may also claim that they have a disability

Facilitation of the use of facilities ← **Objective** → **Training high-quality assistance dogs**

Responsibilities of partners

- To carry a certificate[a] and put a sign[b] on a dog (a legal requirement).
- To manage and control the health and behavior of their dogs.

Assistance dogs

- Guide dogs
- Hearing dogs
- Service dogs

Responsibilities of assistance dog training organizations

- To perform type 2 social welfare services registration.
- To provide qualified dogs and collaborate with medical and veterinary services.
- To provide continuing support and re-training when necessary.

Certification by an organization designated by the Minister of Health, Labour, and Welfare

- This type of organization comprises public interest or social welfare corporations that provide training for or conduct research on assistance dogs.

Certification

Societal responsibilities in terms of granting public access to assistance dogs

Places that are required to accept dogs include:

- Public facilities that are managed by local or national public organizations, the offices of local or national public organizations, public transportation, and private businesses with ≥ 50 employees.
- Public facilities (i.e., commercial facilities, restaurants, hospitals, and hotels) that are used by the general public.

Places that could make an effort to accept assistance dogs include:

- Private businesses with ≤ 50 employees
- Private housing complexes

A An example of an assistance dog certificate

B An example of an assistance dog sign

FIGURE 1 | Overview of the act on assistance dogs for physically disabled persons. **(A)** The assistance dog certificate shows photographs of the dog service partner and his or her assistance dog; the name, date of birth, address, and contact information of the service dog partner; the name, date of birth, breed, hair color, hair

(Continued)

FIGURE 1 | texture, and registration number of the dog, in accordance with the rabies prevention law; the certification number and date; the name, address, and contact information of the designated corporation; and the name, address and contact information of the training organization. **(B)** The assistance dog sign indicates (from left to right) a guide, service, or hearing dog sign, with certification number and certified date; the breed of the dog; and the name, address, and contact information of the designated corporation that approved the certification.

even though they do not. The physical disability certificate can prevent such situations from occurring.

Nine hundred and forty-one working guide dogs were registered in Japan in March 2018; a considerable decline from 1,070 in 2011. Sixty-six service dogs and 67 hearing dogs were registered in the country in January 2019 (19). While service dogs in the USA and certain countries in Europe are trained to assist people with mental illness and autism, the provision of Japanese service dogs is only applicable to people with physical disabilities. Unlike guide and hearing dogs, the extent to which people have impaired mobility varies considerably, meaning that their needs also vary. Accordingly, rehabilitation professionals are tasked to determine the tasks for which the dogs must be trained, to match service dogs with partners, and advise on suitable ways in which partners can take care of and control their dogs. The current practices and use of service dogs in Japan are now covered.

Service Dog Uses

Classification of the disabilities of 70 dog assistance partners was shown to include neuromuscular disease (excluding stroke) (26%), cervical spine injuries (17%), spinal cord injuries (12%), cerebral infarction sequela (10%), and cerebral palsy (10%) in a recent study (20). The average age of the dog assistance partners ranged from 46 to 49 years, three quarters (71%) of whom were grade 1 certificate holders and 19% of whom were grade 2 holders. This indicates that 90% of the study subjects had severe mobility impairments. Classification of grade 1 or 2 in mobility disabilities according to the Law for the Welfare of People with Physical Disabilities is:

Grade 1 Impairment

Grade 1 impairment includes (1) upper limb impairment, i.e., total loss of function on both upper limbs or amputation above the wrist on both upper limbs; (2) lower limb impairment, i.e., total loss of function on both lower limbs or transfemoral (above-knee) amputation on both lower limbs; and (3) trunk impairment, i.e., the absence of balance while sitting.

Grade 2 Impairment

Grade 2 impairment includes (1) upper limb impairment, i.e., severe loss of function on both upper limbs, the amputation of five fingers on both hands, amputation above half-length of the humorous on one of the upper limbs, or total loss of function on one of the upper limbs; (2) lower limb impairment, i.e., the severe loss of function on both lower limbs or amputation above half-length of the lower thigh on both lower limbs; and (3) trunk impairment, i.e., difficulty sitting or standing, or difficulty standing up.

The accreditation of assistance dog-partner teams presupposes that the partners will take full responsibility for their assistance dogs when exercising their legal right to public access and that their dogs will not inconvenience others. Thus, each partner is evaluated for his or her suitability when acquiring an assistance dog. The evaluation is similar to that of a test for a driver's license. A thorough evaluation must be conducted by a group of professionals, including a rehabilitation physician, physiotherapist, and occupational therapist; to ensure various perspectives to determine whether or not the partner's quality of life and self-reliance would be improved by assistance from a service dog. For example, service dogs are particularly effective in improving the self-reliance of people with C6 cervical cord spinal injuries, and who constitute a large proportion of the population needing service dog partners in Japan. These dogs enable their partners to go out by themselves supported by equipment that has specifically been prepared by occupational therapists to cater to their needs. However, it has been found that the use of service dogs for partners with C5 injuries or above is unlikely to lead to enhanced independence. A secondary consideration is that partners with C5 injuries require substantial assistance in managing and caring for their service dogs.

The effective use of service dogs has been attributed to service dog partners with progressive diseases, including neuromuscular diseases, i.e., multiple sclerosis; severe myasthenia gravis; Becker muscular dystrophy; and spinal muscular atrophy. Nevertheless, ongoing disease monitoring must be performed for this patient group as, for example, it is thought that service dog partners experience a detrimental rather than a beneficial effect when there is rapid disease progression, i.e., occurring within a year or over several months. Once a service dog and partner have been paired, they receive team training at the partner's home or training center (**Figure 2**).

Public training extends to visits to stores, various amenities, and public transportation. The training is supervised by medical professionals because it must not exacerbate the service dog partner's medical condition. Service dogs are lent by training organizations free of charge to partners. However, it is the partner's responsibility to manage the daily health, sanitary, and general behavior of his or her service dog. This can pose a considerable strain for a partner if his or her medical condition is unstable.

Eligibility for Certification as a Service Dog Partner

Similar to the way in which it is necessary to evaluate the eligibility of an applicant for a driver's license or his or her ability to handle an electric wheelchair, an applicant wanting a service dog must be assessed for his or her ability to assume responsibility for that dog. This is achieved by undertaking and passing an assistance dog certificate examination. A flow chart of the certification procedure at the Yokohama City Rehabilitation Center details the steps that need to be taken

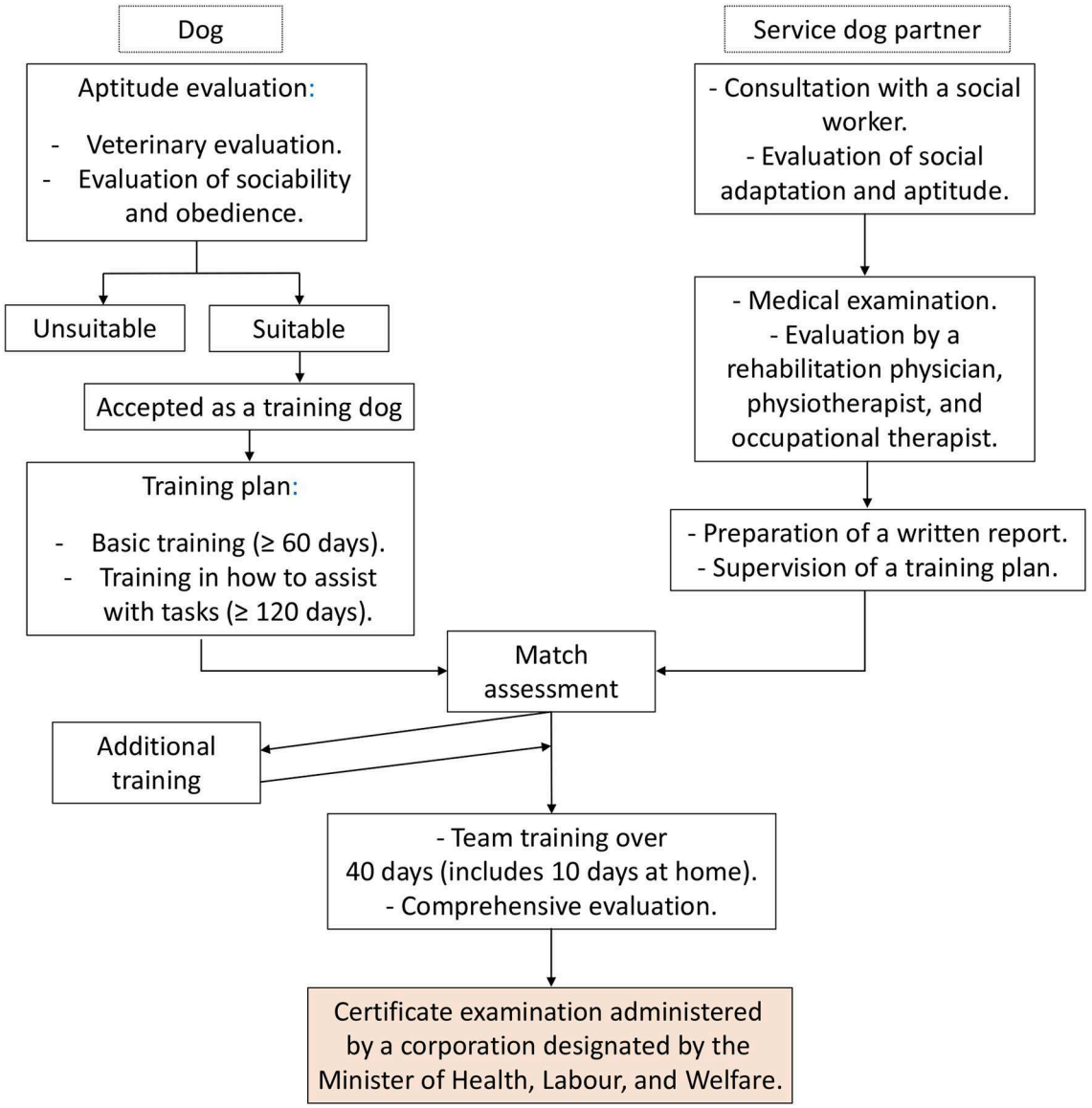

FIGURE 2 | A flow chart of the certification procedure at the Yokohama City Rehabilitation Center, Kanagawa, Japan. The upper left side of the flow chart depicts the training of a service dog, while the upper right side details the evaluation of a person in terms of eligibility for being a service dog partner. Team training only begins once the person is deemed to be eligible. The team is certified once it has passed a final certificate examination that is administered by a corporation that has been designated by the Minister of Health, Labor, and Welfare.

in this regard (**Figure 2**). Consultations are offered out at the Yokohama City, Nagoya City, Chiba Prefecture, and Hyogo Prefecture Rehabilitation Centers at which potential applicants are advised on how to become a service dog partner. Partners and their service dogs receive partial training, and certification is performed by a corporation that has been designated by the Minister of Health, Labor, and Welfare.

The ability of the accompanying service dog to comprehend and uphold the responsibilities in public is evaluated by a social worker or similarly qualified medical professional during the consultation process. If it is determined that the prospective partner lacks the intellectual, mental, developmental, or necessary brain capacity to provide proper and continuous care to the dog and/or optimally manage his or her health, the candidate will be informed that he or she is ineligible to partner with the service dog, even if the dog could be of help in certain situations. Above all, it is believed that the consultation service represents an opportunity to identify issues that might impede the quality of life of a prospective partner and determine what he or she expects from the service dog. This also provides the prospective partner with an opportunity to obtain useful information about related social welfare services

and equipment, as well as facilitate an assessment of his or her capacity for rehabilitation. Further information can be obtained in this regard, if required. The consultation process represents an opportunity to help people improve their quality of life by offering them opportunities that will facilitate their independence and social participation that include, but are not limited to, service dogs.

The Consultation Process, Service Dog Lending, and Follow-Up Support

Service dogs act as an important aid to partners. However, the process of acquiring a service dog is different to that involved in obtaining a prosthetic device. A prosthetic device is often recommended for people with disabilities by a rehabilitation specialist. Conversely, people with disability often request a service dog because rehabilitation specialists are not always familiar with this concept. People learn about service dogs through television, newspapers, and demonstrations at events held by training organizations. Having requested a service dog, the evaluation process is commenced by training organizations and professionals at designated rehabilitation centers. After matching a prospective partner with a potential service dog in accordance with a written opinion from a rehabilitation specialist, the team training commences. Following the completion and approval of a certificate examination, the dog is officially certified as a service dog, and the person and dog begin to live together. It is the responsibility of the training organizations to continue to provide assistance to the service dog partners. It is also their obligation to provide re-training to partners and their service dogs in the event of a change in circumstances, i.e., the progression of disability, or if the environment of the partner changes.

Certification Procedures for Guide Dogs and Hearing Dogs

Public access by people living with guide dogs and hearing dogs is protected under the same act. The procedure for certifying hearing dogs and their human partners is the same as the process for certifying service dogs and their owners. Exceptions to the procedure for certifying hearing dogs and their partners are human health professionals, such as speech therapists. Guide dogs have a longer history in Japan than service dogs and hearing dogs do. Therefore, guide dogs are certified by a slightly different procedure than those used for service dogs and hearing dogs. Guide dogs are trained by an organization designated by the National Public Safety Commission, and the same organization also certifies the dogs that they train. Otherwise, the procedures and responsibilities of the training organizations and the partners are the same for hearing dogs and service dogs.

DISCUSSION

The roles of assistance dogs have expanded in the US and European countries (13), where regulations and laws for the training and certification of assistance dogs usually do not exist. Hence, it is possible for people who believe in the potential ability of dogs to create their own assistance dogs. However, the lack of regulation also facilitates people who falsely claim that their pet dogs are assistance dogs. Incidents of bites by falsely claimed assistance dogs and assistance dogs with inadequate temperaments have been also reported, and death and serious injuries have occurred (21, 22). Therefore, it is essential to regulate assistance dogs to protect the right of public access for people living with adequately trained assistance dogs and to maintain the safety of the public. It is also necessary to protect the welfare of dogs so that those with inadequate temperaments are stressed by stimulations in public or the tasks that are expected of them. The Act on Assistance Dogs for Physically Disabled Persons allows assistance dog partners to confidently accompany their assistance dogs in public. In addition, members of the public are able to accept assistance dogs because the act stipulates the responsibilities of assistance dog training organizations, certifying organizations, assistance dog partners, and society.

Although the act has promoted the field of assistance dogs in Japan, some challenges remain. First, the act applies only to guide dogs for people with visual impairments, hearing dogs for people with hearing impairments, and mobility service dogs for people with mobility impairments. Other types of service dogs, such as those for people with psychiatric disabilities and children with autism, are not covered by the act. The need for such dogs was not recognized when the act was established. Moreover, only guide dog partners, hearing dog partners, and mobility service dog partners lobbied to establish the act. Moreover, the act was established based on the major premise that the partners of assistance dogs must be responsible for them in public. Therefore, people who are unable to fulfill these responsibilities cannot be an assistance dog partner. An example is children with disabilities. Assistance dogs that are not covered by the act could be included if their partners' needs are recognized in the future. Second, assistance dog partners are still prevented from using facilities even though the act was established 17 years ago. The reason is that the act has not gained enough public recognition, and there is no punishment for people or facilities that deny entrance to assistance dogs and their partners. Most people have not encountered assistance dogs and their human partners in public because their number is limited in Japan. The result is that many people do not recognize the act, and they do not know how to interact with a person with an assistance dog. Therefore, people with assistance dogs are still forced to live restricted lives (23), which is the main challenge that needs to be addressed. Lastly, some assistance dog training organizations also certify them. Hence, not all assistance dogs are certified by a third party, which hinders objectivity in assessing and maintaining the quality of assistance dogs. However, the Ministry of Health, Labor, and Welfare is now revising the act to resolve this problem.

CONCLUSION

The definition of "assistance dog" is clearly explained on the Act on Assistance Dogs for Physically Disabled Persons, and the process of training and certification is based on this law. Challenges with verifying the authenticity of assistance

dogs, while experienced in other countries, are generally not encountered in Japan as it is relatively easy to verify this by asking to see the dog's sign and the certificate. Therefore, it can be said that the Act on Assistance Dogs for Physically Disabled Persons in Japan has created a strong foundation for assistance dog partners to confidently accompany their assistance dogs in public, and people are able to accept assistance dogs with peace of mind. However, some remaining challenges need to be resolved.

DATA AVAILABILITY

No datasets were generated or analyzed for this study.

AUTHOR CONTRIBUTIONS

TT and MY, the two authors, equally contributed to write the mini review.

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Supportive Care for People With Disabilities as Working Partnerships With Their Assistance Dogs Are Ending: A Perspective From Veterinary Oncology

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People with disabilities and those working to train, provide and support assistance animals, along with their veterinary teams, would all benefit if they RETHINK their perspective and viewpoint, and roles when these very special relationships come to an end. The end of the relationship may be when the assistance animal must retire, must be redirected, or euthanized due to illness or cancer. The loss or separation at the end of an assistance animal's service marks a heavy loss for the disabled person. Emotions emerge when the assistance animal is sick or has developed cancer or is approaching the difficult period known as "end of life." Anticipatory grief and heartbreak may be very difficult to manage and support. We can help ease the burden of decision making when euthanasia is needed for the assistance animal. If the disabled person takes on the good shepherd role and if the veterinary team emulates the minister or Mother Nature's role at the end of life or at the end of the working relationship, heartache may be lifted from both sides of the leash.

Keywords: disability, euthanasia, veterinary oncology, quality of life, RETHINK, good shepherd, self-care

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INTRODUCTION

The importance of the special relationship between the veterinarian and a disabled handler-service dog team escalates when the dog's job becomes jeopardized due to illness, aging, or behavior challenges. The strong human-animal bond shared between handlers and their assistance animals involves emotional, physical, and spiritual dependency. A threatened bond resembles dealing with the loss of a spouse, or person that provides complete support. Initially a close working relationship sensitizes the veterinary team to the special needs of the person with disabilities, setting the stage for addressing difficult situations. While the assistance animal is still working, the veterinarian can guide the handler in fulfilling the caregiving role, and regularly monitoring wellness. If the dog declines, the veterinarian can counsel, and offer options. When deciding to retire the dog or provide euthanasia, expertise at this heartbreaking moment is crucial. The veterinary team's relationship with the person and dog merits special consideration to assure effective, convenient and supportive care for both, including:

1. Building a close working relationship from the beginning.
2. Guiding the client in assessing the dog's quality of life, wellness, and providing palliative care when needed.
3. Facilitating the client in making difficult decisions, preparing for changes, and taking necessary next steps.
4. Assisting the client during separation from the working relationship.
5. Supporting the family facing difficult decisions.
6. Supporting the handler in accepting their loss via euthanasia or ending the working relationship.

People with disabilities and their assistance animals, along with their veterinary teams, can all benefit by conjointly rethinking their perspective, and viewpoints when this special working relationship ends. The assistance animal may need to retire, be redirected, or may be euthanized due to severe illness, or terminal cancer. This loss or separation marks a heavy loss for the handler with disabilities who views the dog as an essential lifeline (1). Strong emotions, such as sorrow and anticipatory grief, may emerge when the assistance animal has developed cancer or is approaching the period known as "end of life." Easing the burden of decision making about euthanasia is very important. If the veterinary team emulates the minister role or the role of Mother Nature's helping hand; and if the disabled person emulates the good shepherd role, when the assistance animal's working relationship or life is ending, heartache can be alleviated on both sides of the working harness (2).

AN ASSISTANCE DOG WITH CANCER: DIFFICULT DECISIONS

Lucy, an 11 year old female, neutered Golden Retriever was an assistance dog for a very spirited person who was wheel-chair bound since childhood. Lucy developed a mast cell tumor near her left knee, which enlarged during the month before being surgically removed.

The biopsy reported a low-grade mast cell tumor, but residual cancer cells remained at the surgical site. The mitotic index (rate of cell division) score of 5 was higher than a low-grade score of below 4. The standard options to manage Lucy's cancer were: more surgery, radiation therapy, and chemotherapy; all were declined by Lucy's handler and her mother. At the first post op consultation, Lucy's local lymph node, and other examinations for metastatic cancer cells were negative. Therefore, a new ablative technology was offered for Lucy: electrochemotherapy (ECT) or electroporation (EP), which kills residual cancer cells at the surgical site without surgery (3). Lucy began working again soon after her EP.

After 8 months, Lucy's cancer spread, causing severe symptoms. Lucy began an end of life Pawspice program, providing gentle palliative cancer care, while also alleviating pain, and other distressful symptoms.

The treatment goal was to restore and maintain Lucy's quality of life. Lucy's handler declined standard IV chemotherapy but authorized the use of steroids and oral chemotherapy. Lucy responded quickly to treatment and worked again for 6 additional weeks. The family was counseled that with every day, Lucy was giving them a very sweet and prolonged farewell.

CONTRASTS BETWEEN WILD AND DOMESTICATED ANIMALS

During end-of-life consultations, clients can be encouraged to consider adopting this realistic philosophy. When animals became domesticated, they no longer could separate from their pack, when it was their time to die. Wild animals in decline fall behind their pack or they may separate themselves from the pack and lay under a bush to wait for death from harsh elements, or predation. A prolonged, lingering phase at the end of life is rare for weak, or sick animals in natural habitats. The natural laws of predator-prey mean that frail animals in the wilderness do not linger for long: sick and debilitated animals cannot keep up their daily routine for survival. Unprotected, they are subject to the harshness of Mother Nature's quick hand due to the elements that cause dehydration, cold or heat; and they become prey, entering the food cycle.

Humans domesticated animals and adopted the ancient contract of the good shepherd to care for them, including helping to separate pets at end-of-life when their quality of life declines to a low level, or if they suffer relentlessly. We assume the responsibility to help them depart with a compassionate death. We help provide our assistance animals with the gift of a loving bond-centered euthanasia, assuring that they will have a peaceful and painless passage as we escort them through their transition.

Handlers with disabilities can learn that their assistance animals totally rely on them, as their good shepherds. They can help their assistance animals make a peaceful transition at end of life. If their assistance animals were in the wild, at the end of life, they would have separated themselves from their pack to go off under a bush to await their death. Disabled clients and their families can be counseled that when their loyal assistance dogs are terminally ill, they deserve the benefits of a bond-centered euthanasia. This is a final loving gift that assures a peaceful end-of-life transition.

Domesticated dogs, cats, horses and pocket pets depend on our kindness and wisdom to help them transition when it is their time. People with disabilities can redirect their thinking and grief into the noble thought that they are keeping their obligations as the good shepherd, bound by the ancient contract (4). By providing a compassionate euthanasia, that reflects the handler's cultural, religious and social perspectives, the angst over decision making, grief and mourning may be less emotionally painful for disabled handlers as they part with their beloved assistance animals.

When an assistance dog must retire or be retrained for another role, the loss of the relationship can be very distressful and heartbreaking and may require further professional counseling. Maintaining contact with the animal can be comforting by helping the handler know that their former dog is doing well (5, 6).

PROFESSIONAL CAREGIVERS POSITIVELY RETHINKING THEIR ROLES

Veterinarians, and those who care for assistance animals, would benefit it they can rethink what a meaningful and

spiritual honor it truly is to oversee compassionate euthanasia services, in accordance with the cultural, religious, and social background of the handlers. They can assume the minister role, or the role as Mother Nature's helping hand, for these very important assistance animals, their disabled handlers, and their families.

Those involved with decision making conversations must avoid and help their clients avoid using negative words and phrases such as: kill, take a life, put down, put to sleep, playing God, blue juice, executioner, etc. Such terms contribute to the veterinary staff's depression, ethics fatigue, and compassion fatigue. Instead, use positive words and phrases, such as: help, escort, assist, transition, transformation, lift, Rainbow Bridge, give back, last kindness, merciful, final loving gift, giving them wings, peaceful, and painless passing, etc.

Self-Care

All veterinarians and their teams need to revise and rethink their perspective of consistently feeling broken hearted and diminished after providing compassionate euthanasia for their beloved patients, especially for assistance animals. Modifying this thinking will lift the spirits of the entire veterinary team.

Veterinary staff involved with sick or terminal assistance animals need to rethink their roles as helping to provide a bond-centered euthanasia. The team's role in the euthanasia process can be framed as a privilege that is parallel to a minister conducting a sacred sacrament or parallel to Mother Nature's ultimate plan. Rather than being a dreaded weight on well-being, compassionate euthanasia can be considered a last rite ceremony. This "sacrament" is empathetically and professionally delivered by the veterinary "clergy" to assure that the assistance animal has a peaceful and painless passage.

Teaching Staff Members to Be Supportive

Veterinarians can teach their staff how to communicate about euthanasia, so they learn communication skills for providing emotional support by role-playing and practicing the right words to say. The staff's compassionate emotional support for people with disabilities who face loss, whether to early retirement or to euthanasia, is extremely valuable, and a much needed service. If the assistance animal is sick and is being euthanized, the staff can support the person in knowing and assuring them that they are doing the right thing by validating their difficult decision.

Teaching Handlers With Disabilities Quality of Life Assessment for Their Assistance Dogs

The veterinary team provides medical care to patients during all the stages of their lives. At the end-of-life stage, the team assists in decision making, and provides palliative care to alleviate pain and distress. When treatment is ineffective or futile, society expects veterinarians to spare their patients relentless, and unnecessary suffering by professionally providing a peaceful, and painless passage with the gift of euthanasia. Veterinary teams can feel reverent and honored to serve persons with disabilities at this sensitive time.

The H5M2 (HHHHHMM) Quality of Life Scale for dogs and cats teaches clients to assess criteria for quality of life (7, 8). The scale assists carers in improving and understanding the quality of life of their animals, guiding their decision making, and is available for free download at: www.pawspice.com click: Menu, Library.

Quality of Life Scale
H5M2 (HHHHHMM QoL Scale)

Caregivers can use this Quality of Life Scale to assess animals and guide decision making for Pawspice care. Use numbers from 0 to 10 (10 is ideal or normal) to score the patient's condition.

Score	Criterion
0–10	**HURT**—Adequate pain control & breathing ability is top priority. Trouble breathing outweighs all concerns. Is pain being treated properly or not? Can the animal breathe properly? Is supplemental oxygen necessary?
0–10	**HUNGER**—Is the pet eating enough? Does hand feeding help? Does the patient need a feeding tube?
0–10	**HYDRATION**—Is the pet dehydrated? For patients not drinking enough water, use subcutaneous fluids daily or twice daily to supplement fluid intake.
0–10	**HYGIENE**—The pet should be brushed and cleaned, particularly after eliminations. Avoid pressure sores with soft bedding and keep all wounds clean.
0–10	**HAPPINESS**—Does the pet express joy and interest? Is the pet responsive to family, toys, etc.? Is the pet depressed, lonely, anxious, bored, or afraid? Can the pet's bed be moved to be close to family activities?
0–10	**MOBILITY**—Can the pet get up without assistance? Does the pet need human or mechanical help? Is the dog willing/able to go out for short walks? Is the pet having seizures or stumbling? Some feel euthanasia is preferable to amputation. But a companion animal with 3 legs or limited mobility can be alert, happy and have a very good QoL only if the family is committed to helping their companion animal get around with: ramps, cart, harness, braces, rehab, acupuncture, etc.
0–10	**MORE GOOD DAYS THAN BAD**—When bad days outnumber good days, QoL may be too compromised. When a healthy human-animal bond is no longer possible, the family must be made aware that the end is near. The decision for euthanasia needs to be made if the animal has pointless suffering. If death comes peacefully and painlessly at home, that is okay.
∗**TOTAL**	∗A total over 35 points represents acceptable life quality to continue with Pawspice/hospice.

Oncology Outlook, by Dr. Alice Villalobos, Quality of Life Scale Helps Make Final Call, VPN, 09/2004. Adapted for author's textbook, Canine and Feline Geriatric Oncology: Honoring the Human-Animal Bond, Blackwell Publishing, 2007 & 2018, CB, VCNA, IVAPM Palliative Care & Hospice Statement, 2011, Merial's Pre-EVCONC-World Vet Cancer Congress-Round Table, 2012, with permission of Dr. Villalobos & Wiley-Blackwell Publishing, Hoboken, NY.

In Lucy's case, her handler, along with her mother, used the Quality of Life scale to evaluate Lucy when her mast cell cancer relapsed with recurring symptoms. Lucy's handler and her mother chose compassionate euthanasia for Lucy when her Quality of Life Score dropped below 35. The New York Times featured this Quality of Life Scale in an article titled, "Is it Time?

Making End of Life Decisions for Pets," on 3-13-2019, https://nyti.ms/2Fel9kC (9).

Emulating the Role as Good Shepherd

Because assistance animals are trained to be constant helpers and companions, people with disabilities may tend to overprotect them. They may also feel desperate, wanting to hang on to their assistance dogs, when it is not in their dog's best interest. The veterinary team should counsel, comfort and enlighten heartbroken clients with disabilities and ease their burden of guilt by reminding them of their good shepherd responsibility and that their terminally ill beloved assistance dogs should not be forced to suffer needlessly.

Emulating the Role as Chaplain or Mother Nature's Helper

To enhance personal resilience and professional endurance, veterinarians and team members *must* rethink their esteemed and powerful role in the euthanasia process, visualizing their role in a more positive light, as resembling an honored and respected minister; a chaplain, rabbi, priest, high priestess or Mother Nature's helping hand. Think this way vs. being the executioner.

Veterinarians can consider the role that chaplains play at end of life, consoling the bereft and providing emotional comfort, assuring grieving clients with disabilities that they are giving the meaningful gift of a quality death with a bond-centered euthanasia. It is a reverent honor to serve the disabled community at this very vulnerable and sensitive time. Euthanasia should be described to clients with its literal meaning, "good death," along with gentle words such as: "We will escort your beloved (name of the patient) with a peaceful and painless passing."

Providing a Bond-Centered Euthanasia

Lucy's Decline

When Lucy's quality of life reached a low point, her loving handler and mother wanted to bring her to our veterinary clinic for her final visit. The family wanted Lucy's final farewell to be surrounded by the veterinary team who knew her well. Our staff validated their difficult decision, since it was best to let Lucy go before she suffered in futility. Our team offered hugs and supported their decision so that Lucy's handler and her mother would not later feel guilty about helping Lucy transition. We assured them that they acted as the good shepherd and that they helped Lucy avoid enduring unnecessary and futile suffering if they had waited much longer.

Compassionate Planning for Euthanasia

Providing a compassionate euthanasia occasion (with candles, flowers, and poems based on client preferences) should be considered a special personal and professional honor, not a dreaded task. Euthanasia can be viewed as a "balloon" or a "lifter": an opportunity to kindly oversee and alleviate a heartbreaking event. This process teaches assistance animal care providers to feel better about themselves as they ease the loss for the carers.

Euthanasia: Recommendations for the Veterinary Team

Many carers prefer home euthanasia as a more comfortable setting for their final farewell; this option should be encouraged and can be facilitated by referral to a house call practice that provides hospice and home euthanasia services.

The exam room setting for compassionate bond-centered euthanasia can be provided as described below (10):

Light candles, bring in flowers, and turn down bright lights.

Assure that the family is unified with the decision for retiring their assistance animal or validate them for making the difficult decision for euthanasia.

Explain the two-step procedure to the family to assure a peaceful and painless passage. The first step is to give a sedative by injection, either intramuscular (IM) or subcutaneous (SQ), to allow the patient to fall asleep peacefully in the presence of the family. Once the pet is sedated, the second step is to provide an intra-organ injection that will cause the heart and breathing to stop. Some doctors prefer to place an IV catheter after sedation.

Avoid separating the pet from their family. If preferring to place an intravenous catheter for the final injection, place the catheter after the IM or SQ sedation is in effect, with the family present. Do not break the bond at this time. Explain to the family that some pets will take a reflex breath up to 2–5 min after they are deceased, so the family will know what to expect and not be alarmed.

For the final intra-organ injection, cover the pet with a towel and instruct the family to massage their pet's head and neck. Under the towel, listen for the heart and then administer the euthanasia solution into the heart, kidney, liver, or as an intraperitoneal injection, which takes longer for the heart to stop. Wait peacefully for the last heartbeat. Pronounce the pet's time of death when the heartbeat becomes inaudible. Document this in the chart.

Invite the family to stay with their deceased pet for whatever time they need. Tell them that this special time is their version of a wake. Validate their decision as being right for the given circumstances.

Read poetry such as: "The Rainbow Bridge."

Family members can be asked to blow out the candle(s) as a symbol of life's end, before they leave. The family generally leaves their deceased pet at the hospital for afterlife arrangements (cremation, aquamation, burial, paw print, pictures). If at home, the deceased may be taken for after life body care by the doctor's staff or by a service.

Parting With Lucy

Terina Sprague (Lucy's handler) and Sherril Sprague (Terina's mother) gave us verbal and written consent to publish potentially-identifying images and information about Lucy's very special and interesting case. They were grateful for our pet loss counseling and the emotional support provided during Lucy's care and end of life process. Our entire oncology team hugged them and gave them flowers and Lucy souvenirs: including a special Lucy paw print for Terina and a lock of Lucy's fur in a windowed envelope. We gave Terina photos and an autographed poetry book, *Angel Whiskers*, which includes the Rainbow Bridge poem and other poems that I read during the wake (11). Our veterinary team arranged for Lucy to be cremated with her teddy bear and a special picture of Lucy, wheelchair assistance dog, next to Terina during a favorite "Rolling Along" sporting event.

Losing the assistance dog relationship with Lucy was very difficult for Terina and her mother. They memorialized Lucy with tattoos.

Afterlife Body Care: Assuming a Role as Funeral Director

It is important to provide personal and private assistance when making afterlife arrangements for cremation or burial of a deceased assistance dog. Ask this simple question, "Have you thought about or planned for cremation or burial?" Never ask the horrible question: "How do you want to *dispose* of the body?" After the decision for private or group cremation, then the veterinary team can assist the client in "making arrangements" with the afterlife service provider. Some useful gestures may include:

Send a sympathy card with your personal notation(s).
Donate to a special cause in the name of the deceased.
Contact the family 1 or 2 days later and ask:
"How is your heart and soul doing?"

Offer additional emotional support and recommend pet loss counseling, with contact information, or a chaplain to help process their grief. Suggest pet loss books such as *So Easy to Love, So Hard to Lose* (12). Recommend a pet loss chat room provided by the Association of Pet Loss and Bereavement at: www.aplb.org.

If children are part of the family, be sure to address their grief.

Instruct the family to set up a shrine with pictures of the pet and to light a candle to honor their human-animal bond.

SUMMARY

As relationships of handlers and their assistance dogs are ending, occupational pressures for the veterinary team may cause stress, depression, compassion fatigue, and ethics fatigue. Rethinking compassionate euthanasia with the good shepherd and minister philosophy can lessen heartbreak and negativity surrounding end of life, as shown in Lucy's case. By elevating veterinarians to emulate the chaplain role and enlightening clients to assume the good shepherd role, we can all be honored escorts for our beloved assistance dogs as they make job transitions or as they transition at end-of-life. Thus, we elevate the spirit and reverence for the very special love within this unique human-animal bond. Please refer to the Resources section at the end of this article for more information about end of life care for animals and emotional support for those providing home care and medical care.

AUTHOR CONTRIBUTIONS

The author confirms being the sole contributor of this work and has approved it for publication.

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Geographic Availability of Assistance Dogs: Dogs Placed in 2013–2014 by ADI- or IGDF-Accredited or Candidate Facilities in the United States and Canada, and Non-accredited U.S. Facilities

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Assistance dogs' roles have diversified to support people with various disabilities, especially in the U.S. Data presented here are from the U.S. and Canada non-profit facilities (including both accredited and candidate members that fulfilled partial requirements: all here termed "accredited") of Assistance Dogs International (ADI) and the International Guide Dog Federation (IGDF), and from non-accredited U.S. assistance dog training facilities, on the numbers and types of dogs they placed in 2013 and 2014 with persons who have disabilities. ADI categories of assistance dogs are for guide, hearing, and service (including for assistance with mobility, autism, psychiatric, diabetes, seizure disabilities). Accredited facilities in 28 states and 3 provinces responded; accredited non-responding facilities were in 22 states and 1 province (some in states/provinces with responding accredited facilities). Non-accredited facilities in 16 states responded. U.S./Canada responding accredited facilities (55 of 96: 57%) placed 2,374 dogs; non-accredited U.S. facilities (22 of 133: 16.5%) placed 797 dogs. Accredited facilities placed similar numbers of dogs for guiding ($n = 918$) or mobility ($n = 943$), but many more facilities placed mobility service dogs than guide dogs. Autism service dogs were third most for accredited ($n = 205$ placements) and U.S. non-accredited ($n = 72$) facilities. Psychiatric service dogs were fourth most common in accredited placements ($n = 119$) and accounted for most placements ($n = 526$) in non-accredited facilities. Other accredited placements were for: hearing ($n = 109$); diabetic alert ($n = 69$), and seizure response ($n = 11$). Responding non-accredited facilities placed 17 hearing dogs, 30 diabetic alert dogs, and 18 seizure response dogs. Non-accredited facilities placed many dogs for psychiatric assistance, often for veterans, but ADI accreditation is required for veterans to have financial reimbursement. Twenty states and several provinces had no responding facilities; 17 of these states had no accredited facilities. In regions lacking facilities, some people with disabilities may find it inconvenient living

far from any supportive facility, even if travel costs are provided. Despite accelerated U.S./Canada placements, access to well-trained assistance dogs continues to be limited and inconvenient for many people with disabilities, and the numerous sources of expensive, poorly trained dogs add confusion for potential handlers.

Keywords: assistance dogs, service dogs, autism service dogs, mobility service dogs, hearing dogs, psychiatric service dogs, seizure assistance dogs, diabetes alert dogs

INTRODUCTION

With little monitoring to track changes in assistance dog placements over time, assistance dogs' roles have rapidly diversified to support people with various disabilities, especially in the U.S. since passage of the Americans with Disabilities Act (1). This U.S. legislation and its enabling regulations assure reasonable accommodation, which includes public access for a person with an assistance dog, sometimes termed service dog (2). Emphasizing that the dog performs tasks that assist with the person's disability, the U.S. uses the inclusive term "service dog," whereas internationally, "assistance dog" is the inclusive term that includes all dogs fulfilling assisting roles for persons with disabilities (and is the term primarily used here). Lacking any centralized registration process, not requiring any specific accreditation verifying the training of the dogs, and allowing people to train their own assistance dogs, the U.S. has no system for monitoring the numbers or types of assistance dogs that are working and makes it easy for new facilities or someone with a disability to train such dogs. Thus, numerous informal training procedures or facilities exist in the U.S. In contrast, some other countries specify and limit who is qualified to train assistance dogs for public access. For example, Japan (2) and Taiwan (3) have a centralized method for tracking assistance dogs.

Legislation and regulations in the U.S. assure persons with disabilities the right to have public access with their assistance dogs that perform tasks related to the person's disability (4). Although it is required that the dog be trained in these tasks, the method and source of the training are unspecified and no certification process or special identification is required for the assistance dog or its handler. With this permissive framework, both the numbers and types of assistance dogs have sharply increased in recent decades, particularly in the U.S.; placements in Europe show a similar trend that is less rapid (5). Also, the types and body sizes of dogs used in assistance work are changing and now include a wide range of purebred and mixed breed dogs acquired from various sources, with many small as well as larger dogs serving in the various assisting roles (5, 6). It adds confusion that in the U.S., emotional support animals for people with disabilities are recognized by Housing and Urban Development for access with the handler to housing (7–9) and by the U.S. Department of Transportation for access with the handler to air travel (10); these animals are not required to perform tasks and are not being addressed in this paper.

Assistance Dogs International (ADI) categorizes the roles of assistance dogs as guide, hearing, and service; the roles of service dogs include assistance for mobility, autism, seizures, psychiatric symptoms, and medical alert (11). Like the International Guide Dog Federation [IGDF; (12)], ADI accredited facilities are required to be non-profit, and must fulfill the extensive requirements of ADI Standards (5). As some examples, facilities must assure the long-term support of clients and dogs, and dogs are expected to be people oriented, and not aggressively protective. Accredited facilities also are required to have a strong track record of successful placement of human-assistance dog teams. Facilities that are seeking to become accredited and that already fulfill some of the requirements can become candidate facilities.

Additionally, ADI provides facilities with specific standards for training and placement of assistance dogs for veterans with military-related PTSD (13), requiring that the dog facilitate friendly public interaction with the veteran and have training based on praise and positive affect, and that the veteran-service dog team be supported by at least two individuals, such as family members. Candidate and accredited facilities placing these dogs with veterans are required to have a licensed mental health professional available, and address issues of suicide and anger management.

Historically in the U.S., guide dog facilities were established from 1929 through the 1950s; subsequently numerous mobility service dog and a few hearing dog facilities were founded from 1973 through the 1990s (5). More recently, additional new facilities were established, contributing to the growth of dogs' roles for assistance with psychiatric, autistic, and medical alert needs. A similar pattern occurred in Europe, with the expansion of numerous mobility service dog facilities and one large hearing dog facility beginning in the 1980s. Facilities were established outside U.S./Canada and Europe beginning in 1957; the large majority of these facilities still place solely guide dogs (5).

With the proliferation of assistance dogs in the U.S., along with increasing numbers of emotional support animals that are allowed access in housing and air transport (7–10), and growing use of therapy dogs in animal-assisted interventions, social conflict has arisen and confusion has increased regarding the varied roles of dogs and their legally allowed public access. Societal conflict primarily has focused on animals in airplanes, leading airlines to create new policies regarding animals in the airplane cabins (14, 15). Legislators have sought solutions (16), and the American Veterinary Medical Association (AVMA) has endeavored to provide accurate information (17), develop clarifications, and broker solutions for revised policies or new legislation. Concern has grown that some assistance dogs or emotional support animals have inappropriate behavior, and that purported assistance dogs may be fraudulently labeled by their

handlers if the dogs lack appropriate behavior or do not perform tasks related to the handler's disability.

Some states have legislation strengthening protection of public access with assistance dogs and assuring access to people with assistance dogs in training, including punishment for interfering with or injuring dogs, e.g., California and Florida [summarized in 2006 worldwide by ADI, (18)]. Some pushback limiting assistance dogs has come from legislation in other states. Also, the U.S. Army and Veterans Administration, appreciating the specified training requirements of ADI, require that their clients acquire assistance dogs from facilities accredited by ADI and will not reimburse expenses for dogs acquired from other sources (19, 20). Yet, persons seeking to acquire an assistance dog may not be familiar with ADI and the training and placement process involved. They may lack knowledge of how to assess a non-accredited facility placing dogs and may be vulnerable to opportunists. Finding access to this essential information on well-trained dogs can be challenging in the U.S.; this was the case when studied among people with visual and other physical disabilities in Japan (21, 22). Many facilities that place dogs have long waiting lists, adding frustration to the process of expeditiously acquiring a dog. While handlers in the U.S. are allowed to train their own assistance dogs, supportive resources that are economical and effective for this approach may not be easy to find. Some private dog trainers sell trained assistance dogs for very high prices, but then when the dogs do not always perform in the role that was promised (23), the person with a disability who needs a canine partner has no recourse.

The objective of this survey was to assess current geographic patterns of placements of assistance dogs, focusing on the states of the U.S. and the provinces of Canada, where the numbers and roles of these dogs have been expanding rapidly.

MATERIALS AND METHODS

For this study, all U.S. and Canada facilities associated with ADI or IGDF were contacted up to three times by e-mail and sometimes telephone, if requested by the facility, concerning the numbers and roles of dogs they placed in 2013 and 2014 with persons who have disabilities, requesting that the facilities complete a brief survey. Both accredited facilities and candidate facilities that are seeking to become accredited and that have already fulfilled some of the accreditation requirements were contacted; these all generally are termed accredited in subsequent text. Among these facilities, 55 out of 96 (57%) facilities responded and provided information on their placements of 2,374 dogs.

We also e-mailed a survey to all non-accredited U.S. facilities listed online. The initial list of 170 facilities was developed by searching: assistance dogs, service dogs, mobility service dogs, seizure response dogs, diabetes alert dogs, autism service dogs, PTSD dogs, and psychiatric service dogs; lists of facilities posted online also were gathered. Facilities also appearing on ADI or IGDF lists were deleted, as well as duplicates. Email invitations were successfully transmitted to 133/170 facilities; 37/170 (22%) bounced back from failed addresses, reflecting turnover. Among the 133 invited non-accredited U.S. facilities, the response rate by 22 facilities was 16.5%, reflecting their placements of 797 dogs. Two reminder emails were sent to all non-respondents.

We assessed placements of the dogs for the various roles throughout the U.S. and Canada as related to the facility's year of establishment. The survey was distributed to facilities worldwide and some results were previously published (5), whereas this study focuses on the specific results from North America. The survey included the following questions: year that the facility started producing dogs; the numbers and roles of dogs placed in 2013 and 2014; the total number of assistance dogs that were placed each year; numbers of guide, hearing, mobility service, seizure response, autism service, diabetic alert, and psychiatric service dogs placed; the breeds of dogs used; the sources of the dogs (breeding within the program, outside breeders, clients' pets, shelters, or other sources); and the duration of team training in which a new handler is taught to work with the canine partner.

Data were analyzed using chi-squared tests of independence between particular categorical variables, including the relationships between types of assistance dogs, geographical regions, accreditation, and the sources of the dogs.

RESULTS

Geographic Distributions of Facilities Placing Dogs in Various Roles

Accredited facilities in 28 states and 3 provinces responded; accredited non-responding facilities were in 22 states and 1 province (some in states/provinces with responding accredited facilities). Non-accredited facilities in 16 states responded.

The four maps in **Figures 1–4** represent the distributions of responding service dog organizations from the U.S. and Canada placing: guide dogs; mobility service dogs; autism service dogs; and psychiatric service dogs. The plain numbers and colors represent the numbers of responding ADI/IGDF accredited facilities in U.S. or Canada, while the numbers in parentheses and the grayscale represent the numbers of responding unaccredited U.S. facilities. For each role of dog, the approximate numbers of dogs placed by the responding facilities in each state during the 2 years is indicated by the shaded colors shown on the figure legend. For these and subsequent figures, **Figures 1–6**, the same numerical information also is provided in **Supplementary Tables**. This will accommodate anyone to more easily see the actual numbers and interpret the data that are provided here.

Guide Dogs

Placements of guide dogs in the U.S./Canada were very numerous (accredited facilities, $n = 918$; non-accredited facilities, $n = 3$), with the number of placements of guide dogs by 11 accredited facilities similar in numbers to placements of mobility dogs in the same period. Facilities training and placing guide dogs consistently placed primarily guide dogs, often in somewhat large numbers. Some facilities placing guide dogs occasionally produced dogs trained to fill other roles, but in much fewer numbers. Guide dogs were the first type of service dog placed in the U.S., beginning in 1929.

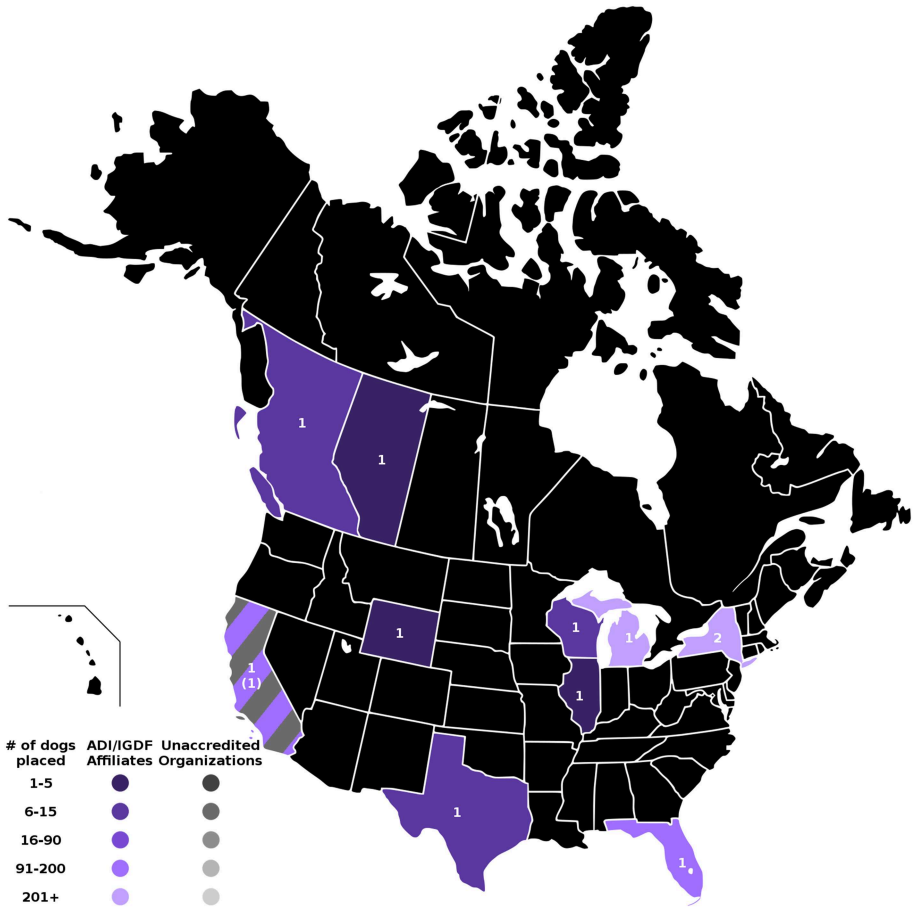

FIGURE 1 | Guide dog facilities and placements in the U.S. and Canada. Digital numbers in states and provinces indicate numbers of responding facilities, with non-accredited facilities in parentheses. Color coding for each state or province indicates the range of numbers of guide dogs placed in 2013 and 2014, with accredited facilities represented in color, and non-accredited facilities in grayscale.

As shown in **Figure 1,** accredited facilities placing guide dogs only responded in 8 states and 2 provinces. Facilities in the states of Michigan and New York placed the most, over 200 guide dogs per facility, followed by California and Florida, then Wisconsin, Texas, and British Columbia. Responding facilities in Illinois, Wyoming, and Alberta each placed 5 or fewer guide dogs. New York was the only state with a response from more than one accredited facility placing guide dogs. There was an additional response from one non-accredited facility in California that had placed a few guide dogs.

Mobility Service Dogs

The total number of mobility service dogs placed was 1054 (accredited facilities, $n = 943$; non-accredited $n = 111$). This was similar to the number of guide dog placements from U.S./Canada accredited facilities, but these dogs were placed by far more facilities ($n = 60$), both accredited ($n = 45$) and non-accredited ($n = 15$). Service dogs for mobility were not always the most numerous type of dog placed by these facilities. Historically, mobility service dogs were the second earliest type of service dog placed by these facilities, the first facility producing them appeared in 1973. As shown in **Figure 2,** responses were received from accredited facilities placing mobility dogs in 21 states and 3 provinces. Responses were received from non-accredited facilities in 11 states. California and Florida placed a large number of dogs. Numerous states had responses from both accredited and non-accredited facilities placing mobility service dogs, including California, Florida, Illinois, Missouri, Ohio, Pennsylvania, and Virginia. Georgia, Idaho, Indiana, and Oregon each had only one responding non-accredited facility.

No guide dog or mobility service dog facilities responded from Alabama, Alaska, Arizona, Arkansas, Connecticut, Iowa, Kansas, Kentucky, Louisiana, Maine, Montana, Nebraska, Nevada, New Hampshire, New Mexico, North Dakota, Oklahoma, South Dakota, Utah, Vermont, and West Virginia (42% of states). In Canada, no guide dog or mobility service dog facilities responded from Labrador, Manitoba, the Maritime Provinces, Northwest Territory, Newfoundland, Nunavut, Quebec, Saskatchewan, and Yukon, but one accredited facility for mobility dogs responded in each of the following provinces: British Columbia, Alberta, and Ontario.

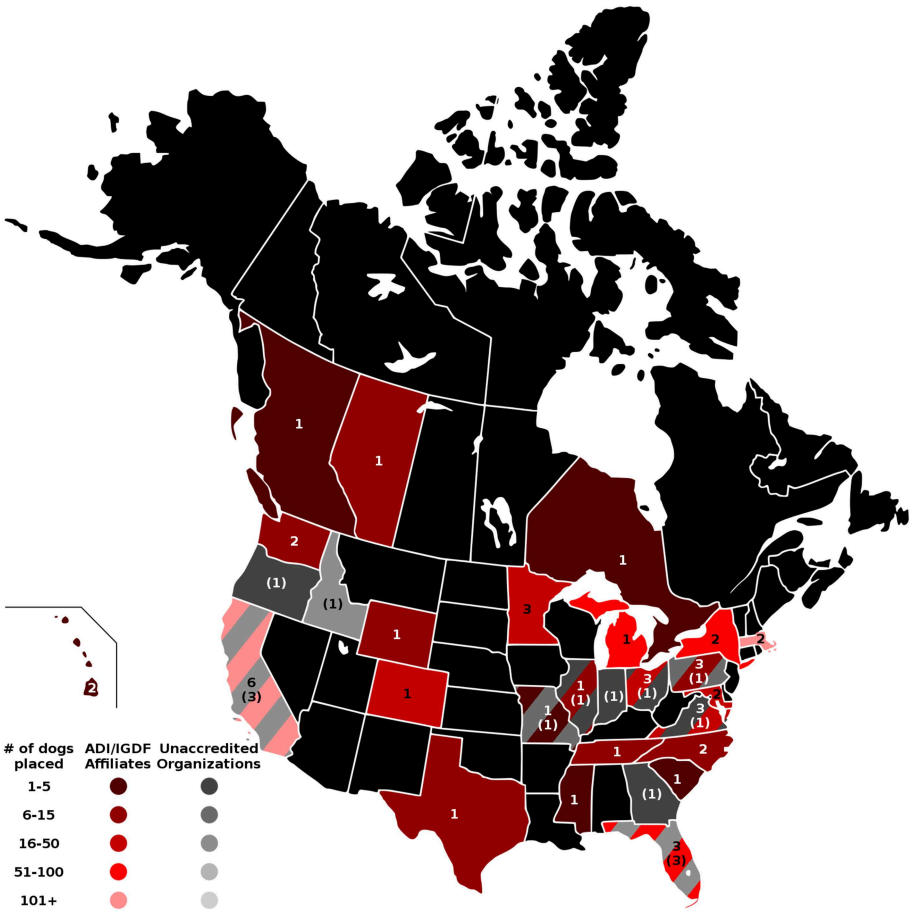

FIGURE 2 | Mobility service dog facilities and placements in the U.S. and Canada. Digital numbers in states and provinces indicate numbers of responding facilities, with non-accredited facilities in parentheses. Color coding indicates the ranges of total numbers of mobility service dogs placed in 2013 and 2014 for accredited and non-accredited facilities.

Autism Service Dogs

Placements of autism service dogs were the third most numerous type of dog placed by accredited facilities for the 2 years in U.S./Canada (n = 205 dogs) and also third for U.S. non-accredited facilities (n = 72 dogs). The number of autism service dogs placed increased by 16% from 2013 to 2014 in U.S./Canada for accredited facilities. Four U.S. accredited facilities listed autism service as their primary placements. In the U.S., five accredited mobility service facilities established in the 1970–1980s listed autism service dogs as their second or third most numerous type placed. Among responding non-accredited facilities, the oldest facility, established in 1984, placed all seven types of dogs, with autism service their fifth most numerous type. Five other non-accredited facilities placed primarily autism service dogs. As shown in **Figure 3,** there were multiple responses from both accredited and non-accredited facilities in California, Florida, Pennsylvania, and Ohio. Minnesota and Virginia each had 2 accredited facilities, and remaining states and provinces had a single accredited or non-accredited facility. Altogether, 14 states (11 with accredited facilities; 7 with non-accredited facilities) had responses from facilities producing autism service dogs (accredited facilities n = 18; non-accredited facilities n = 9). As with mobility service dogs, there was one response from an accredited facility placing autism service dogs in each of the following Canadian provinces: British Columbia, Alberta, and Ontario.

Psychiatric Service Dogs

Placements of psychiatric service dogs by accredited facilities were fourth most common in U.S./Canada (n = 119 dogs), surpassing hearing dog placements. Among reporting non-accredited U.S. facilities, psychiatric dogs accounted for the most placements (n = 526 dogs). As shown in **Figure 4,** while only 11 states had responses from accredited facilities placing psychiatric service dogs, 10 states had responses from non-accredited facilities placing psychiatric service dogs. Hence, over one-third of responding states had responses from facilities placing psychiatric dogs. Once again, California and Florida each had responses from multiple accredited and non-accredited facilities. Colorado, Massachusetts, Minnesota, Mississippi, New York, North Carolina, South Carolina, and Virginia each had one response from an accredited facility. Arizona, Georgia, Idaho,

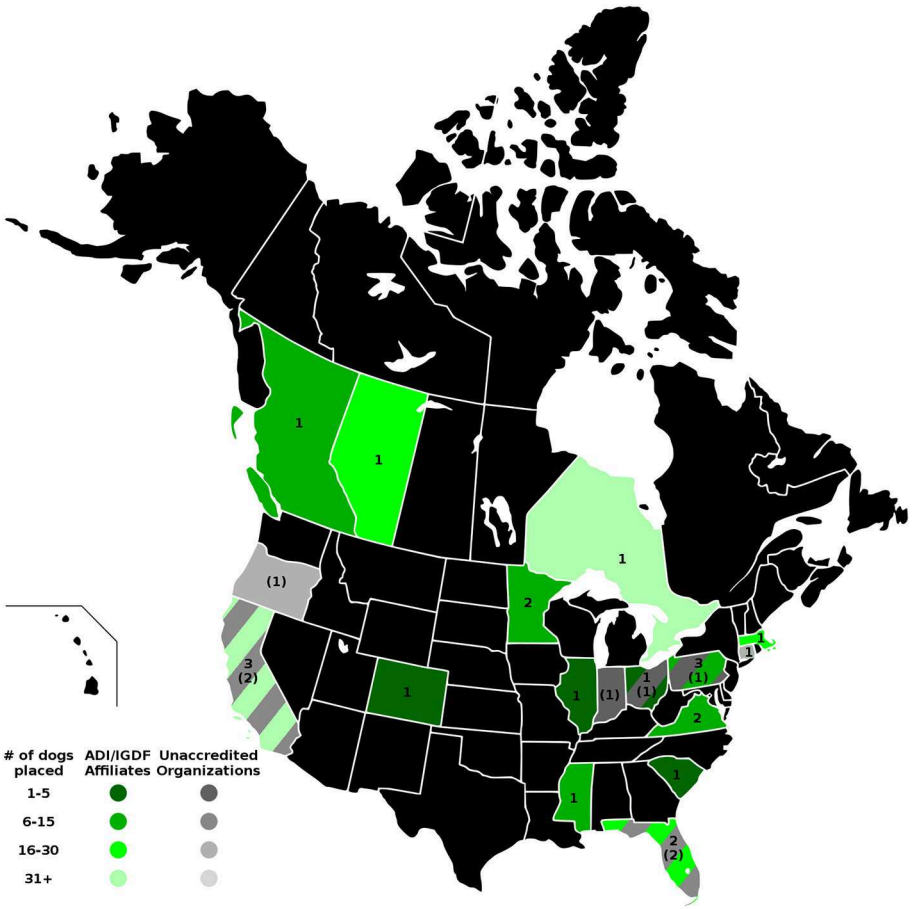

FIGURE 3 | Autism service dog facilities and placements in the U.S. and Canada. Digital numbers in states and provinces indicate numbers of responding facilities, with non-accredited facilities in parentheses. Color coding indicates the ranges of total numbers of autism service dogs placed in 2013 and 2014 for accredited and non-accredited facilities.

Missouri, New Mexico, Ohio, and Texas each had one response from a non-accredited facility.

Hearing Dogs, Diabetic Alert Dogs, Seizure Alert/Response Dogs, and "Other"

The survey also sought information about these other roles of service dogs, which accounted for the fifth (hearing, $n = 109$ dogs), sixth (diabetic, $n = 69$ dogs), and seventh (seizure, $n = 11$ dogs) most numerous placements in North America for accredited organizations, respectively. For reporting non-accredited facilities, 17 hearing dogs, 30 diabetic alert dogs, and 18 seizure alert/response dogs were placed. The "Other" category was used by only one responding organization that had placed one alert dog for a mast cell disease.

Non-responding Accredited Facilities

Despite considerable effort to solicit responses from all ADI and/or IGDF accredited facilities, 44 accredited or candidate facilities located in 23 states and 2 provinces did not respond. The numbers of responding and non-responding accredited facilities located in each state or province are listed in **Table 1**. The responding and non-responding ADI and/or IGDF accredited facilities also are indicated in **Figure 5.** Additionally, the non-responding facilities are shown in **Figure 6,** as well as the specific roles of dogs placed by these facilities, as currently indicated in their 2018 websites. These are shown by letter abbreviations for each role, listed in the order used in the original web survey that was provided to facilities.

Considering all ADI and/or IGDF facilities, both responding and non-responding, 17 states (34%), primarily in the Southeast, Midwest, and Northeast—Alabama, Arkansas, Delaware, Georgia, Idaho, Iowa, Louisiana, Maine, Montana, Nebraska, Nevada, Oklahoma, Rhode Island, South Dakota, Utah, Vermont, West Virginia (and District of Columbia)—had no facilities that were accredited or candidates of ADI and/or IGDF in 2015. However, among these states, Idaho and Georgia each had a responding non-accredited facility.

In Canada, the only provinces with facilities were British Columbia, Alberta, Ontario, and Quebec.

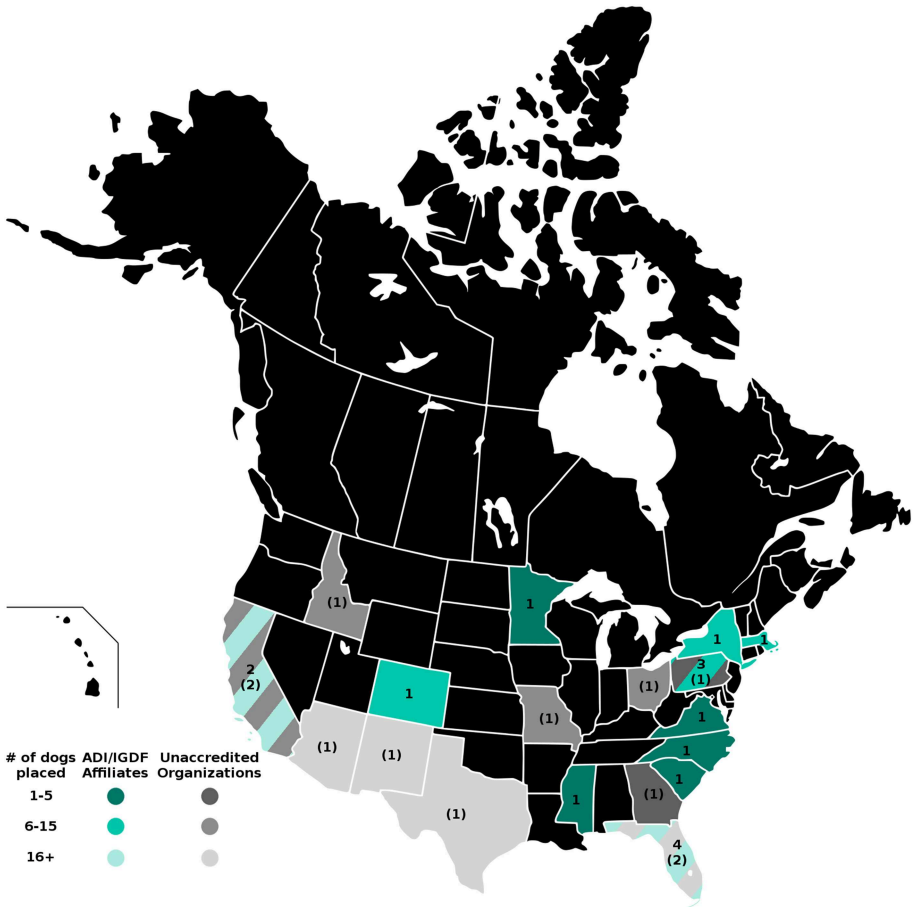

FIGURE 4 | Psychiatric service dog facilities and placements in the U.S. and Canada. Digital numbers in states and provinces indicate numbers of responding facilities, with non-accredited facilities in parentheses. Color coding indicates the ranges of number of psychiatric dogs placed in 2013 and 2014 by accredited and non-accredited facilities.

Roles of Dogs Related to Accreditation Status of Facilities

The accreditation status of facilities was significantly associated with the roles of dogs they placed (Chi-square: $p < 0.0001$). Hearing, mobility service, and guide dogs, and also autism service dogs, more often were associated with accredited facilities. Diabetes dogs more often were associated with candidate facilities. Non-accredited facilities were associated with psychiatric service and seizure alert dogs.

Facilities' Accreditation Status and Sources of Dogs Related to Roles of Dogs

The roles of dogs placed by facilities were significantly associated with the facilities' accreditation status and the sources of the dogs placed (Chi-square: $p < 0.0001$). Accredited facilities more often bred their own dogs and used outside breeders, but not clients' pets, shelters or other sources: each source was significantly associated with the facilities' status (Chi-square: $p < 0.0001$). These accredited facilities placed guide, mobility service, autism service and hearing dogs. Seizure alert and diabetes detection dogs somewhat more often were placed by facilities that were candidates for accreditation. Non-accredited facilities often used clients' own pets or dogs from shelters but did not breed their own dogs, and often placed psychiatric service dogs.

Diversified Roles of Dogs Currently Placed by Facilities

The responding 11 accredited guide dog facilities that were established in the 1930s through 1940s are continuing to place primarily guide dogs, except for one that also placed some dogs trained for other roles. The 23 responding, accredited facilities established 1975–1999 were training dogs for various single roles. For 19 of these facilities, most dogs were placed for the role of mobility service. One facility placed most dogs for autism service, 2 facilities most dogs for guiding, and 1 most dogs for assisting with seizures. Of these, only 6 facilities placed only dogs of one type for one specific disability. This pattern of diversifying to train dogs of a few different role types has continued for the 24 facilities established from 2000 on, with most facilities training dogs of several types to fill various single roles; only 8 facilities placed only one type of dog to address one specific disability.

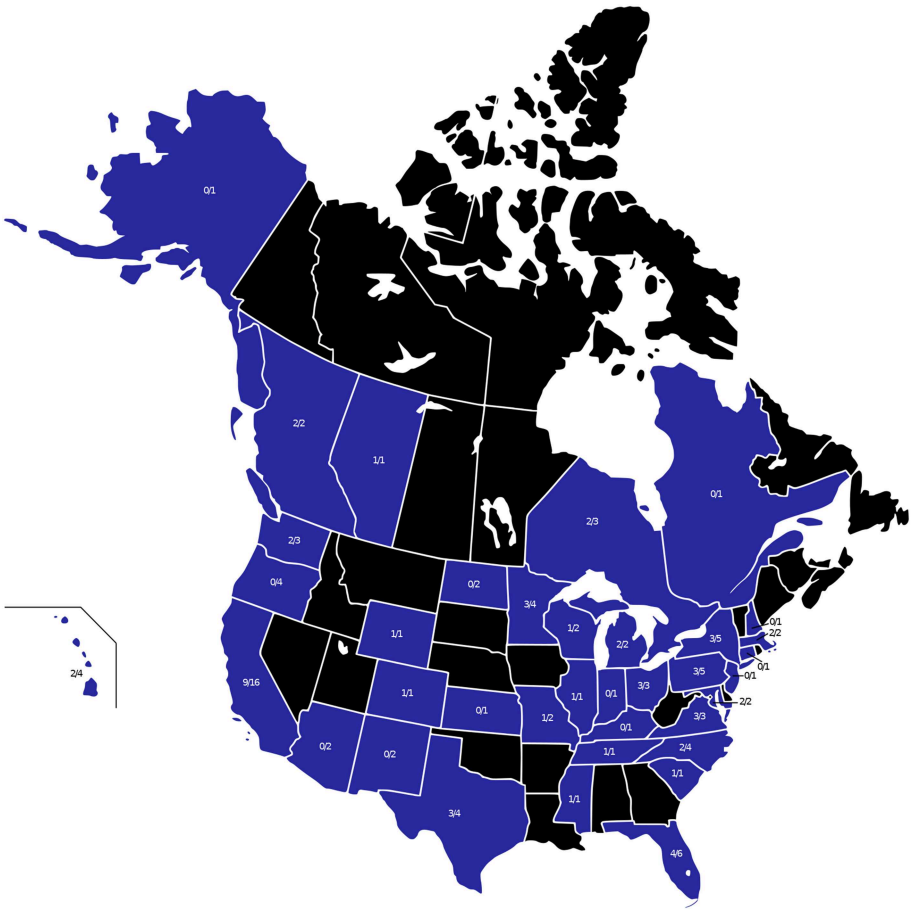

FIGURE 5 | All states and provinces with ADI and/or IGDF facilities at the time of the survey are shown in blue. The numerator indicates the number of responding facilities and the denominator shows the total number of ADI and/or IGDF facilities at the time of the survey.

As mentioned, responding facilities trained dogs with each dog filling only a specific single role for a specified disability. However, most facilities focused on more than one role, e.g., placing various types of dogs to accommodate the needs of persons with visual, hearing, mobility, psychiatric, autistic, seizure, or diabetes disabilities. Among accredited and non-accredited facilities that responded, a majority trained dogs of one or two types, focusing on either one or two specific disabilities. Nonetheless, among responding accredited facilities, 8 trained dogs for 3 single roles, 5 for 4 roles, and 2 for 5 roles. Non-responding ADI facilities similarly listed a median and mode of 2 roles for which they placed dogs; 2 trained dogs for 3 single roles, 4 for 4 roles, 2 for 5 roles, 2 for 6 roles, and 1 for 7 roles. Among non-accredited facilities, 3 trained dogs for 3 single roles, 1 for 4 roles, 3 for 6 roles, and 1 for 7 roles. Both accredited and non-accredited providers are diversifying and placing dogs that accommodate varied specific disabilities. For persons with multiple disabilities, the dog would be trained first to assist with the primary disability, and further personalized training could be developed later.

Limitations

These data reveal the availability in states and provinces of dogs trained by responding ADI or IGDF facilities and suggest that this may pose an inconvenience for some people seeking an assistance dog. For example, one-third of states lacked an accredited facility. However, almost half of accredited facilities failed to respond and their data are not included in the data presented here. The non-responding could particularly have affected data for facilities placing guide dogs; while relatively few in number, the guide dog facilities often place numerous dogs.

The inconvenience of not having facilities in some states is mitigated by that fact that some facilities provide travel funds that assist prospective handlers of assistance dogs. The study did not explore the extent to which the geographic constraints are inconvenient for people acquiring assistance dogs. Nor was any information collected from dog handlers concerning other possible factors making it inconvenient to acquire a dog.

Surveying non-accredited facilities posed particular challenges. While mentions were found on-line for over one hundred non-accredited facilities, only a small minority of these facilities responded. A high number of kicked-back

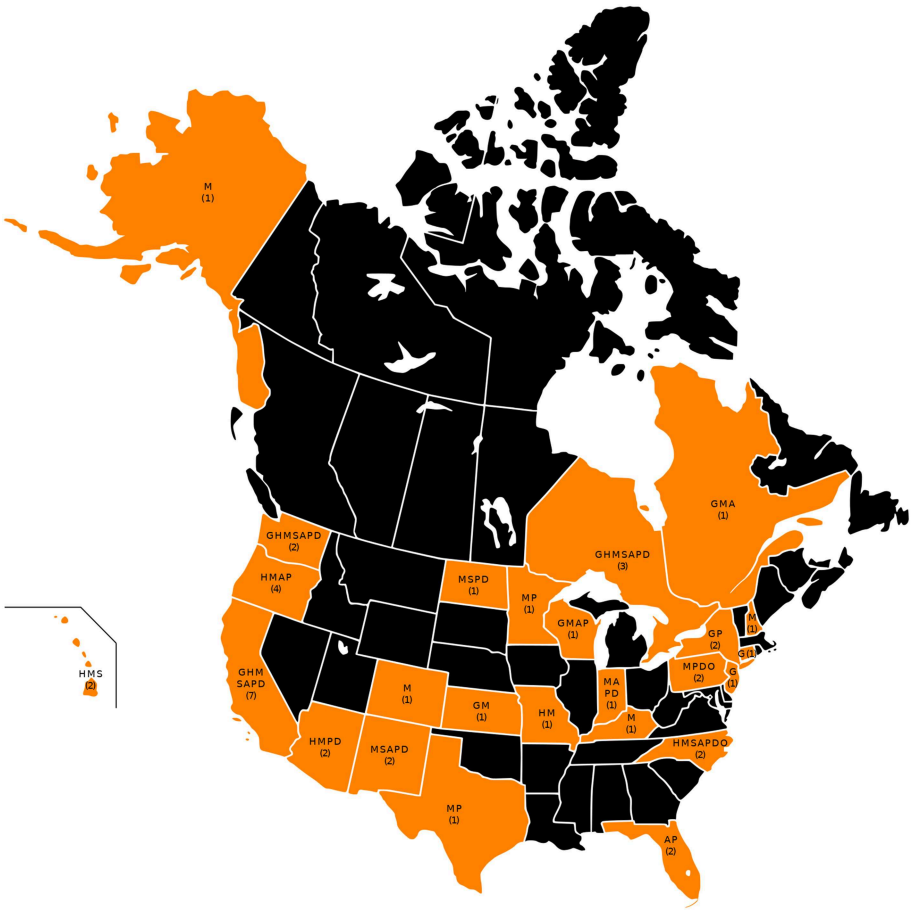

FIGURE 6 | All states and provinces with non-responding ADI and/or IGDF facilities at the time of the survey are shown in orange. The number of these non-responding facilities is shown on orange states and provinces. The letters indicate the types of dogs placed by these facilities in each state, according to their websites, listed in the order used in the survey. Key: G, guide; H, hearing; M, mobility; S, seizure; A, autism; P, psychiatric; D, diabetes.

messages indicated some turnover in these facilities. Some of the responding non-accredited facilities were placing large numbers of dogs. The data on non-accredited facilities obviously are incomplete and not representing all non-accredited facilities, yet the data reveal statistically significant patterns in the roles of dogs placed and the sources of the dogs when the accredited facilities are compared with the non-accredited facilities.

DISCUSSION

When facilities initially were established and began training and placing guide, hearing, and service dogs, training at each facility was somewhat standardized with a goal of each dog filling certain tasks for its role. Over one hundred tasks are delineated for guide, hearing, and (mobility) service dogs in a document posted by International Association of Assistance Dog Partners [IAADP: (24)]. For example, mobility service dogs are taught many tasks that are: retrieving, carrying (non-retrieval), deposit-based, tug-based, nose nudge-based, pawing-based, bracing-based, and harness-based. While much of the training for guide or mobility service dogs, in terms of tasks, understandably remains consistent, the broadening types of dogs are leading to new lists of required tasks that increasingly become tailored to the particular needs of the person becoming the dog's partner. Facilities in the U.S. and Canada have responded to the personalized needs of their clients by adding new roles for the dogs they place. A strong majority of facilities responding from the U.S. and Canada train and prepare dogs addressing the needs of clients with varied disabilities; for example, they do not only train mobility dogs, but also may train some other dogs for assistance with autism. A similar pattern was reported in Europe, but not internationally in other countries, where facilities more typically still place dogs of only one type (5).

The U.S. has led the way in developing many of the new uses for assistance dogs. With its relaxed laws and enforcement regarding assistance dogs, the U.S. can be the most innovative country in terms of uses and tasks of dogs. Although many states have facilities placing dogs to fill various roles, 11 states with accredited facilities failed to respond and 15 states lacked either an accredited facility or a non-accredited responding facility. In addition to dealing with disabilities that make traveling difficult and inconvenient, some potential partners of assistance dogs

TABLE 1 | Numbers of responding and non-responding ADI/IGDF facilities for the 33 states of the US and the four provinces of Canada with accredited facilities.

State	Responding	Non-responding	Total
Alberta	1	0	1
British Columbia	2	0	2
Ontario	2	3	5
Quebec	0	1	1
Alaska	0	1	1
Arizona	0	2	2
California	9	7	16
Colorado	1	1	2
Connecticut	0	1	1
Florida	4	2	6
Hawaii	2	2	4
Illinois	1	0	1
Indiana	0	1	1
Kansas	0	1	1
Kentucky	0	1	1
Maryland	2	0	2
Massachusetts	2	0	2
Michigan	2	0	2
Minnesota	3	1	4
Mississippi	1	0	1
Missouri	1	1	2
New Hampshire	0	1	1
New Jersey	0	1	1
New Mexico	0	2	2
New York	3	2	5
North Carolina	2	2	4
North Oakota	0	2	2
Ohio	3	0	3
Oregon	0	4	4
Pennsylvania	3	2	5
South Carolina	1	0	1
Tennessee	1	0	1
Texas	3	1	4
Virginia	3	0	3
Washington	2	1	3
Wisconsin	1	1	2
Wyoming	1	0	1
Totals	56	44	100

face economic challenges due to low incomes (25). Responses in this study reveal that availability for obtaining a well-trained assistance dog is less accessible in some states and provinces than others. Despite the U.S. having numerous facilities that place a large number of assistance dogs, many people in the U.S. have inconvenient access to providers of these dogs. These data expose the geographic hurdles that people with disabilities can face when they consider applying for an assistance dog. The facilities are not evenly distributed throughout the U.S. and Canada, and access to ADI-accredited facilities that train and place assistance dogs can be extremely inconvenient. Needing to negotiate with a distant facility and then travel there for a team training of a few weeks may pose an insurmountable burden for someone seeking an assistance dog. Such persons may become vulnerable targets to corrupt claims by people selling dogs that are sold as well-trained assistance dogs, but the dogs sometimes do not perform as promised.

Guide dogs assure physical safety for partners, as well as assisting with various tasks. This poses special difficulties and hard choices when an assistance dog needs to be retired. Very often the partner needs to quickly begin working with a new dog while deciding at the same time how to retire the older dog, so as to maintain function and travel in the world (26, 27). With only few widely dispersed facilities placing guide dogs, these partners face particular hurdles when retiring a dog is necessary. The waitlist for a dog may be long and the geographic distance may be a further consideration.

Numerous facilities, both accredited and non-accredited, train and place mobility service dogs; this means obtaining one of these dogs may be less challenging than for some other roles. Nonetheless, some outstanding facilities have long wait lists, which can lead people to approach facilities that are not non-profit or that may place less well-trained dogs, or that may offer less follow-up support. Potential handlers face difficult choices when deciding on which facility to focus their efforts.

Dogs that assist with autism and psychiatric disabilities are two newer types of dogs where placements, while still fewer in number than guide and mobility service dogs, are rapidly expanding. Autism dogs are commonly accepted, particularly because they assist with children who have autism. These dogs increasingly are placed by both the accredited and the non-accredited facilities. Acceptance of and demand for psychiatric dogs have increased due to the frequency of post-traumatic stress disorder in veterans. Non-veterans also are seeking psychiatric service dogs to assist with multiple psychiatric disabilities. While relatively few accredited organizations have filled this need for psychiatric service dogs, non-accredited facilities in the U.S. have increased and produce dogs to meet this need. A challenge for these veterans is that the Veterans Administration (VA) only supports people acquiring psychiatric service dogs trained by ADI accredited organizations (20). People needing VA support need to be on a long waiting list for an ADI-trained dog, even though there are many non-accredited facilities providing psychiatric service dogs. Many of these non-accredited facilities are non-profits that are preparing to apply for accreditation. They often assign the handler a dog selected from a shelter and then work with the new handler and dog over a period of about a year [e.g., Animal Rescue Foundation, Pets and Vets (28); Operation Freedom Paws (29)], or place the dog after considerable preparatory training for the new handler [e.g., Starfleet Service Dogs (30)]; some may even assist people in training their own dogs. Thus, all breeds and body sizes of dogs are being used to some extent in assisting roles. A study of dogs registered in California as assistance dogs included equal numbers of large and small dogs, and a lesser number of medium sized dogs (6).

Our results show that accredited facilities continue to place primarily guide, hearing, and mobility dogs, plus the newer autism dogs. Candidate facilities were placing diabetes detection

dogs, and non-accredited facilities were likely to place seizure detection and psychiatric service dogs. The accredited facilities placed facility-bred or specially bred dogs, not those from shelters or the handlers' own pet dogs, and the converse was the case for the non-accredited facilities.

Assistance dogs provide life-changing benefits for their handlers. This is widely understood with regards to guide dogs (31), and perhaps also mobility dogs (32). In addition, the full-time assistance dogs of other types also provide essential support of great value to their handlers (33), for example, including dogs for autism (34) or diabetes detection (35). Veterans living with their assistance dogs gain physiological and behavioral benefits (36). Even dogs with no special assistance training can alleviate mental illness symptoms (37). As most readers will recognize, these assistance dogs may facilitate the social interactions their handlers have with members of the public (38).

A problem sometimes experienced by assistance dog handlers is mistreatment of their dogs by the public, such as aggression from other dogs; this even can require early retirement of the dog (26). It undoubtedly impacts handlers that states greatly vary in the legal protection they provide to assistance dogs, ranging from no laws, to civil violations, misdemeanors, or felonies, as maximal penalties. A few of the states with no accredited facilities, Iowa, Montana, West Virginia, as well as District of Columbia, also have no laws protecting service dogs; Connecticut, Maine, and Vermont have only passed civil violations (39). A prospective handler living in a large state like Montana is highly disadvantaged when seeking an assistance dog: no accredited facilities and no legal protection for the dog.

Assistance dog facilities can play a major role in placing assistance dogs from reputable sources and that are adequately trained. ADI accredited facilities are required to be non-profit, and they can be one source of information, as can many of the non-accredited facilities that have a strong track record. The data clarify that non-profit accredited facilities typically follow a more conventional pattern of selecting dogs of known breed history and having an extended training, especially for roles in assisting with guiding, mobility, hearing, and autism. The less formalized non-accredited facilities often use dogs from shelters or the persons' own dogs for training, especially for roles as psychiatric service dogs.

Despite the rapid expansion of assistance dog facilities in the U.S. and Canada, there are significant gaps in the geographic distribution of these providers. This likely creates considerable hardships for many prospective assistance dog partners. Their disabilities and reduced economic status can combine with geographic hurdles as barriers to acquiring an assistance dog—one that could ameliorate some of their challenges with disabilities. Nonetheless, a majority of states had responses from either a mobility or guide dog facility, and many facilities addressed a variety of disabilities with the dogs they placed.

ETHICS STATEMENT

The study included only census information from assistance dog facilities on the numbers of dogs they placed. The study involved no direct involvement with the dogs or handlers, and thus no ethical review was required. We contacted the assistance dog facilities to acquire information on the dogs they had recently placed.

AUTHOR CONTRIBUTIONS

SW conducted all electronic communications with survey participants, managed the data for analyses, and prepared the figures. AT assisted in planning the study. NW provided statistical guidance. MY participated in the initial concept and survey design, and assisted in the initial manuscript draft. LH conceived the idea, oversaw data collection, and drafted the manuscript. All authors reviewed all drafts.

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SUPPLEMENTARY MATERIAL

The Supplementary Material for this article can be found online at: https://www.frontiersin.org/articles/10.3389/fvets.2019.00349/full#supplementary-material

The complete dataset is available on Figshare: doi: 10.6084/m9.figshare.7560380

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Conflict of Interest: The authors declare that the research was conducted in the absence of any commercial or financial relationships that could be construed as a potential conflict of interest.

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