The Applicability of the Difficulty with Mobility Questionnaire (DMQ) as an Outcome Measure for Dog Guide Instruction

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This study sought to assess the reliability, validity, and sensitivity of the Difficulty with Mobility Questionnaire (DMQ) to determine its applicability as an outcome measure for dog guide instruction. Forty-nine trainees receiving dog guide instruction from Leader Dogs for the Blind participated in this study. All rated their overall ability to get around (AGA) and the difficulty they experienced with 16 separate mobility related behaviours (DMQ-16) before and after training. The DMQ-16 was found to be reliable, valid, and sensitive enough to register change over time and therefore useful as an outcome measure. Dog guide instruction was found to result in changes in mean AGA, mean DMQ-16 and all but one of the 16 items this measure assesses.

Despite the obvious benefits of the dog guide as a mobility aid and numerous testimonials to that affect (Edwards, 2002; Ireson, 1991; Purves & Godwin, 1981; Warnath & Seyfarth, 1982) there is little published evidence of the efficacy of dog guide instruction on mobility-related behaviours in travellers who are blind and vision impaired (Lloyd, La Grow, Stafford, & Budge, 2008). However, what there is tends to be positive (Clarke-Carter, Heyes, & Holwarth, 1986; Delafield, 1974; Gray & Todd, 1968; Lloyd et al., 2008; The Seeing Eye, 2007, as cited in Franck, Haneline, Brooks, & Whitstock, 2010). Yet, most of this evidence has been gleaned from studies with very small numbers of participants (six or less) (Clarke-Carter et al., 1986; Delafield, 1974; Gray & Todd, 1968), have been extremely limited in scope for example, impact of dog guide instruction on preferred walking speed (Clarke-Carter et al., 1986) or have been retrospective in nature for example, "do you travel better now with a dog than you had before having a dog?" (Franck et al., 2010; Lloyd et al., 2008). None of this information would be sufficient to evaluate the effectiveness of dog guide instruction or to assess the value of varying aspects of its provision (e.g., length, intensity, location). As a result, more needs to be done to quantify the impact of dog guide instruction on mobility-related behaviours. This conclusion is not unique to

dog guide instruction, but has been found for all forms of mobility instruction conducted with people who are blind or vision impaired (Virgili & Rubin, 2010).

One reason for this finding may be that, despite their being some consensus over the content taught and modes of delivery in both orientation and mobility (O&M) (Barlow, Bentzen, Sauerburger, & Franck, 2010; Hill & Ponder, 1976; Jacobson, 2013; La Grow & Blasch, 1992; La Grow & Long, 2011) and dog guide (Franck, Haneline, Brooks, & Whitstock, 2010) instructional programs, there has not been a widely accepted evaluative tool that measures the breadth of skills to be obtained from such programs (Virgili & Rubin, 2010; Whiteneck, 1994). However, a tool which may meet this demand, the Difficulty with Mobility Questionnaire (DMQ) (La Grow & Ebrahim, 2012a; La Grow & Ebrahim, 2012b) has recently been developed as an outcome measure for O&M training. This measure assesses perceived difficulty across a broad range of skills usually addressed in comprehensive O&M training programs for example, avoiding obstacles in one's path of travel, walking along streets with footpaths, crossing streets at controlled intersections, maintaining orientation during travel, and using public transportation (Hill & Ponder, 1976; Jacobson, 2013; La Grow & Long, 2011).

The reliability, validity, and sensitivity of this measure has been evaluated with those enrolled in short but intensive O&M training programs (i.e., one week residential training programs) and found to be adequate in all cases (i.e., reliable, valid, and sensitive) (La Grow, Ebrahim, & Towers, 2014). As such, the DMQ appears to have promise as an outcome measure for evaluating the efficacy of O&M instruction. Yet, it is not known to what extent it would be applicable as an outcome measure for dog guide programs as well. The purpose of this study is, therefore, to assess the applicability of the DMQ (i.e., in this case the DMQ-17) as an outcome measure for an instructional program used to teach the use of a dog guide as a mobility aid.

Method

Participants in this study were all trainees undertaking centre-based dog guide instruction at Leader Dogs for the Blind, Rochester Michigan, USA from September 2013 to October 2014. In addition to the standard questions asked at intake, these trainees were also asked to rate their ability to get around and the degree of difficulty experienced when performing 17 specific mobility-related behaviours as a pre-training measure. They were then phoned and asked those same questions by an independent party six months after training as a post-training measure. An independent party was used at follow-up to avoid any bias that could result from being contacted and asked to rate their travel after training by their service provider. No other aspect of the usually available program was altered for this study (e.g., criteria for participation, content of instructional program, duration of instructional program, beginning and ending date of instruction, participating instructors, etc.). This project has been evaluated for ethical concerns by peer review, judged to be low risk and recorded on Massey University's Human Ethics Committee Low Risk Database.

Participants

Forty-nine persons presented for instruction with a dog guide during this time period. Twenty-three were to receive instruction with their first dog and 26 with a replacement dog (i.e., a new dog). They ranged in age from 23 to 82 years (mean age = 51.6) and 39% were male. All met the Leader Dogs for the Blind eligibility criteria for receiving dog guide instruction, these are to: (a) be at least 16 years of age (b) be legally blind (i.e., have visual acuity of 20/200 or less in the better eye with correction, or visual field that does not exceed 20 degrees at its widest angle) (c) be in good mental and physical health, including having the ability to walk unassisted for several blocks per day without jeopardising any current conditions and (d) have successfully completed a basic O&M training program (i.e., in the use of the long cane). In response to the question "*How much usable vision would you say you have?*" 12 (25%) persons indicated none, 32 (65%) a little, and 5 (10%) a lot.

Measures

Ability to Get Around: A single item was used to assess trainees' general levels of mobility or their 'ability to get around' (AGA). Each trainee was specifically asked '*How well are you able to get around?'* with response options ranging from 1 'Very poorly' to 5 'Very well'.

Difficulty with Mobility: The questionnaire used in this study was a shortened form of the original DMQ-23 (La Grow & Ebrahim, 2012a) which was found to contain a number of apparently redundant items (La Grow & Ebrahim, 2012b). Three items related to street crossing behaviours (i.e., *crossing quiet streets, crossing busy streets with pedestrian control devices,* and *crossing busy streets without pedestrian control devices*) appearing in the original questionnaire were replaced with a single item covering street crossing behaviour (i.e., *crossing busy or complex intersections*). In addition, four other mobility related behaviours (i.e., *getting around in department stores, getting around in supermarkets, re-establishing orientation if lost,* and *travelling in unfamiliar environments*) were removed from the questionnaire as they resulted in responses that were too similar to those obtained from questions reflecting related behaviours (i.e., *getting around in office buildings/schools/hospitals, getting around in shopping malls, maintaining orientation during travel,* and *travelling in familiar environments*) (La Grow & Ebrahim, 2012b).

The 17 remaining items were presented following the root question '*How much difficulty would you say you have in completing the following tasks?* Available responses ranged from 1 '*none at all*' to 5 '*an extreme amount'*. A '*don't know*' response option was also available for the instances where an individual genuinely had no idea how much difficulty performing a given task would be. An analysis of responses to all 17 mobility related behaviours assessed revealed that, on average, participants' responded '*don't know*' less than 5% of the time. However, one item (i.e., *travelling on escalators*) had an exceptionally high number of '*don't know'* responses (i.e., 12% at pre-training and 38% at post-training). As a result, the item '*travelling on escalators*' was dropped from analyses in this study effectively resulting in a 16 item measure (DMQ-16). Table 1 reports the format and response options for the revised DMQ-16.

Table 1. The Difficulty with Mobility Questionnaire (DMQ-16) item format and response options.

On a scale of 1-5 with 5 being most difficult, rate how much difficulty would you say you have in completing the following tasks?	None at all	A little	A moderate amount	A great deal	An extreme amount	Don't know
1. Avoiding obstacles in your path of travel	1	2	3	4	5	6
2. Walking along streets with footpaths	1	2	3	4	5	6
3. Walking along streets without footpaths	1	2	3	4	5	6
4. Identifying drop-offs (curbs/steps)	1	2	3	4	5	6
5. Negotiating curbs	1	2	3	4	5	6
6. Negotiating stairs	1	2	3	4	5	6
7. Getting around in your home and garden	1	2	3	4	5	6
8. Getting around in your immediate neighbourhood	1	2	3	4	5	6
9. Getting around in office buildings/ schools/hospitals	1	2	3	4	5	6
10. Getting around in shopping malls	1	2	3	4	5	6
11. Negotiating parking lots	1	2	3	4	5	6
12. Travelling on elevators	1	2	3	4	5	6
13. Maintaining orientation during travel	1	2	3	4	5	6
14. Travelling in familiar outdoor environments	1	2	3	4	5	6
15. Using public transportation	1	2	3	4	5	6
16. Crossing at busy or complex intersections	1	2	3	4	5	6

Note: For scoring purposes all 'don't know' responses are identified as 'missing items', all item responses are then summed and divided by the number of items each client responds to which provides an average DMQ score.

Analysis

The DMQ-16 was assessed for reliability, validity, and sensitivity to determine its applicability as an outcome measure for dog guide instruction. Reliability (i.e., the consistency of measurement) is a necessary but not sufficient condition for validity. Reliability was assessed using Cronbach's alpha coefficient, a commonly used measure of internal consistency (Pallant, 2011). Concurrent validity (i.e., the extent to which the score obtained from this measure correlates with the score obtained from a measure of a different but related construct) of the DMQ was assessed by determining

the degree to which the mean DMQ-16 score correlated with the mean AGA score. AGA is a well-established global measure of mobility (La Grow, Alpass, Stephens, & Towers, 2011; La Grow, Yeung, Towers, Alpass, & Stephens, 2011, 2013; Yeung, La Grow, Towers, Alpass, & Stephens, 2011). The evaluation of reliability and concurrent validity was assessed using both pre and post-training scores.

Sensitivity relates to the degree to which the measure is responsive to variations in either participant characteristics, intervention or both. In this case, sensitivity was assessed both across time (i.e., before and after intervention) and group (i.e., those receiving training with their first dog and those receiving training with a successor dog). As such, trainees were assigned to two groups depending on whether they were receiving training with their first dog (i.e., First Dog) or with a new replacement dog (i.e., Successor Dog). Groups were compared on both the mean DMQ-16 score and the single-item AGA score. While the telephone interview schedule resulted in no missing data for any measure used, the '*don't know'* responses from the individual DMQ items were treated as missing data when determining the mean DMQ score. A mixed between-within subjects analysis of variance (ANOVA) was then conducted to determine whether there were significant main effects for time (i.e., pre-training to post-training training) and group (i.e., First Dog versus Successor Dog) and whether or not an interaction effect between the two variables (i.e., time and group) was evident on either of these measures (i.e., mean DMQ-16 score and single-item AGA score). Eta Squared (η^2) was employed as a measure of the effect size of any main or interaction effects observed for this analysis. Change scores were also calculated on each of the 16 separate items making up the DMQ-16 by subtracting the post-training score from the pre-training for each participant. Change scores were reported for each item and each group separately.

Results

Scale reliability analysis using Cronbach's alpha coefficients at pre-training (0.92) and post-training (0.96) indicated that the shortened DMQ-16 has high internal consistency significantly above the level of 0.7 considered to show adequate reliability (DeVellis, 2003). The concurrent validity is moderate with the mean DMQ score and the mean AGA being found to have a medium strength correlation at both pre ($r = .407$) and post-training ($r = .332$).

Sensitivity of the DMQ and the utility of the AGA as outcome measures for dog guide instruction were assessed by comparing scores over time and between groups. Figures 1 and 2 illustrate the changes in the AGA and DMQ-16 mean scores (including 95% confidence intervals) observed overtime (i.e., from pre-training to post-training) for both the First Dog and Successor Dog groups. Table 2 provides the results of mixed between-within subjects ANOVA comparing group (First Dog and Successor Dog) against time (pre-training and post-training) for both the AGA and DMQ-16 mean scores separately. These results indicate that a significant main effect was found for time (i.e., from pre-training to post-training) for both the mean AGA and DMQ for both groups. Furthermore, the effect size found for both scores was large suggesting that participation in the training

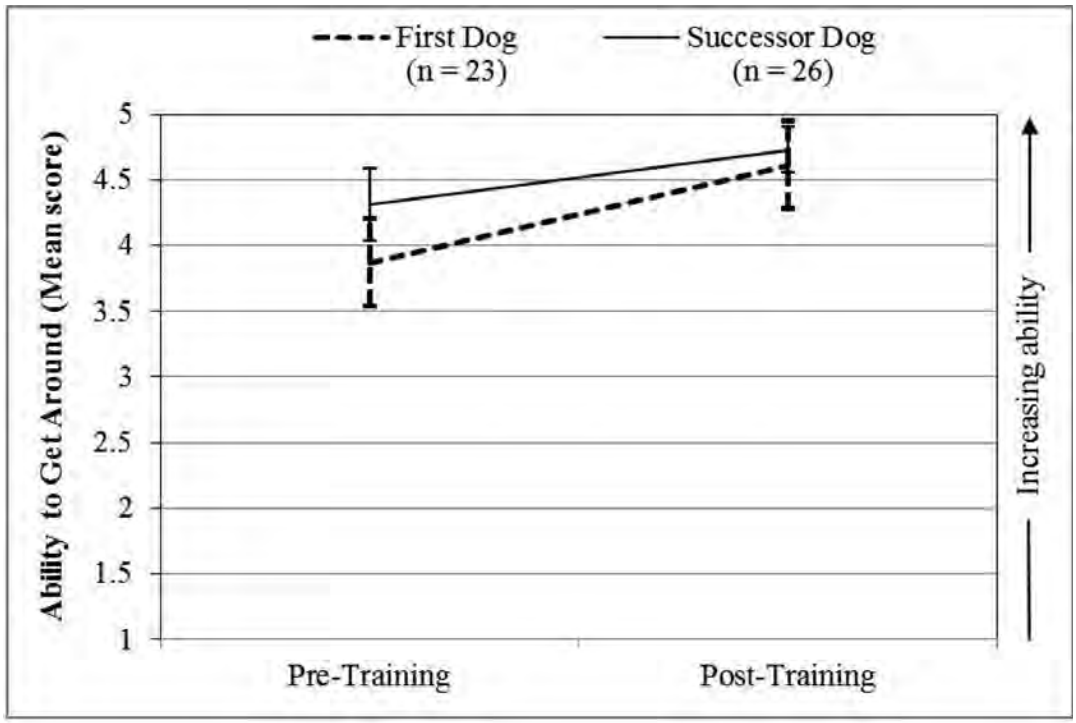

Figure 1. Changes from Pre-Training to Post-Training in mean Ability to Get Around score (with 95% CI) for First Dog and Successor Dog groups.

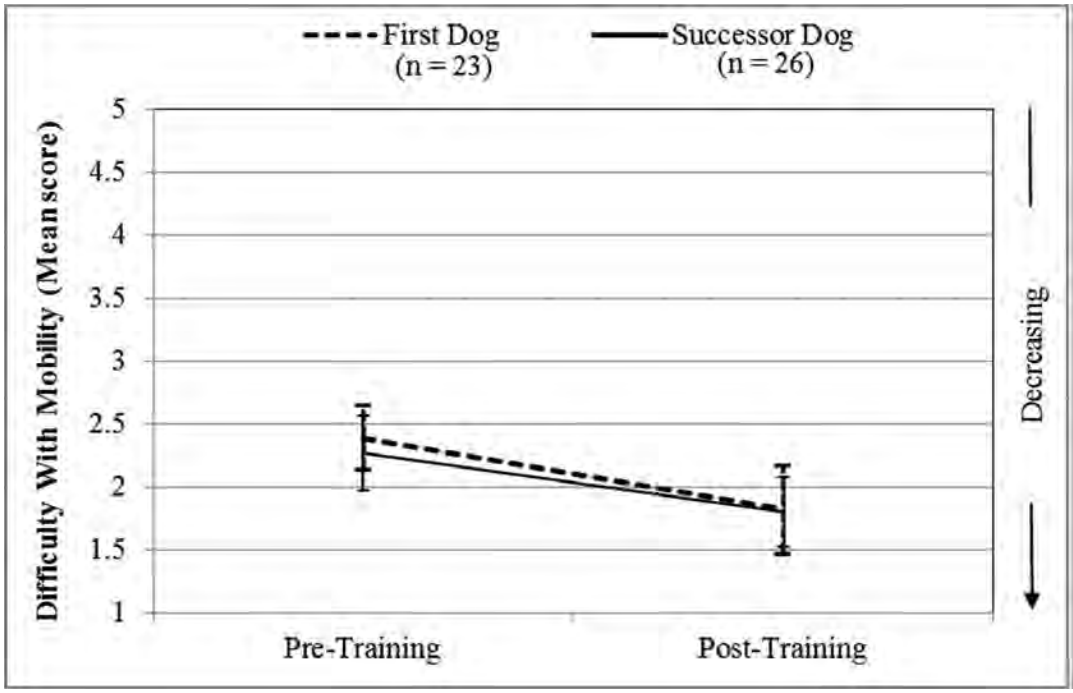

Figure 2. Changes from Pre-Training to Post-Training in mean Difficulty with Mobility score (with 95% CI) for First Dog and Successor Dog groups.

Table 2. A mixed between-within ANOVA assessing change in AGA and DMQ-16 scores from Pre-training to Post-training for First Dog and Successor Dog groups.

				Time: $\bar{x}$ (sd)				
		Group	**n**	**Pre-training**	**Post-training**	**F (df)**	**p**	**η^2**
AGA	Main effect: Time	*Total sample*	49	4.10 (.80)	4.67 (.66)	19.98 (1, 47)	<.001	.43
	Interaction: Group*Time	First Dog	23	3.87 (.82)	4.61 (.84)	1.48 (1,47)	.23	.03
		Successor Dog	26	4.31 (.74)	4.73 (.45)	-	-	-
DMQ-16	Main effect: Time	*Total sample*	49	2.33 (.70)	1.81 (.77)	11.83 (1, 47)	=.001	.25
	Interaction: Group*Time	First Dog	23	2.39 (.61)	1.82 (.87)	0.14 (1, 47)	.72	>.01
		Successor Dog	26	2.27 (.78)	1.80 (.78)	-	-	-

Note: AGA = Ability to Get Around mean score; DMQ-16 = Difficulty with Mobility Questionnaire (16-item version) mean score.
$\bar{x}$ (sd) = group mean (standard deviation); F(df) = F test (degrees of freedom); η^2 = Eta-Squared (≤ .02 = small effect; .13 = medium effect; ≥ .26 = large effect)

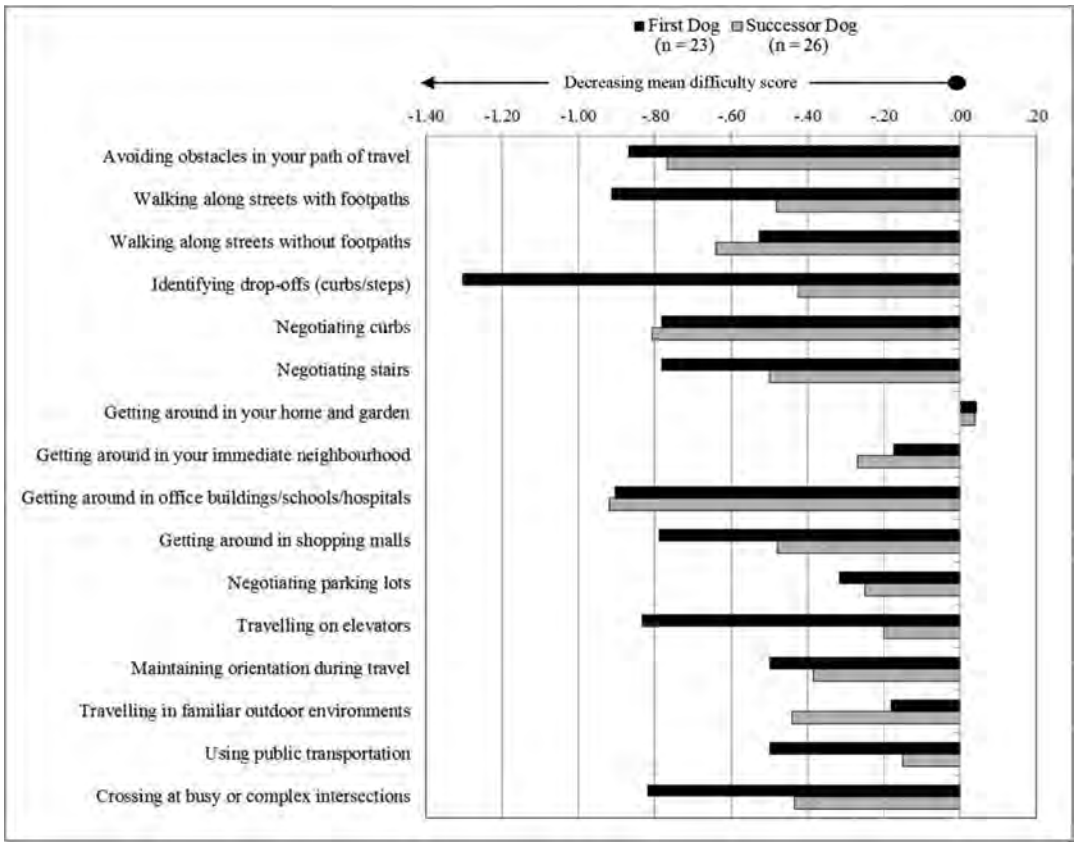

Figure 3. Direction of Pre-Training to Post-Training change in mean score for each of the Difficulty with Mobility Questionnaire (DMQ) items for First Dog and Successor Dog groups.

program increased perceived ability to get around while reducing the overall degree of difficulty reported for the various mobility related behaviours assessed with the DMQ-16. A small but significant difference was found to have existed between the groups (t (47) = 1.98, p=.05, d = .57) on one of the scores (i.e., the AGA score) before training. No differences were found between the groups on either score after training. No significant interaction effect was found between time and group for either the AGA or DMQ-16 mean scores. These results suggest that the degree of change observed for both the AGA and DMQ-16 mean scores from pre-training to post-training were experienced relatively similarly for both groups.

Change scores were used to ascertain the impact that dog guide instruction was seen to have on each of the separate items included in the DMQ-16. Figure 3 illustrates the direction of change from pre-training to post-training for each item for each group (i.e., First Dog and Successor Dog) separately. More and greater changes were observed for the First Dog group than the Successor Dog group, with the greatest changes observed for *identifying drop-offs (curbs/steps), avoiding obstacles in your*

path of travel, walking along streets with footpaths, getting around in office buildings/ schools/hospitals, and *negotiating curbs.*

Discussion

From the results of this study, it seems clear that the DMQ-16 is both reliable (i.e., a high level of internal consistency) and has a reasonable degree of concurrent validity (i.e., medium strength correlation between mean DMQ and AGA scores) as measured against the AGA; a different but related measure of mobility. The DMQ-16 has also been demonstrated to be sensitive to both change over time (i.e., pre to post-training) and to differences in participant characteristics (i.e., those training with their first dog compared to those training with a replacement dog) and, therefore, appears fit for use as an outcome measure for dog guide instruction. These findings are similar to those reported by La Grow et al. (2014) when evaluating the suitability of the DMQ as an outcome measure with two long cane programs and together suggest that the DMQ may be an appropriate measure for assessing O&M instruction regardless of the type of mobility aid used.

It is also clear from the findings reported here that dog guide instruction results in improvement in both measures used in this assessment with the participant's overall perception of their ability to get around increasing and their difficulty with mobility decreasing from pre- to post-instruction. However, it is worth noting that both groups (i.e., First Dog and Successor Dog) rated their ability to get around highly both before and after training. The AGA measure was scored such that a score of 3 reflects ability that is 'neither poor nor well', 4 reflects 'well' and 5 'very well'. Those who were training with a replacement dog had a mean AGA score of 4.31 (SD = .74) before training and 4.73 (S = .45) after, while those who were training with their first dog had a mean AGA of 3.87 (SD = .82) before training as compared with 4.61 (SD = .84) after. This was not surprising as both groups were experienced travellers. It is also not surprising that the First Dog group experienced a greater change in score over time than the Successor Dog group as those in the First Dog group had not used a dog guide as a mobility aid before while those in the Successor Dog group had. It is also worth noting that there was a significance difference found in AGA between these groups before training but not at six months after training. Thus, it seems, that those who do travel with a dog as a mobility aid do perceive that they can get around better overall than they did before using it as has been reported more anecdotally elsewhere (Clarke-Carte et al., 1986; Delafield, 1974; Gray & Todd, 1968; Lloyd et al., 2008; The Seeing Eye, 2007 in Franck et al., 2010).

Similarly, both groups rated their mean difficulty with performing the mobility related behaviours (note: 3 = a moderate amount, 2 = a little and 1 = none at all) as being between 'a little' and 'a moderate amount' before training and 'a little and none at all' after training (Mean DMQ-16 for both groups: pre-training = 2.33, SD = .70; post-training = 1.81, SD = .77). While the First Dog group appeared to have a higher mean difficulty score at pre-training than the Successor Dog group there were no statistically significant differences found between the groups either before or after training in their overall rating of their

difficulty with performing these mobility related behaviours.

When looking at the behaviours listed on the individual DMQ items, participants rated the performance of these behaviours as substantially *less* difficult after training in all cases but one (i.e., getting around in your home and garden). The greatest decrease in difficulty was experienced with *identifying drop-offs (curbs/steps), walking along streets with footpaths, avoiding obstacles in your path of travel, getting around in office buildings/schools/hospitals, travelling on elevators, crossing busy or complex intersections, and negotiating curbs* in that order. The greatest changes were also experienced by the First Dog group in all cases except *walking along streets without footpaths, negotiating curbs, getting around in office butildings/schools/hospitals* and *travelling in familiar outdoor environments.* While it is evident that the training program was effective for both groups, it seems that it may have been so for different reasons.

The First Dog group, for example, changed mobility aids as part of this program from using a long cane to a dog guide, while the Successor Dog group did not. Rather, the latter simply changed the mobility aid used from a dog that was presumably no longer functioning optimally to a new dog. Thus, it is not surprising that the First Dog group experienced more and greater changes (i.e., on 10 of the 16 behaviours assessed) than the Successor Dog group in the level of difficulty experienced performing specific mobility related behaviours. It is also not surprising that those behaviours included *identifying drop-offs (curbs/steps), walking along streets with footpaths, using public transportation,* and *crossing at busy or complex intersections* as the dog is specifically trained to perform each of these tasks (Franck et al., 2010) as part of their role as a mobility aid. The one other mobility-related behaviour that stands out is *travel on elevators*, which is presumably less difficult when travelling with a dog than with a cane as the dog will lead the traveller to the call button and into the open door while the cane traveller has to find the button tactually and identify the opening door aurally.

No such advantage appears to exist for travelling on escalators. It is also apparent that instruction in performing this mobility-related behaviour is not a standard part of the dog guide program at Leader Dog as nearly twice as many trainees from the First Dog group than the Successor Dog group reported that they 'did not know' how much difficulty this task would pose after training than before. If this is true with other dog guide programs then it may be best to use the 16 item version of the DMQ rather than the 17 item version initially proposed for this study. It is heartening to note that shortening this version from the original DMQ-23 did not result in an appreciable loss in reliability (La Grow et al., 2014).

There were a number of limitations in this study that must be acknowledged. First, there were no controls set in place to ensure that instruction with a dog guide was in fact the reason for the change observed from before to after training. It is possible, but not overly likely, that changes observed were the result of the passage of time only. Second, the sample of this study was a convenience one. All those who received training with the dog guide did so because they sought it. No planned comparison between training with a long cane and training with a dog guide was carried out. The sample size remains small. Studies conducted with larger

samples would be preferable. Finally, the intervention compared across groups varied in amount and content. Those receiving a first dog received more training on average and a more standard program of training than those returning for a replacement dog. Future studies should address these limitations. However, it does appear that the measures used here make it possible to do so. It would be particularly valuable if they would be used in addition to some more objective measures (e.g., geo-mapping, pedometers, travel logs etc.).

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