



Parents' perspectives on the value of assistance dogs for children with autism spectrum disorder: a cross sectional study

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7 **Parents' perspectives on the value of assistance dogs for children with autism**
8 **spectrum disorder: a cross sectional study**
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Abstract.

Background: Whilst there is an emerging literature on the usefulness of assistance dogs for children with Autism Spectrum Disorder (ASD), there is a dearth of quantitative data on the value of assistance dogs programmes for the family unit and family functioning.

Objectives: Using previously validated scales and scales developed specifically for this study, we measured parents/guardians perceptions of having an assistance dog on (a) child safety from environmental dangers, (b) public reception of ASD, (c) levels of caregiver strain and sense of competence. We also obtained open ended response data from parents/guardians on benefits and constraints of having an assistance dog.

Primary and Secondary Outcome Measures: The primary outcome measures were scores on environmental hazards and public reception scales. Secondary outcome measures were scores on caregiver strain and competence scales.

Setting: This study was based in the primary care setting, within the context of a specific national assistance dog's programme in the Republic of Ireland.

Participants: A total of 134 parents/guardians with an assistance dog, and 87 from a waiting list control group were surveyed.

Results: Parents/guardians of children who have ASD and an assistance dog rate their child as significantly safer from environmental dangers ($p < 0.001$), perceive that the public act more respectfully and responsibly towards their child ($p < 0.001$), and feel more competent about managing their child ($p = 0.023$) compared to controls. There was an intensity of positive feeling towards assistance dogs programmes. Safety and comfort for children, and a sense of freedom from family restrictions associated with ASD were regarded as the most important benefits of having an assistance dog. The amount of dedication and commitment

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2
3 required to care for a dog were viewed as the primary constraints. **Conclusions:** Our
4
5 findings indicate that the assistance dog programmes can be a valuable intervention for
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7 families with children who have ASD.
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10 11 12 **Main Strengths and Limitations of this study** 13

- 14
15 • This study is the first to capture the views of a large group of parents/guardians on
16
17 an assistance dog's intervention.
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- 19
20 • Findings indicate the high value of dogs in promoting safety, security and positive
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22 public reception for children with ASD.
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- 24
25 • This study assessed the perceptions of waiting list controls as opposed to using a
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27 stronger RCT design, where controls are randomly assigned to another intervention.
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Introduction

The presence of animals as an intervention tool was first studied by psychotherapist Boris Levinson via a series of case studies.¹ At the time animals were seen as inferior replacements for human social interactions.² Since the 1970's animals have been used as a means of improving human physical, emotional, cognitive and social functioning. Animal interventions are classified into three groupings; animal assisted activities (AAA), animal assisted therapies (AAT) and service animal programmes (SAP).³

Animal assisted activities are delivered by trained personnel in environments such as hospitals and educational settings with an emphasis on quality of life enhancement via recreation and education e.g., therapeutic horse riding to treat populations with physical and mental disabilities.⁴⁻⁵ Animal assisted therapies are practiced by professionals with individualised therapy goals.⁶ The emphasis is on improvements in physical, social and cognitive functioning. A meta-analysis of the literature on AAT has shown that they are associated with moderate effect sizes in improving outcomes in four areas: autism spectrum symptoms, medical difficulties, behavioural problems, and emotional well-being.⁷

Service animal programmes (SAP) use dogs to assist people with a disability in performing daily activities. Service dogs live in-house with the people they work with. Of late assistance dogs have received growing attention as a means of aiding children with ASD. The presence of a dog has been shown to improve quality of life in children.⁸ Social and cognitive benefits in addition to physical and medical benefits have been found.⁹⁻¹⁰ Assistance dogs complete a unique triad between parent/guardian and child. Typically the child is attached to the dog via a lead (leash) and belt. The dog walks with the child but

1
2
3 takes commands from the parent (handler).¹¹ If the child tries to step off a footpath or
4
5 attempts to bolt, the dog will use all his/her power to slow the child down. Assistance dogs
6
7 prohibit dangerous behaviour such as elopement (bolting) and provide a calming presence.
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12 Elopement or the tendency to 'bolt' is characteristic of ASD. Such behaviour can result in a
13
14 child's exposure to dangerous traffic situations or encounters with strangers.¹² Despite
15
16 reports of higher mortality rates in ASD populations owing to accidents such as suffocation,
17
18 drowning and injuries, research on elopement behaviour is sparse.¹³⁻¹⁵ If left untreated
19
20 elopement may result in the need for a child to be moved to a restrictive setting.¹⁶ In a
21
22 systematic review of the literature on current elopement treatments such as function based
23
24 interventions, Lang and colleagues conveyed that just two of ten studies examined reported
25
26 complete elimination of elopement.¹⁷ Treatments that effectively eliminate elopement
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28 behaviours are warranted.
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36 Social, emotional and behavioural challenges at home and in public mean that
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38 parents/guardians of children with ASD experience stress in most areas of their lives.¹⁸⁻²¹ In
39
40 addition to behaviours such as elopement, public tantrums and the reaction from others are
41
42 regarded as being some of the more difficult aspects of a child with ASD's behaviour.
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44 Situations can leave parents/guardians feeling judged as 'bad' parents, or feeling like a
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46 failure.²² In this context assistance dogs can provide a unique support by facilitating child
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48 safety and promoting positive public reception.
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55 Currently there are 188 service animal programmes registered with the governing body
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57 Assistance Dogs International (ADI). These programmes include guide dogs for the blind,
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3 hearing dogs for the hard of hearing, and service dogs for people with other disabilities
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5 including autism. In this study we measured parents/guardians ratings on: (a) the impact of
6
7 having an assistance dog on child safety from environmental hazards, (b) public acceptance
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9 and awareness of autism, (c) sense of competence with managing a child with autism and
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11 (d) levels of caregiver strain. We also obtained parents/guardians views on the primary
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13 benefits and constraints of having an assistance dog.
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20 **Methods**

21 **Study Design and Participants**

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23 Our study was based in the primary care setting, within the context of a specific national
24
25 assistance dog's programme in the Republic of Ireland. Parents/guardians with an
26
27 assistance dog (N=205) and parents/guardians on the waiting list for an assistance dog
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29 (N=107) were eligible to take part. Expedited ethical approval was granted from the Clinical
30
31 Research Ethics Committee of the Cork Teaching Hospitals. Data were gathered between
32
33 October 2012 and March 2013.
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40 **Measures**

41
42 Parents/guardians were asked to complete a four part questionnaire (Table 1). Part one
43
44 examined child demographics. Part two measured parents/guardians sense of competence
45
46 for managing a child with autism using Perceived Competence Scales (PCS)²⁴ ($\alpha = 0.876$, 7
47
48 point scales: low-high competence). It also assessed levels of strain using the Caregiver
49
50 Strain Questionnaire CGSQ²⁵ ($\alpha = 0.940$, 5 point scales: low-high strain), which has been
51
52 validated to assess burden among caregivers of children with autism.²⁶ Part three examined
53
54 perceptions of child safety from environmental hazards such as traffic, dangerous materials
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2
3 and outdoor spaces ($\alpha=0.928$, 7 point scales: low-high safety/security). Additionally it
4
5 assessed parents/guardians ratings on the general public's acceptance of their child
6
7 ($\alpha=0.940$, 7 point scales: low-high acceptance). Scales for part three were developed with
8
9 reference to the format and structure of the Neighbourhood Environment Walkability Scale
10
11 – Youth²⁷, and via consultation with parents and author MC, who is a psychologist
12
13 specialising in children with autism. Part four asked participants to give their views of the
14
15 main benefits/constraints of having an assistance dog. Those on the waiting list were asked
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17 to give the benefits/constraints that they feel a dog will bring.
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24 **Pilot**

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26 We piloted the questionnaire with eight parents/guardians, four of which have an assistance
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28 dog and four who are on the waiting list. Minor modifications were made to the final
29
30 questionnaire on the basis of their responses.
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33 **Procedures**

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35 The primary caregiver from each family with an assistance dog, and each family on the
36
37 waiting list received a postal questionnaire from the contact person at the assistance dog's
38
39 centre. In the interests of confidentiality, the researchers at University College Cork did not
40
41 have access to names and addresses of participants. The assistance dog's centre did not
42
43 have access to the completed questionnaires. Each questionnaire pack contained a consent
44
45 form with study details, a questionnaire, a stamped addressed envelope, and an envelope
46
47 marked 'Research'. Participants were requested to place completed questionnaires in the
48
49 envelope marked 'Research' and to seal it. They were asked to place the sealed envelope
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51 with the signed consent form in the stamped addressed envelope, and to post back to the
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3 assistance dog's centre. Participants were assured that participation in the study would
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5 have no impact on their status with the centre.
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10 **Data Analysis**

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12 Descriptive statistics are reported using frequencies tables. T-tests were used to test for
13
14 differences within the data on competence, caregiver strain (CGSQ), environmental hazards
15
16 and public awareness. We adjusted for age, gender, location and type of school attended
17
18 using a linear regression model. Qualitative data were analysed thematically, coded and
19
20 cross checked by authors LB and LD.
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27 **Results**

28 **Demographics**

29
30 A total of 134 parents/guardians with an assistance dog (65% response), and 87
31
32 parents/guardians from the waiting list controls (81% response) completed the
33
34 questionnaire. A large proportion of participants with a dog have children over the age of
35
36 ten (40%) compared to just three participants from the waiting list. For this reason we
37
38 eliminated the 'over tens' from further analysis in this paper.
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46 A breakdown of the demographic characteristics of participants' children is in Table 2. A
47
48 majority are male (87.5% with dog; 91.7% waiting list) and similar percentages have other
49
50 medical conditions in addition to ASD (35% with dog; 32.1% waiting list). The largest group
51
52 live in suburban areas (41.3% with dog; 57% waiting list) followed by the countryside (45%
53
54 with dog; 34% waiting list). Over half of the children with a dog are verbal (52.5%) and
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56 under half of the waiting list controls are verbal (42%). There are differences in types of
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3 school attended between participants whose children have an assistance dog and controls.
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5 These are reflective of the remaining age differences between the two groups post removal
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7 of the over tens from the total sample. The main difference is that 61.3% of children with a
8
9 dog attend a special school for ASD compared to 35.7% of waiting list controls. Conversely
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11 34.5% of controls are in a special class in primary school compared to 21.3% who have a
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13 dog.
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19 With regard to conventional interventions received there are some descriptive differences
20
21 between participants whose children have an assistance dog and waiting list controls (Table
22
23 2). There is a less than 10% difference between the groups for regular speech and language
24
25 therapy (47.5% with dog; 38.1% waiting list) and regular occupational therapy (46.3% with
26
27 dog; 38.1% waiting list). Similar percentages from both groups have a resource teacher
28
29 (25% with dog; 26.2% waiting list), and there is a 12% difference with regard to special
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31 needs assistants (80% with dog; 67.9% waiting list)
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39 There are significant differences between profiles of children who have a dog and waiting
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41 list controls with respect to gender, age and schooling. There are no significant differences
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43 between the groups for other conditions in addition to ASD, whether a child is verbal or
44
45 nonverbal, conventional interventions and home location.
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50 **Environmental Hazards & Public Awareness**

51
52 The environmental hazards scales are summarized in Table 4. Ratings are from low
53
54 perceived safety to high safety. Mean ratings are higher for parents/guardians whose
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56 children have a dog (32.43) than for those on the waiting list (22.97). These differences
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3 remain significant after adjustment for gender, age, home location and school type
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5 (p<0.001). We did however find a significant interaction between school types and
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7 whether children have a dog. Although there are significant differences between the rating
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9 of parents/guardians with a dog and those on the waiting list for children attending a special
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11 school for autism (mean difference=6.62: 95%CI 0.639, 12.61), the effect is not as large as it
12
13 is for children attending a primary school (mean difference=12.53: 95%CI 4.16, 20.90) or a
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15 special class in a primary school (mean difference=19.49: 5%CI 13.171, 25.821).
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21 The range of scores from the public perception scales (Table 3) are from low to high, with
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23 higher scores indicating a perception from parents/guardians that people act more
24
25 respectfully and responsibly towards children with ASD when in public settings.
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29 Parents/guardians mean ratings are higher for those whose children have an assistance dog
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31 (15.87) than for controls (10.67). For the most part these differences remain significant
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33 after adjusting for gender, age, home location and education level (p<0.001). However,
34
35 there was a significant interaction between type of school attended and whether children
36
37 have an assistance dog. Although there are significant differences between the ratings of
38
39 parents/guardians with a dog and waiting list controls where their children attend a special
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41 school for autism (mean difference=6.65: 95%CI 3.79, 9.51), and a special class in primary
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43 school (mean difference=7.01: 95%CI 2.88, 11.13), there is no significant difference in the
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45 ratings of parents/guardians who have a child in a main stream primary school (p=0.09).
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52 **Perceived Competence and Caregiver Strain**

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54 A summary of results from parents/guardians perceived competencies with regard to caring
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56 for and managing their child with ASD are in Table 3. Mean scores for parents/guardians
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3 whose children have an assistance dog (19.75) show higher perceived competencies than
4
5 waiting list controls (17.91). This difference remained significant after adjusting for gender,
6
7 age, home location and education level ($p=0.02$). Results from the Caregiver Strain
8
9 Questionnaire (CGSQ) (Table 3) show that parents/guardians rated the questionnaire items
10
11 similarly. We found no significant differences between the groups with regard to any of the
12
13 individual items on the scales, or the summarized scores for 'objective strain', 'subjective
14
15 internalized strain', and 'subjective externalized strain'.
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22 **Benefits and Constraints**

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24 Qualitative data were analysed using a thematic approach and constant comparison
25
26 techniques by authors LB and LD. The initial qualitative analysis was performed by LB, and
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28 these results were cross-checked and refined by LD. We analysed the first and second listed
29
30 benefits and constraints of having an assistance dog. Data beyond the first two benefits and
31
32 constraints are sparse and not reported.
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39 Three themes were identified under 'benefits'. These were; physical factors, relationship
40
41 factors and family factors (Figure 1). 'Physical factors' is divided into four categories and
42
43 focuses on how assistance dogs can keep a child safe whilst facilitating parents' ability to
44
45 manage: *"A sense of security & protection for our daughter especially walking in local*
46
47 *environments" (parent of girl 7-9yo with a dog), "(Dog) will stop child from bolting from*
48
49 *home" (parent of boy 4-6yo on waiting list)*. For 3 out of 4 categories, this theme is evenly
50
51 dispersed between parents who have a dog and waiting list controls. For the fourth
52
53 category 'no bolt', more parents/guardians from the waiting list state the benefit of the dog
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55 being able to stop the child from eloping. 'Relationship factors' is grouped into two
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3 categories and centres on the direct positive relationship between the child with ASD and
4
5 his/her assistance dog: *"She is his very best friend"* (parent of boy 4-6yo with a dog), *"It*
6
7 *might calm him down instead of him head banging the windows"* (parent of boy 4-6yo on
8
9 *waiting list*). The categories making up this theme are almost evenly dispersed between
10
11 parents/guardians who have a dog and waiting list controls. 'Family factors' is split into five
12
13 categories and is about how day to day family and social life is affected by the introduction
14
15 of an assistance dog: *"Ability to do maybe ordinary things and go to ordinary places"* (parent
16
17 *of boy 7-9yo on waiting list*), *"a sense of responsibility, for example he can feed the dog"*
18
19 *(parent of boy 4-6yo with a dog)*. There were differences in the dispersal of this theme
20
21 among parents/guardians with a dog and those on the waiting list. For example benefits
22
23 listed by those with a dog formed more of the category 'visibility', which is about public
24
25 reception and awareness of ASD. Benefits listed by parents/guardians on the waiting list
26
27 formed more of the categories 'social' and 'emotion and stress'. 'Social' is about a child
28
29 with ASD's sociability with family and outside the home. 'Emotion and stress' is about levels
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31 of emotion/stress in the family, and to a lesser extent the ability of the child to express
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33 emotion.
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43 Four themes emerged from the data on constraints. These were; 'change factors',
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45 'relationship factors', 'limiting factors' and 'no constraints' (Figure 2). Change factors has
46
47 three categories and focuses on life style challenges that parents/guardians experience or
48
49 anticipate experiencing when they have an assistance dog: *"Its' like an additional child in the*
50
51 *family"*(parent of boy 4-6yo with a dog), *"To make time to go for walks everyday"* (parent of
52
53 *boy 7-9yo on waiting list*). The categories comprising this theme are quite evenly dispersed
54
55 between parents/guardians of children with a dog and those on the waiting list. Slightly
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3 more parents/guardians waiting for a dog list 'dedication', which is the time and effort given
4
5 to care for the dog as a main constraint. As with the benefits themes, 'relationship factors'
6
7 is about the direct relationship between the child with ASD and the dog: *"My son may not*
8
9 *connect with the dog"* (parent of boy 4-6yo on waiting list), *"my concern is when the dog has*
10
11 *to retire, how will my child cope?"* (parent of boy 7-9yo with a dog). More
12
13 parents/guardians on the waiting list make up the category 'acceptance', which is
14
15 concerned about how the dog will be accepted by the child and other family members. The
16
17 third theme 'limiting factors' has four associated categories and centres on day to day
18
19 constraints of having a dog on family life; *"Extra expense for food, vet bills etc"* (parent of
20
21 *boy 7-9yo with a dog)*, *"it will be a bit difficult to travel"* (parent of boy 4-6yo on waiting list).
22
23 There are large differences in the dispersal of two of the categories within this theme. In
24
25 particular, more parents/guardians whose children have a dog contributed to the category
26
27 'clean', which is about day to day hygiene activities related to the dog e.g., dog hair in the
28
29 house and dealing with dog toileting. More parents/guardians on the waiting list
30
31 contributed to a category on 'holidays', which expressed concerns about going on holidays
32
33 with the dog. The final theme 'no constraints' has just one category. This was a category in
34
35 which parents/guardians stated no issues for concern or anticipated drawbacks; *"There are*
36
37 *none....our dog is a valuable and much loved addition to the family"* (parent of boy 7-9yo
38
39 *with a dog)*, *"don't anticipate any, feeling very positive about it"* (parent of boy 4-6yo on
40
41 *waiting list)*. This category was almost evenly dispersed between parents whose children
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43 have a dog and those on the waiting list.
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55 Discussion

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3 Our study is the first to capture the views of a large group of parents/guardians on an
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5 assistance dog's intervention. Quantitative findings indicate the value of dogs in promoting
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7 safety, security and positive public reception for children with ASD. They also suggest that
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9 the presence of an assistance dog can make parents/guardians feel more competent with
10
11 managing their child. Qualitative findings indicate the role assistance dogs play in
12
13 promoting child safety, calmness and provision of friendship. They also highlight the role
14
15 the dog has in facilitating 'normal' family functioning, such as being able to visit a shopping
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17 centre. Constraints associated with having a dog relate to specific lifestyle changes
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19 experienced by parents/guardians and the larger family group, such as dedicated care of the
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21 dog.
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29 There are several study limitations. Firstly, our findings are based on self-reports and are
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31 subject to participant overestimation and recall bias. Secondly, there were considerable
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33 differences in children's ages and type of schools attended between our two sample groups
34
35 which resulted in removal of the over tens from our analyses and a reduction in sample size.
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37 Thirdly we did not assess the views of parents/guardians who do not want an assistance dog
38
39 for their child. The fourth and main limitation of the study is that we assessed the
40
41 perceptions of waiting list controls as opposed to using a RCT design, where controls are
42
43 randomly assigned to another intervention. Such a design was not feasible however and the
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45 current data do provide insights.
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53 Recognition of the value animal interventions play in promoting human health is gaining
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55 momentum. Animal interventions have been shown to produce increases in self-efficacy
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57 and coping in psychiatric patients²⁸⁻²⁹ promote recovery from ill health^{30, 2, 31}, and improve
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3 academic performance, adaptive functioning and behavioural/emotional problems with
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5 special education adolescents.³² Autism spectrum disorder is one of the areas within which
6
7 animal interventions have had most success.⁷ This is particularly the case for assistance dog
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9 programmes, since dogs not only provide a possible mechanism for promoting
10
11 improvements in social and behavioural functioning, they also play a part in control of
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13 elopement and promotion of child safety. Once a child is attached to a dog they cannot
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15 'bolt'. In this study parents/guardians with a dog rated their child as considerably more safe
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17 from environmental hazards than did waiting list controls. We did find a reportable
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19 interaction between having an assistance dog, type of school attended and
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21 parents/guardians ratings. This interaction indicated a lesser albeit significant effect of
22
23 having a dog for parents/guardians whose children attend a special school for ASD. The
24
25 smaller effect may be due to the specific care that children and families receive from ASD
26
27 schools. Currently there are no other interventions that can successfully eliminate
28
29 elopement among children with ASD.¹⁷ Our quantitative findings authenticate the role of
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31 assistance dogs in providing this service. Our qualitative findings provide additional
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33 validation with safety and security being the most frequently stated benefit of having a dog.
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43 Behavioural, social and emotional difficulties that encompass the lives of children with ASD
44
45 can impact on parents/guardians wellbeing.¹⁸⁻¹⁹ Our findings suggest that assistance dogs
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47 can provide parents/guardians with a higher sense of competency with regard to managing
48
49 their child than waiting list controls. This result may reflect added supports dogs provide in
50
51 public settings. Indeed public tantrums and reactions from the public are regarded as one
52
53 of the more difficult aspects of a child with ASD's behaviour.²² Qualitative results from this
54
55 study highlight the role that an assistance dog has in promoting public awareness and
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3 acceptance of ASD. Quantitative results suggest that parents/guardians whose children
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5 have assistance dogs rate the public's perception of their child as more positive. Our
6
7 regression analysis did show an interaction between having an assistance dog and type of
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9 school attended. On examination we found that whilst the ratings of parents/guardians
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11 remained significantly different where their children attend a special school for autism or a
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13 special class in primary school, they were not significantly so where children attend a main
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15 stream primary school. Such a result may reflect a lack of awareness/acceptance of ASD in
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17 main stream schools.
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24 Our findings from the caregiver strain questionnaire (CSGQ) show no significant differences
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26 between parents/guardians who have a child with a dog and waiting list controls. There are
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28 three sub scales within the CSGQ. 'Objective strain' deals with the caregiver burden on day
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30 to day tasks related to care, 'subjective internalized strain' deals with negative feelings
31
32 internal to the caregiver, and 'subjective externalized strain' deals with negative feelings by
33
34 the caregiver towards the child. We considered two reasons which may explain the lack of
35
36 any real differences between the groups with regard to caregiver strain. Firstly
37
38 parents/guardians expressed that the dedication required to care for a dog is a main
39
40 constraint which may have affected responses on the objective strain scale. Secondly, we
41
42 noticed that our sample scores on the CSGQ were generally less positive than scores from
43
44 parents/guardians who took part in the most recent CSGQ validation study.²⁶ This may
45
46 reflect a lower provision of services for families of children with autism in the Republic of
47
48 Ireland. The ability of assistance dogs to provide a sense of calm and comfort for children
49
50 with ASD is documented.^{8,10} Qualitative results from this study lend support to this view.
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57 Parents/guardians with an assistance dog frequently mentioned the dogs' ability to promote
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3 calmness in their child. Those on the waiting list anticipated ways in which the dog would
4
5 aid their child in times of distress. Previous research has recognised the role that dogs have
6
7 in facilitating social development in children with ASD.^{9, 33- 34} Our qualitative findings point
8
9 to the idea that assistance dogs can act as a 'bridge' between children and the physical and
10
11 social environment. However, more parents/guardians on the waiting list for a dog wrote
12
13 about the anticipated ability of a dog to promote social development in their children than
14
15 those with a dog. Those with a dog wrote more about the increased public awareness and
16
17 acceptance of their child as a main benefit. That dogs may facilitate social interaction in
18
19 children with ASD is not in dispute, but perhaps this role is more suited to the therapy dog
20
21 (AAT) than the service dog. Parents/guardians listed constraints of having an assistance dog
22
23 were centred on the lifestyle changes. Such changes include the care and costs required to
24
25 ensure a dogs' health and wellbeing in addition to the restrictions associated with the dogs'
26
27 requirements for exercise and companionship. It is important to recognise that each
28
29 parent/guardian has a different level of tolerance for specific canine behaviours.³⁵ Whilst
30
31 many of the parents/guardians in our study discounted the constraints of having a dog,
32
33 some were explicit about their concerns. More of those with a dog expressed concern
34
35 about the increase in housekeeping tasks associated with having a dog in house.
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37 Parents/guardians with children on the waiting list were more concerned about what to do
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39 with the dog during family holiday time.
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50 **Conclusions**

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52 Our findings indicate that assistance dog programmes are a valuable intervention in the
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54 treatment of ASD, particularly in relation to the control of elopement. Dogs help to
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56 promote calmness and provide a source of comfort for children. Further research with
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3 stronger designs is required to support the case that assistance dogs can act as facilitators of
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5 social and emotional development in children.
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36 **Funding Statement**

37
38 This research received no specific grant from any funding agency in the public, commercial
39
40 or not for profit sectors.
41
42

43 **Contributorship Statement**

44
45 Louise Burgoyne was the lead researcher and was involved in the design, implementation, analysis
46
47 and reporting of the study.
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51
52 Lisa Dowling took part of the project as her final year medical project. She was involved in the
53
54 qualitative analysis and interpretation together with the overall reporting of the study and approval
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56 of the manuscript.
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5 Anthony (Tony) Fitzgerald is the study statistician responsible for interpretation of the quantitative
6
7 data and final approval of the manuscript.
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9
10 Micaela Connolly is a psychologist specializing in children with autism. She was involved in the study
11
12 design and was clinical adviser to the group throughout the course of research. She was also
13
14 involved in the study reporting and approval of the manuscript.
15

16
17
18 John Browne is a psychologist and health services researcher. He was involved in the study analysis
19
20 critical review and approval of the manuscript.
21
22

23
24
25 Ivan J Perry was the main project supervisor. He was responsible for overseeing the project from
26
27 start to finish and approved the final manuscript.
28

29 **Data Sharing Statement**

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31 Technical appendix, statistical code, and dataset available from the corresponding author at
32
33 University College Cork, who will provide a permanent, citable and open access home for the
34
35 dataset.
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38 Technical appendix, statistical code, and dataset available from the corresponding author at
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40 University College Cork, who will provide a permanent, citable and open access home for the
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42 dataset.
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44 **Competing Interests:** None
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48 **References**

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Table 1 Questionnaire subsections, details and measures.

Section	Details	Measure
Part 1. Demographics	<ol style="list-style-type: none"> Gender, age, other medical conditions, age of diagnosis, home location. Education, learning level, verbal/non verbal Interventions and therapies received 	Tick boxes, yes/no options, free text.
Part 2. Parenting & Autism	<ol style="list-style-type: none"> Perceived competence Caregiver strain questionnaire <ul style="list-style-type: none"> <i>Objective strain</i> <i>Subjective internalised strain</i> <i>Subjective externalised strain</i> 	<p>Four items on a 7-point scale.</p> <p>21 items on a 5 point scale.</p> <p>11 items</p> <p>6 items</p> <p>4 items</p>
Part 3. Environment & Public	<ol style="list-style-type: none"> Environment safety and security Public Perception 	<p>Eight items on a 7-point scale.</p> <p>Four items on a 7-point scale.</p>
Part 4. Benefits & constraints	<ol style="list-style-type: none"> Benefits of having an assistance dog Constraints of having an assistance dog 	Free text.

Table 2 Participant Characteristics (With Dog n=80, Waiting list for Dog n=84)

<i>Characteristics</i>		<i>With Dog N (%)</i>	<i>Waiting for Dog N (%)</i>	<i>P-value</i>
Gender	Male	70 (87.5)	77 (91.7)	<0.001
Age	0-6 years	30 (37.5)	60 (71.4)	<0.001
	7-9 years	50 (62.5)	24 (28.6)	
Location	Town/city centre	11 (13.8)	8 (9.0)	0.217
	Suburb	33 (41.3)	47 (57.0)	
	Countryside	36 (45.0)	28 (34.0)	
Other conditions	Yes	47 (35.0)	27 (32.1)	0.767
Verbal	Yes	42 (52.5)	35 (42.0)	0.165
Education	Preschool	0	10 (11.9)	<0.001
	Home tuition	1 (1.0)	4 (5.0)	
	Primary	13 (16.3)	11 (31.1)	
	Special class (Primary)	17 (21.3)	29 (34.5)	
	Special school (ASD)	49 (61.3)	30 (35.7)	
Interventions	Speech and Language	38 (47.5)	32 (38.1)	0.224
	Occupational Therapy	37 (46.3)	32 (38.1)	0.290
	Resource Teacher	20 (25.0)	22 (26.2)	0.861
	Special Needs Assistant	64 (80.0)	57 (67.9)	0.077

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Table 3. Summary of results from Environmental Hazards, Public Awareness, Competence and Caregiver Strain scales.

Item	Description	Mean (95%CI)		Diff* (95% CI)	P-value
		With Dog (n=80)	Waiting Dog (n=84)		
HAZ	Environmental Hazards (range 8 -56)	32.43 (29.47: 35.39)	22.97 (20.83: 25.11)	10.9 (6.97, 14.89)	<0.001 ¹
PUBLIC	Public Acceptance(range 4 –28)	15.87 (14.23: 17.50)	10.67 (9.56:11.77)	5.80 (3.69, 7.90)	<0.001 ²
SD	Competence (range 4 – 28)	19.75 (18.74:20.77)	17.91 (16.52: 18.92)	1.97 (0.273, 3.68)	0.023
OS	Objective strain (range 11-55)	35.03 (32.81: 37.20)	35.91 (34.08:38.01)	-0.54 (-3.78, 2.70)	0.744
SIS	Subjective Internalised strain (range 6-35)	22.47 (21.21:23.60)	23.63 (22.89:25.03)	-0.81 (-2.63, 1.00)	0.380
SES	Subjective Externalised strain (range 4-20)	7.74 (7.01: 8.46)	7.88 (7.28:8.49)	-0.34 (-1.37, .69)	0.522

*Adjusted for gender, age, location, education

- 1. There was a lesser albeit significant effect of having a dog for parents/guardians whose children attend a special school for children with ASD
- 2. There is no significant difference in ratings of parents/guardians who have a child in a main stream primary school (p=0.09)

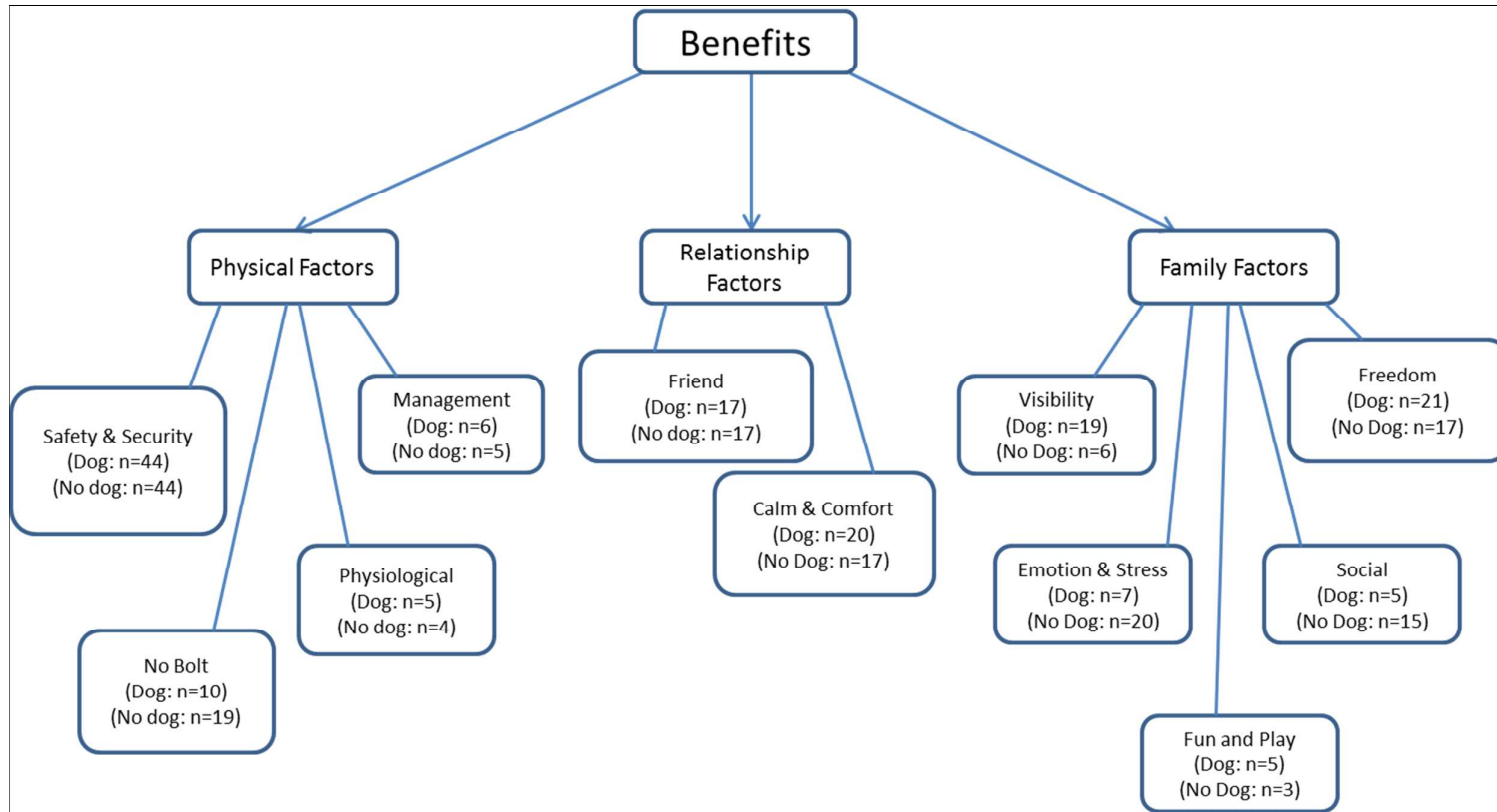


Figure 1 – Benefits of having an assistance dog (themes and categories)

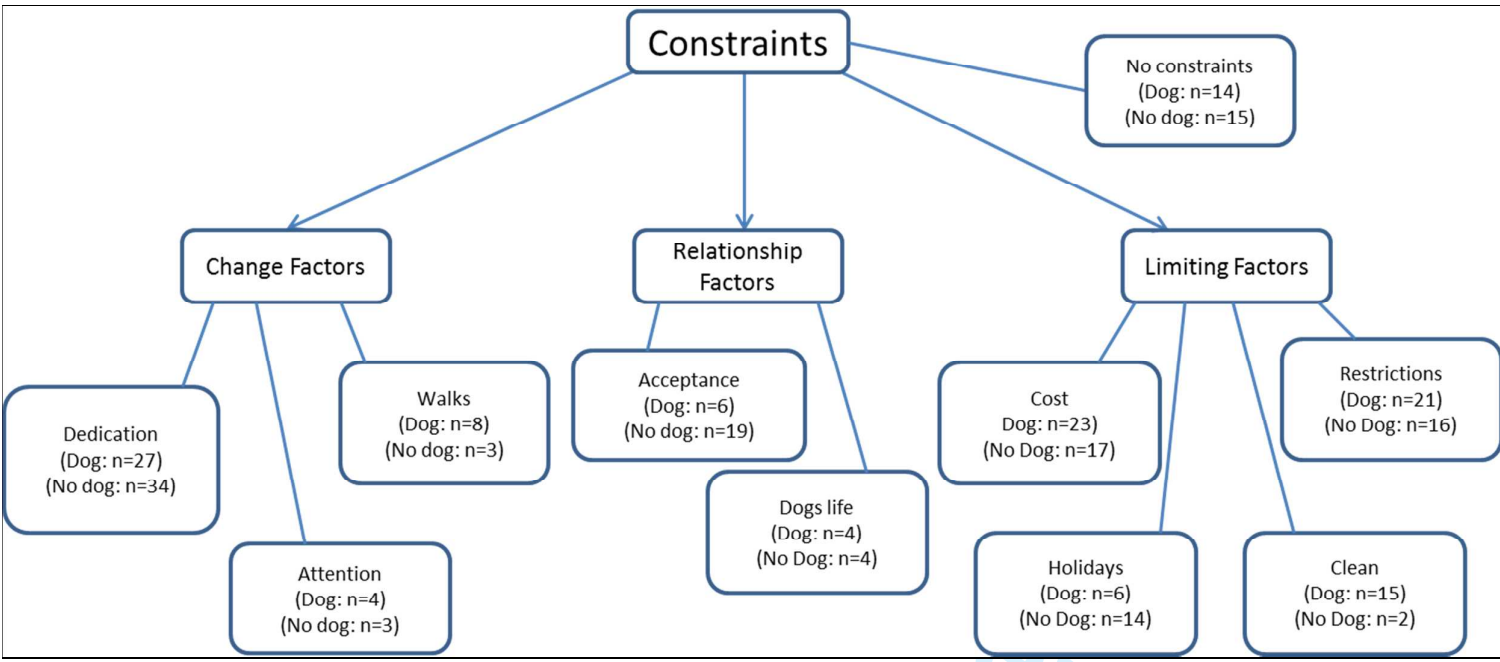


Figure 2 – Constraints of having an assistance dog (themes and categories)

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STROBE Statement—parents perspectives on the value of assistance dogs for children with autism spectrum disorder: a cross sectional study.

	Item No	Recommendation
Title and abstract	1	(a) We have indicated the study's design with a commonly used term in the title (b) We have provided in the abstract an informative and balanced summary of what was done and what was found
Introduction		
Background/rationale	2	We have explained the scientific background and rationale for the investigation being reported
Objectives	3	Specific objectives, including any prespecified hypotheses are stated at end of the introduction
Methods		
Study design	4	We have presented key elements of study design early in the paper – details given in Methods section and at end of Introduction.
Setting	5	We have described the setting, locations, and relevant dates, including periods of recruitment, exposure, follow-up, and data collection
Participants	6	<i>Cross-sectional study</i> —We have given the eligibility criteria, and the sources and methods of selection of participants
Variables	7	We have clearly defined all outcomes, exposures, predictors, potential confounders, and effect modifiers.
Data sources/ measurement	8*	We have provided full descriptions of our measures and assessments in the methods section
Bias	9	We have addressed biases in our procedures section and in our regression analysis - adjusting for key demographic variables.
Study size	10	We sampled the total population of users of a national assistance dog's organisation. Explained in Methods section.
Quantitative variables	11	Data management techniques are described in the data analysis section at end of the Methods.
Statistical methods	12	(a) We have described all statistical methods, including those used to control for confounding – in the Methods section. (b) We have described methods used to examine subgroups and interactions in the Results section. (c) We had minimal missing data. <i>Cross-sectional study</i> —we used data analysis techniques appropriate for comparing two independent groups. (e) Describe any sensitivity analyses – we did not do a sensitivity analysis.

Continued on next page

Results

Participants	13*	(a) We have reported numbers of individuals in our cross sectional study—eg numbers potentially eligible, examined for eligibility, confirmed eligible, included in the study, and analysed (b) We omitted the over tens from our analysis for this study – described in Results section. (c) We have the maximum of 5 tables and figures included – these were considered essential and so we do not have space for a flow diagram. We are happy to provide one if requested.
Descriptive data	14*	(a) We have given characteristics of the study participants (eg demographic, clinical, social) and information on exposures and potential confounders (start of Results section) (b) We had minimal missing data.
Outcome data	15*	<i>Cross-sectional study</i> —We have reported the numbers of outcome events or summary measures in the Results section.
Main results	16	(a) We have given unadjusted and adjusted means and 95% confidence intervals. We have explained the reasons for adjustment in the results section. (b) We did not categorise continuous variables. (c) If relevant, consider translating estimates of relative risk into absolute risk for a meaningful time period – this was not relevant.
Other analyses	17	Report other analyses done—eg analyses of subgroups and interactions – main interactions are reported in the Results section and in the Discussion.

Discussion

Key results	18	We have summarised key results with reference to study objectives
Limitations	19	We have discussed limitations of the study, taking into account sources of potential bias or imprecision.
Interpretation	20	We have given a cautious overall interpretation of results considering objectives, limitations, multiplicity of analyses, results from similar studies, and other relevant evidence
Generalisability	21	We have discussed the generalisability (external validity) of the study results at the end of the Discussion.

Other information

Funding	22	This study was not funded from any particular source. It was done at University College Cork and by kind permission of the Irish Guide Dogs for the Blind. They assisted us in contacting their service users. We did not have access to their service users lists. They did not have access to the study data.
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*Give information separately for cases and controls in case-control studies and, if applicable, for exposed and unexposed groups in cohort and cross-sectional studies.

Note: An Explanation and Elaboration article discusses each checklist item and gives methodological background and published examples of transparent reporting. The STROBE checklist is best used in conjunction with this article (freely available on the Web sites of PLoS Medicine at <http://www.plosmedicine.org/>, Annals of Internal Medicine at <http://www.annals.org/>, and Epidemiology at <http://www.epidem.com/>). Information on the STROBE Initiative is available at www.strobe-statement.org.

BMJ Open

Parents' perspectives on the value of assistance dogs for children with autism spectrum disorder: a cross sectional study

Journal:	<i>BMJ Open</i>
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Date Submitted by the Author:	16-Apr-2014
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Primary Subject Heading:	Public health
Secondary Subject Heading:	Epidemiology, Health services research, Public health
Keywords:	EPIDEMIOLGY, PUBLIC HEALTH, PRIMARY CARE

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Manuscripts

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8 **Parents' perspectives on the value of assistance dogs for children with autism**
9 **spectrum disorder: a cross sectional study**
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15 **Corresponding Author: Louise Burgoyne,**

16 **Institution: Department of Epidemiology & Public Health, University College Cork (UCC).**

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25 **Micaela Connolly, Psychologist, Brothers of Charity, Cork.**

26 **John Browne, Professor, Department of Epidemiology & Public Health, UCC**

27 **Ivan J Perry, Professor & Head of Department of Epidemiology & Public Health, UCC.**
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35 **Key Words**

36 **Public Health, Epidemiology, Autism Spectrum Disorders, Assistance Dogs, animal assisted**
37 **interventions.**

38 **Word Count Revised Document:**

39 **Abstract = 304 words**

40 **Revised document = 5,027 words (excluding title page, references, tables,**
41 **figures and bullet pointed strengths and weaknesses)**
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50 This research received no specific grant from any funding agency in the public, commercial
51 or not for profit sector. Technical appendix, statistical code, and dataset available from the
52 corresponding author at University College Cork, who will provide a permanent home for
53 the dataset.
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Main Strengths and Limitations of this study

- This study is the first to capture the views of a large group of parents/guardians on an assistance dog intervention.
- Findings suggest that parents perceive a high value in dogs for promoting safety, security and positive public reception for children with ASD.
- This study assessed the perceptions of parents/guardians on the wait list for a dog as opposed to using a stronger randomised control trial (RCT) design, where controls are randomly assigned to another intervention.

Introduction

There is an expanding literature indicating the human mental and physical health benefits derived from interaction with companion animals.¹ The presence of animals as an intervention tool was first studied by psychotherapist Boris Levinson via a series of case studies.² At the time animals were seen as inferior replacements for human social interactions.³ Since the 1970's animals have been used as a means of improving human physical, emotional, cognitive and social functioning. Animal assisted interventions (AAI) are classified into three groupings; animal assisted activities (AAA), animal assisted therapies (AAT) and service animal programmes (SAP).⁴

Animal assisted activities are delivered by trained personnel in environments such as hospitals and educational settings with an emphasis on quality of life enhancement via recreation and education e.g., therapeutic horse riding to treat populations with physical and mental disabilities.⁵⁻⁶ Animal assisted therapies are practiced by professionals with

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3 individualised therapy goals.⁷ The emphasis is on improvements in physical, social and
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5 cognitive functioning e.g., an occupational therapist working to facilitate fine motor skills
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7 development in a child via a series of structured tasks such as grooming and feeding a cat.
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10 A meta-analysis of the literature on AAT has shown that they are associated with moderate
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12 effect sizes in improving outcomes in four areas: autism spectrum symptoms, medical
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14 difficulties, behavioural problems, and emotional well-being.⁸ A recent systematic review of
15
16 the literature on AAI for ASD has indicated preliminary 'proof of concept', but highlights the
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18 needs for more rigorous research to establish a convincing evidence base.⁹ This view is
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20 upheld by another recent review pointing to the need for better research designs and larger
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22 sample sizes.¹⁰
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29 Service animal interventions (SAP) use dogs to assist people with a disability in performing
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31 daily activities. Service dogs live in-house with the people they work with. Of late
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33 assistance dogs have received growing attention as a means of aiding children with Autism
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35 Spectrum Disorder (ASD) . Qualitative inquiry on the integration of assistance dogs into ten
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37 families with a child who has ASD, showed that the presence of a dog can improve quality of
38
39 life for children and parents.¹¹ A study examining risks and benefits of assistance dogs using
40
41 a series of structured interviews with 17 families, reported social and cognitive benefits in
42
43 addition to physical and medical benefits.¹² An experimental study which assessed the
44
45 effects of assistance dogs on basal salivary cortisol secretion of 42 children with ASD,
46
47 demonstrated a reduction in the cortisol awakening response and the number of disruptive
48
49 behavioural incidents post introduction of the dog.¹³ Assistance dogs complete a unique
50
51 triad between parent/guardian and child. Typically the child is attached to the dog via a
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53 lead (leash) and belt. The dog walks with the child but takes commands from the parent
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3 (handler).¹⁴ If the child tries to step off a footpath or attempts to bolt, the dog will use all
4
5 his/her power to slow the child down. Assistance dogs prohibit dangerous behaviour such
6
7 as elopement (bolting) and provide a calming presence.
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11
12 Elopement or the tendency to 'bolt' is characteristic of ASD. Such behaviour can result in a
13
14 child's exposure to dangerous traffic situations or encounters with strangers.¹⁵ Despite
15
16 reports of higher mortality rates in ASD populations owing to accidents such as suffocation,
17
18 drowning and injuries, research on elopement behaviour is sparse.¹⁶⁻¹⁸ If left untreated
19
20 elopement may result in the need for a child to be moved to a restrictive setting.¹⁹ In a
21
22 systematic review of the literature on current elopement treatments such as function based
23
24 interventions, Lang and colleagues conveyed that just two of ten studies examined reported
25
26 complete elimination of elopement.²⁰ Treatments that effectively eliminate elopement
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28 behaviours are warranted.
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36 Social, emotional and behavioural challenges at home and in public mean that
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38 parents/guardians of children with ASD experience stress in most areas of their lives.²¹⁻²⁴ In
39
40 addition to behaviours such as elopement, public tantrums and the reaction from others are
41
42 regarded as being some of the more difficult aspects of a child with ASD's behaviour.
43
44 Situations can leave parents/guardians feeling judged as 'bad' parents, or feeling like a
45
46 failure.²⁵ In this context assistance dogs can provide a unique support by facilitating child
47
48 safety and promoting positive public reception. Outings to public places can become less
49
50 stressful and families can enjoy greater freedom and mobility. Given the resource
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52 implications of assistance dog interventions for ASD, there is a need to assess the value of
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54 acceptability and likely uptake of services.
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Currently there are 188 service animal interventions registered with the standards body Assistance Dogs International (ADI). These interventions include guide dogs for the blind, hearing dogs for the hard of hearing, and service dogs for people with other disabilities including ASD. In this study we measured parents/guardians ratings on: (a) the impact of having an assistance dog on child safety from environmental hazards, (b) public acceptance and awareness of ASD, (c) sense of competence with managing a child with ASD and (d) levels of caregiver strain. We also obtained parents/guardians views on the primary benefits and constraints of having an assistance dog.

Methods

Study Design and Participants

Our study was based in the primary care setting, within the context of a specific national assistance dog intervention in the Republic of Ireland. All children who receive an assistance dog from this centre have been formally diagnosed with ASD via the Irish Health Services Executive (HSE) using standard tools such as the ADOS (Autism Diagnostic Observation Schedule), the ADI-R (Autism Diagnostic Interview) and the DISCO (Diagnostic Interview for Social Communication). Parents/guardians with an assistance dog (N=205) and parents/guardians on the waiting list for an assistance dog (N=107) were eligible to take part in the study. Expedited ethical approval was granted from the Clinical Research Ethics Committee of the Cork Teaching Hospitals. Data were gathered between October 2012 and March 2013.

Measures

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3 Parents/guardians were asked to complete a four part questionnaire (Table 1). Part one
4
5 examined child demographics. Part two measured parents/guardians sense of competence
6
7 for managing a child with ASD using Perceived Competence Scales (PCS)²⁶ ($\alpha = 0.876$, 7
8
9 point scales: low-high competence). The PCS is a measure of one of three fundamental
10
11 psychological needs within Self Determination Theory.²⁷⁻²⁸ Like other measures within
12
13 behavioural change theory, items on the PCS are typically written to be specific to the
14
15 relevant behaviour or domain being examined. A sample item from the PCS we used for this
16
17 study is 'I am able to do my own routine caring for my child with autism'. Part two also
18
19 assessed levels of strain using the Caregiver Strain Questionnaire CGSQ²⁹ ($\alpha = 0.940$, 5 point
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21 scales: low-high strain), which has been validated to assess burden among caregivers of
22
23 children with autism.³⁰ The CGSQ asked participants to consider the past 6 months in terms
24
25 of the problems presented by items such as: 'interruption of personal time resulting from
26
27 your child's emotional or behavioural problem (Objective Strain)', 'how embarrassed did
28
29 you feel about your child's emotional or behavioural problem (Subjective Externalised
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31 Strain)' and 'How worried did you feel about your child's future (Subjective Internalised
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33 Strain)'.
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43 Part three of the questionnaire examined perceptions of child safety from environmental
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45 hazards such as traffic, dangerous materials and outdoor spaces ($\alpha=0.928$, 7 point scales:
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47 low-high safety/security). Participants were asked to rate how strongly they agreed or
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49 disagreed with respect to their child's safety and security over the past 3 months e.g., 'I am
50
51 confident that my child with autism is secure from environmental hazards when we go on
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53 walks in our neighbourhood.' Part three also assessed parents/guardians ratings on the
54
55 general public's acceptance of their child ($\alpha=0.940$, 7 point scales: low-high acceptance). In
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3 this case participants were asked to rate the public's perception of their child over the past
4
5 three months on items such as 'I am sure that people make allowances for my child with
6
7 autism when we are in a restaurant'. Scales for part three were developed with reference
8
9 to the format and structure of the Neighbourhood Environment Walkability Scale – Youth,³¹
10
11 and via consultation with parents and author MC, who is a psychologist specialising in
12
13 children with ASD. Part four asked participants to list their views of the main
14
15 benefits/constraints of having an assistance dog via 'free text'. Those on the waiting list
16
17 were asked to give the benefits/constraints that they feel a dog will bring.
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24 **Pilot**

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26 We piloted the questionnaire with eight parents/guardians, four of which have an assistance
27
28 dog and four who are on the waiting list. Minor modifications were made to the final
29
30 questionnaire on the basis of their responses.
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36 **Procedures**

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38 The primary caregiver from each family with an assistance dog, and each family on the
39
40 waiting list received a postal questionnaire from the contact person at the assistance dog
41
42 centre. In the interests of confidentiality, the researchers at University College Cork did not
43
44 have access to names and addresses of participants. The assistance dog's centre did not
45
46 have access to the completed questionnaires. Each questionnaire pack contained a consent
47
48 form with study details, a questionnaire, a stamped addressed envelope, and an envelope
49
50 marked 'Research'. Participants were requested to place completed questionnaires in the
51
52 envelope marked 'Research' and to seal it. They were asked to place the sealed envelope
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54 together with the signed consent form in the stamped addressed envelope, and to post
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1
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3 back to the assistance dog centre. Participants were assured that participation in the study
4
5 would have no impact on their status with the centre, and that staff at the centre would
6
7 have no access to the survey data.
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10 11 12 **Data Analysis**

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16
17 Descriptive statistics are reported using frequencies tables. Chi Square tests were used to
18
19 test for differences between the categorical demographic variables. T-tests were used to
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21 examine differences between parents of children with an assistance dog and those waiting
22
23 to receive one, within the data on competence, caregiver strain (CGSQ), environmental
24
25 hazards and public awareness. We then fitted a linear regression that included having a dog
26
27 or being on the wait list as a dichotomous variable and each of gender, age, home location
28
29 and education as factors.
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36 Qualitative data were analysed via open coding, followed by a process of categorisation
37
38 which facilitated the emergence of themes. Author LB analysed the qualitative data initially
39
40 and author LD completed a second analysis and cross check.
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44 45 **Results**

46 47 **Demographics**

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50 A total of 134 parents/guardians with an assistance dog (65% response), and 87
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52 parents/guardians from the wait list (81% response) completed the questionnaire. A large
53
54 proportion of participants with a dog have children over the age of ten (40%) compared to
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3 just three participants from the wait list. For this reason we eliminated the 'over tens' from
4
5 further analysis in this paper.
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10 A breakdown of the demographic characteristics of participants' children is in Table 2. A
11
12 majority are male (87.5% with dog; 91.7% waiting list) and similar percentages have other
13
14 medical conditions in addition to ASD (35% with dog; 32.1% wait list). Other conditions
15
16 include mild to moderate learning difficulties, ADHD, asthma and epilepsy. The largest
17
18 group live in suburban areas (41.3% with dog; 57% wait list) followed by the countryside
19
20 (45% with dog; 34% wait list). Over half of the children with a dog are verbal (52.5%) and
21
22 under half of those waiting for a dog are verbal (42%). There are differences in types of
23
24 school attended between participants whose children have an assistance dog and those
25
26 who do not yet have a dog. These are reflective of the remaining age differences between
27
28 the two groups post removal of the over tens from the total sample. The main difference is
29
30 that 61.3% of children with a dog attend a special school for ASD compared to 35.7% of the
31
32 wait list. Conversely 34.5% of children on the wait list are in a special class in primary school
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34 compared to 21.3% who have a dog.
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43 With regard to conventional interventions received there are some descriptive differences
44
45 between participants whose children have an assistance dog and those on the wait list for a
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47 dog (Table 2). There is a less than 10% difference between the groups for regular speech
48
49 and language therapy (47.5% with dog; 38.1% wait list) and regular occupational therapy
50
51 (46.3% with dog; 38.1% wait list). Similar percentages from both groups have a resource
52
53 teacher (25% with dog; 26.2% wait list), and there is a 12% difference with regard to special
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55 needs assistants (80% with dog; 67.9% wait list)
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5 There are significant differences between profiles of children who have a dog and children
6 waiting for a dog with respect to age and schooling. There are no significant differences
7
8 between the groups for other conditions in addition to ASD, whether a child is verbal or
9
10 nonverbal, conventional interventions and home location.
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14 15 16 17 **Environmental Hazards & Public Awareness**

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19 The environmental hazards scales are summarized in Table 3. Ratings are from low
20
21 perceived safety to high safety. T-test results showed that mean ratings are significantly
22
23 higher ($p < 0.001$) for parents/guardians whose children have a dog (32.43) than for those on
24
25 the waiting list (22.97). These differences remain significant after adjusting for gender, age,
26
27 home location and school type ($p < 0.001$). We did however find a significant interaction
28
29 between school types and whether children have a dog. Although there are significant
30
31 differences between the rating of parents/guardians with a dog and those on the waiting list
32
33 for children attending a special school for autism (mean difference=6.62: 95%CI 0.639,
34
35 12.61), the effect is not as large as it is for children attending a primary school (mean
36
37 difference=12.53: 95%CI 4.16, 20.90) or a special class in a primary school (mean
38
39 difference=19.49: 5%CI 13.171, 25.821).
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48 The range of scores from the public perception scales (Table 3) are from low to high, with
49
50 higher scores indicating a perception from parents/guardians that people act more
51
52 respectfully and responsibly towards children with ASD when in public settings. T test
53
54 results showed that parents/guardians mean ratings are significantly higher ($p < 0.001$) for
55
56 those whose children have an assistance dog (15.87) than for the wait list (10.67). For the
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3 most part these differences remain significant after adjusting for gender, age, home location
4
5 and education level ($p < 0.001$). However, there was a significant interaction between type
6
7 of school attended and whether children have an assistance dog. Although there are
8
9 significant differences between the ratings of parents/guardians with a dog and those on
10
11 the waiting list where their children attend a special school for autism (mean
12
13 difference=6.65: 95%CI 3.79, 9.51), and a special class in primary school (mean
14
15 difference=7.01: 95%CI 2.88, 11.13), there is no significant difference in the ratings of
16
17 parents/guardians who have a child in a main stream primary school ($p=0.09$).
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24 **Perceived Competence and Caregiver Strain**

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26 A summary of results from parents/guardians perceived competencies with regard to caring
27
28 for and managing their child with ASD are in Table 3. T-test results show that mean scores
29
30 for parents/guardians whose children have an assistance dog (19.75), are significantly higher
31
32 ($p=0.02$) in terms of perceived competencies than those on the waiting list (17.91). This
33
34 difference remained significant after adjusting for gender, age, home location and education
35
36 level ($p=0.02$). Results from the Caregiver Strain Questionnaire (CGSQ) (Table 3) show that
37
38 parents/guardians who have a dog rated slightly lower levels of strain than those on the
39
40 wait list. However we found no significant differences between the groups with regard to
41
42 any of the individual items on the scales, or the summarized scores for 'objective strain',
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44 'subjective internalized strain', and 'subjective externalized strain'.
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55 **Benefits and Constraints**

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3 Qualitative data were analysed using a thematic approach and constant comparison
4
5 techniques by authors LB and LD. Each participant response was reviewed and codes were
6
7 assigned to each 'segment of meaning'. Open codes were assigned to representative
8
9 categories. The process of coding and categorisation facilitated the emergence of themes
10
11 from within the data. Initial qualitative analysis was performed by LB, and these results
12
13 were cross-checked and refined by LD. We analysed the first and second listed benefits and
14
15 constraints of having an assistance dog. Data beyond the first two benefits and constraints
16
17 are sparse and not reported.
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23
24 Three themes were identified under 'benefits'. These were; physical factors, relationship
25
26 factors and family factors (Figure 1). 'Physical factors' is divided into four categories and
27
28 focuses on how assistance dogs can keep a child safe whilst facilitating parents' ability to
29
30 manage: *"A sense of security & protection for our daughter especially walking in local*
31
32 *environments"* (parent of girl 7-9yo with a dog), *"(Dog) will stop child from bolting from*
33
34 *home"* (parent of boy 4-6yo on waiting list). For 3 out of 4 categories, this theme is evenly
35
36 dispersed between parents who have a dog and waiting list controls. For the fourth
37
38 category 'no bolt', more parents/guardians from the waiting list state the benefit of the dog
39
40 being able to stop the child from eloping. 'Relationship factors' is grouped into two
41
42 categories and centres on the direct positive relationship between the child with ASD and
43
44 his/her assistance dog: *"She is his very best friend"* (parent of boy 4-6yo with a dog), *"It*
45
46 *might calm him down instead of him head banging the windows"* (parent of boy 4-6yo on
47
48 *waiting list*). The categories making up this theme are almost evenly dispersed between
49
50 parents/guardians who have a dog and waiting list controls. 'Family factors' is split into five
51
52 categories and is about how day to day family and social life is affected by the introduction
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3 of an assistance dog: *"Ability to do maybe ordinary things and go to ordinary places"* (parent
4 of boy 7-9yo on waiting list), *"a sense of responsibility, for example he can feed the dog"*
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10
11 among parents/guardians with a dog and those on the waiting list. For example benefits
12 listed by those with a dog formed more of the category 'visibility', which is about public
13 reception and awareness of ASD. Benefits listed by parents/guardians on the waiting list
14 formed more of the categories 'social' and 'emotion and stress'. 'Social' is about a child
15 with ASD's sociability with family and outside the home. 'Emotion and stress' is about levels
16 of emotion/stress in the family, and to a lesser extent the ability of the child to express
17 emotion.
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29 Four themes emerged from the data on constraints. These were; 'change factors',
30 'relationship factors', 'limiting factors' and 'no constraints' (Figure 2). Change factors has
31 three categories and focuses on life style challenges that parents/guardians experience or
32 anticipate experiencing when they have an assistance dog: *"Its' like an additional child in the*
33 *family"*(parent of boy 4-6yo with a dog), *"To make time to go for walks everyday"* (parent of
34 *boy 7-9yo on waiting list)*. The categories comprising this theme are quite evenly dispersed
35 between parents/guardians of children with a dog and those on the waiting list. Slightly
36 more parents/guardians waiting for a dog list 'dedication', which is the time and effort given
37 to care for the dog as a main constraint. As with the benefits themes, 'relationship factors'
38 is about the direct relationship between the child with ASD and the dog: *"My son may not*
39 *connect with the dog"* (parent of boy 4-6yo on waiting list), *"my concern is when the dog has*
40 *to retire, how will my child cope?"* (parent of boy 7-9yo with a dog). More
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3 concerned about how the dog will be accepted by the child and other family members. The
4
5 third theme 'limiting factors' has four associated categories and centres on day to day
6
7 constraints of having a dog on family life; *"Extra expense for food, vet bills etc"* (parent of
8
9 boy 7-9yo with a dog), *"it will be a bit difficult to travel"* (parent of boy 4-6yo on waiting list).
10
11
12 There are large differences in the dispersal of two of the categories within this theme. In
13
14 particular, more parents/guardians whose children have a dog contributed to the category
15
16 'clean' , which is about day to day hygiene activities related to the dog e.g., dog hair in the
17
18 house and dealing with dog toileting. More parents/guardians on the waiting list
19
20 contributed to a category on 'holidays', which expressed concerns about going on holidays
21
22 with the dog. The final theme 'no constraints' has just one category. This was a category in
23
24 which parents/guardians stated no issues for concern or anticipated drawbacks; *"There are*
25
26 *none....our dog is a valuable and much loved addition to the family"* (parent of boy 7-9yo
27
28 *with a dog)*, *"don't anticipate any, feeling very positive about it"* (parent of boy 4-6yo on
29
30 *waiting list*). This category was almost evenly dispersed between parents whose children
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32 have a dog and those on the waiting list.
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41 Discussion

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43 Our study is the first to capture the views of a large group of parents/guardians on an
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45 assistance dog intervention. Quantitative findings indicate the value of dogs in promoting
46
47 safety, security and positive public reception for children with ASD. They also suggest that
48
49 the presence of an assistance dog may make parents/guardians feel more competent with
50
51 managing their child. Qualitative findings indicate the role assistance dogs play in
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53 promoting child safety, calmness and provision of friendship. They also highlight the role
54
55 the dog has in facilitating 'normal' family functioning, such as being able to visit a shopping
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3 centre. Constraints associated with having a dog relate to specific lifestyle changes
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5 experienced by parents/guardians and the larger family group, such as dedicated care of the
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7 dog.
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12 There are several study limitations. Firstly, our findings are based on self-reports and
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14 parents/guardians personal perceptions and are thus subject to participant overestimation,
15
16 recall bias and possible subject expectancy effects. Also since we did not include any
17
18 objective measures, we cannot know if parents perceptions reflect reality e.g., were
19
20 children actually safer and did the public actually view them more positively when
21
22 accompanied by an assistance dog. Secondly, there were differences in children's ages and
23
24 type of schools attended between our two sample groups which resulted in removal of the
25
26 over tens from our analyses and a reduction in sample size. Thirdly we did not assess the
27
28 views of parents/guardians who are not registered with the assistance dog centre. Our
29
30 results therefore can only be relevant to parents who are open to the possibility of having
31
32 an assistance dog. A fourth limitation of the study is that we assessed the perceptions of
33
34 waiting list controls as opposed to using a RCT design, where controls are randomly assigned
35
36 to another intervention. Ideally we would employ a planned activity, another animal such
37
38 as a cat, or a robotic dog as a control. Such a design was not feasible however and the
39
40 current data do provide insights.
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50 Recognition of the value animal interventions play in promoting human health is gaining
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52 momentum. Animal interventions have been shown to produce increases in self-efficacy
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54 and coping in psychiatric patients³²⁻³³ promote recovery from ill health^{34, 3, 35}, and improve
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56 academic performance, adaptive functioning and behavioural/emotional problems with
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3 special education adolescents.³⁶ Autism spectrum disorder is one of the areas within which
4
5 animal interventions have had most success.⁸ This is particularly the case for assistance dog
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7 interventions, since dogs not only provide a possible mechanism for promoting
8
9 improvements in social and behavioural functioning, they also play a part in control of
10
11 elopement and promotion of child safety. Once a child is attached to a dog via the leash
12
13 and belt system they cannot 'bolt'. In this study parents/guardians with a dog rated their
14
15 child as considerably more safe from environmental hazards than did waiting list controls.
16
17 We did find a reportable interaction between having an assistance dog, type of school
18
19 attended and parents/guardians ratings. This interaction indicated a lesser albeit significant
20
21 effect of having a dog for parents/guardians whose children attend a special school for ASD.
22
23 The smaller effect may be due to the specific care that children and families receive from
24
25 ASD schools. Currently there are no interventions that can successfully eliminate elopement
26
27 among children with ASD.²⁰ Our quantitative findings support the role of assistance dogs in
28
29 providing this service. Our qualitative findings provide additional validation with safety and
30
31 security being the most frequently stated benefit of having a dog.
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41 Behavioural, social and emotional difficulties that encompass the lives of children with ASD
42
43 can impact on parents/guardians wellbeing.²¹⁻²² Our findings suggest that assistance dogs
44
45 can provide parents/guardians with a higher sense of competency with regard to managing
46
47 their child than waiting list controls. This result may reflect added supports dogs provide in
48
49 public settings. Indeed public tantrums and reactions from the public are regarded as one
50
51 of the more difficult aspects of a child with ASD's behaviour.²⁵ Qualitative results from this
52
53 study highlight the role that an assistance dog has in promoting public awareness and
54
55 acceptance of ASD. Quantitative results suggest that parents/guardians whose children
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2
3 have assistance dogs rate the public's perception of their child as more positive. Our
4
5 regression analysis did show an interaction between having an assistance dog and type of
6
7 school attended. On examination we found that whilst the ratings of parents/guardians
8
9 remained significantly different where their children attend a special school for autism or a
10
11 special class in primary school, they were not significantly so where children attend a main
12
13 stream primary school. Such a result may reflect a lack of awareness/acceptance of ASD in
14
15 main stream schools.
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22 Our findings from the caregiver strain questionnaire (CSGQ) show no significant differences
23
24 between parents/guardians who have a child with a dog, and those waiting to receive a dog.
25

26
27 There are three sub scales within the CSGQ. 'Objective strain' deals with the caregiver
28
29 burden on day to day tasks related to care, 'subjective internalized strain' deals with
30
31 negative feelings internal to the caregiver, and 'subjective externalized strain' deals with
32
33 negative feelings by the caregiver towards the child. We considered two reasons which may
34
35 explain the lack of any real differences between the groups with regard to caregiver strain.
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38
39 Firstly, it is known that being a parent/guardian of a child with ASD can affect quality of life
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41 with respect to levels of care and support required, and the resulting impacts on family
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43 finance and family time.³⁷⁻³⁸ In our study parents/guardians expressed that the dedication
44
45 required to care for a dog is a main constraint. Assistance dogs require feeding, exercise,
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47 affection, grooming, regular company and financial expenditure. The added tasks of looking
48
49 after an assistance dog may not therefore impact positively upon levels of caregiver strain.
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53 Secondly, we noticed that our sample scores on the CSGQ were generally less positive than
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55 scores from parents/guardians who took part in the most recent CSGQ validation study.³⁰
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58 This may reflect a lower provision of services for families of children with autism in the
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3 Republic of Ireland. It is interesting to note that although there were no significant
4
5 differences between parents/guardians who have a dog and those on the wait list for a dog
6
7 with respect to caregiver strain, there were significant differences with respect to perceived
8
9 competence. Why do parents/guardians with a dog feel more competent but no less
10
11 strained? A possible explanation is that the process and actual event of getting an
12
13 assistance dog, and the specific procedures followed with respect to working with the dog,
14
15 may make parents/guardians feel more competent. Having a dog may add more structure
16
17 to parent's management technique without necessarily reducing levels of strain associated
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19 with having a child with ASD.
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27 The ability of assistance dogs to provide a sense of calm and comfort for children with ASD is
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29 documented.^{11,13} Qualitative results from this study lend support to this view.
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31 Parents/guardians with an assistance dog frequently mentioned the dogs' ability to promote
32
33 calmness in their child. Those on the waiting list anticipated ways in which the dog would
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35 aid their child in times of distress. Previous research has recognised the role that dogs have
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37 in facilitating social development in children with ASD.^{12, 36 & 39} Our qualitative findings
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39 point to the idea that assistance dogs can act as a 'bridge' between children and the physical
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41 and social environment. However, more parents/guardians on the waiting list for a dog
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43 wrote about the anticipated ability of a dog to promote social development in their children
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45 than those with a dog. Those with a dog wrote more about the increased public awareness
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47 and acceptance of their child as a main benefit. It may be that although parents waiting for
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49 a dog anticipate changes in social interaction, this does not emerge as the most important
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51 benefit once they actually get a dog. That assistance dogs may facilitate social interaction in
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53 children with ASD is not in dispute. However, this role may be more suited to animal
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3 assisted therapy (AAT), where a trained therapist may work with a dog to reach specific
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5 cognitive or behavioural goals for a child. Parents/guardians listed constraints of having an
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7 assistance dog were centred on the lifestyle changes. Such changes include the care and
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9 costs required to ensure a dogs' health and wellbeing in addition to the restrictions
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11 associated with the dogs' requirements for exercise and companionship. It is important to
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13 recognise that each parent/guardian has a different level of tolerance for specific canine
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15 behaviours.⁴⁰ Whilst many of the parents/guardians in our study discounted the constraints
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17 of having a dog, some were explicit about their concerns. More of those with an assistance
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19 dog expressed concern about the increase in housekeeping tasks, and specific hygiene
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21 activities associated with having a dog in the family home. Parents/guardians with children
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23 on the wait list were more concerned about whether the dog will be accepted by the child
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25 and family, and logistics during family holiday time. Our results suggest that some of the
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27 anticipated constraints do not necessarily emerge as the most important constraints once a
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29 dog is placed in the home.
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38 **Conclusions**

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40 Our findings indicate that parents/guardians perceive assistance dog interventions are
41
42 valuable in the treatment of ASD, particularly in relation to the control of elopement. They
43
44 also perceive that assistance dogs help to promote calmness and provide a source of
45
46 comfort for children.
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49 **Funding Statement**

50
51 This research received no specific grant from any funding agency in the public, commercial
52
53 or not for profit sectors.
54
55

56 **References**

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52 companion animals. *Anthrozoos*, 4, 82-90.
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Table 1 Questionnaire subsections, details and measures.

Section	Details	Measure
Part 1. Demographics	<ol style="list-style-type: none"> Gender, age, other medical conditions, age of diagnosis, home location. Education, learning level, verbal/non verbal Interventions and therapies received 	Tick boxes, yes/no options, free text.
Part 2. Parenting & Autism	<ol style="list-style-type: none"> Perceived competence From: Self Determination Theory <i>Deci & Ryan (1985 & 2000)</i> Caregiver strain questionnaire From: <i>Brannan et al (1997) & Khanna et al., (2011)</i> <i>Objective strain</i> <i>Subjective internalised strain</i> <i>Subjective externalised strain</i> 	<p>Four items on a 7-point scale</p> <p>21 items on a 5 point scale.</p> <p>11 items</p> <p>6 items</p> <p>4 items</p>
Part 3. Environment & Public	<ol style="list-style-type: none"> Environment safety and security Adapted from scale structures: <i>Rosenberg et al., (2009)</i> Public Perception 	<p>Eight items on a 7-point scale.</p> <p>Four items on a 7-point scale.</p>
Part 4. Benefits & constraints	<ol style="list-style-type: none"> Benefits of having an assistance dog Constraints of having an assistance dog 	Free text.

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For peer review only

Table 2 Participant Characteristics (With Dog n=80, Waiting list for Dog n=84)

<i>Characteristics</i>		<i>With Dog N (%)</i>	<i>Waiting for Dog N (%)</i>	<i>P-value</i>
Gender	Male	70 (87.5)	77 (91.7)	*
Age	0-6 years	30 (37.5)	60 (71.4)	<0.001
	7-9 years	50 (62.5)	24 (28.6)	
Location	Town/city centre	11 (13.8)	8 (9.0)	0.217
	Suburb	33 (41.3)	47 (57.0)	
	Countryside	36 (45.0)	28 (34.0)	
Other conditions	Yes	24 (30.0)	27 (32.1)	0.767
Verbal	Yes	42 (52.5)	35 (42.0)	0.165
Education	Preschool	0	10 (11.9)	*
	Home tuition	1 (1.0)	4 (5.0)	*
	Primary	13 (16.3)	11 (31.1)	0.025
	Special class (Primary)	17 (21.3)	29 (34.5)	
	Special school (ASD)	49 (61.3)	30 (35.7)	
Interventions	Speech and Language	38 (47.5)	32 (38.1)	0.224
	Occupational Therapy	37 (46.3)	32 (38.1)	0.290
	Resource Teacher	20 (25.0)	22 (26.2)	0.861
	Special Needs Assistant	64 (80.0)	57 (67.9)	0.077

P-values are from valid chi-square tests. *not included in chi-square analysis – numbers do not meet minimum expected count.

Table 3. Summary of results from Environmental Hazards, Public Awareness, Competence and Caregiver Strain scales.

Item	Description	Mean (95%CI)			P-value
		With Dog (n=80)	Waiting Dog (n=84)	Diff* (95% CI)	
HAZ	Environmental Hazards (range 8 -56)	32.43 (29.47: 35.39)	22.97 (20.83: 25.11)	10.9 (6.97, 14.89)	<0.001 ¹
PUBLIC	Public Acceptance(range 4 –28)	15.87 (14.23: 17.50)	10.67 (9.56:11.77)	5.80 (3.69, 7.90)	<0.001 ²
SD	Competence (range 4 – 28)	19.75 (18.74:20.77)	17.91 (16.52: 18.92)	1.97 (0.273, 3.68)	0.023
OS	Objective strain (range 11-55)	35.03 (32.81: 37.20)	35.91 (34.08:38.01)	-0.54 (-3.78, 2.70)	0.744
SIS	Subjective Internalised strain (range 6-35)	22.47 (21.21:23.60)	23.63 (22.89:25.03)	-0.81 (-2.63, 1.00)	0.380
SES	Subjective Externalised strain (range 4-20)	7.74 (7.01: 8.46)	7.88 (7.28:8.49)	-0.34 (-1.37, .69)	0.522

*Adjusted for gender, age, location, education

1. There was a lesser albeit significant effect of having a dog for parents/guardians whose children attend a special school for children with ASD
2. There is no significant difference in ratings of parents/guardians who have a child in a main stream primary school (p=0.09)

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Figure 1 – Parents/Guardians perceived benefits of having an assistance dog (themes and categories)

99% of parents/guardians with a dog listed at least two benefits.
99% of parents/guardians on the wait list for a dog listed at least two benefits.
Category 'Physiological' refers to how assistance dogs can facilitate a child with respect to mobility and ambulation.
Category 'Management' refers to how assistance dogs can facilitate day to day management of their child.

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7 Figure 2 – Parents/Guardians perceived constraints of having assistance dog (themes and categories)
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9 66% of parents/guardians with a dog listed at least two constraints.

10 64% of parents/guardians on the wait list for a dog listed at least two constraints.

11 *Please note that one category 'other' from the waiting list group second constraint is not included in the figure.

12 Category 'Dogs life' refers to concerns about what happens when an assistance dog retires/dies.

13 Category 'Acceptance' refers to challenges around family and children's acceptance of an assistance dog.
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8 **Parents' perspectives on the value of assistance dogs for children with autism**
9 **spectrum disorder: a cross sectional study**
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15 **Corresponding Author: Louise Burgoyne,**

16 **Institution: Department of Epidemiology & Public Health, University College Cork (UCC).**

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35 **Key Words**

36 **Public Health, Epidemiology, Autism Spectrum Disorders, Assistance Dogs, animal assisted**
37 **interventions.**

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39
40 **Word Count Revised Document:**

41 **Abstract = 304 words**

42 **Revised document = 5,027 words (excluding title page, references, tables,**
43 **figures and bullet pointed strengths and weaknesses)**
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50 This research received no specific grant from any funding agency in the public, commercial
51 or not for profit sector. Technical appendix, statistical code, and dataset available from the
52 corresponding author at University College Cork, who will provide a permanent home for
53 the dataset.
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Abstract.

Background: Whilst there is an emerging literature on the usefulness of assistance dogs for children with Autism Spectrum Disorder (ASD), there is a dearth of quantitative data on the value of assistance **dog** interventions for the family unit and family functioning. **Objectives:** Using previously validated scales and scales developed specifically for this study, we measured parents/guardians perceptions of having an assistance dog on (a) child safety from environmental dangers, (b) public reception of ASD, (c) levels of caregiver strain and sense of competence. We also obtained open ended response data from parents/guardians on benefits and constraints of having an assistance dog. **Primary and Secondary Outcome Measures:** The primary outcome measures were scores on environmental hazards and public reception scales. Secondary outcome measures were scores on caregiver strain and competence scales. **Setting:** This study was based in the primary care setting, within the context of a specific **accredited** assistance **dog** **intervention** in Ireland. **Participants:** A total of 134 parents/guardians with an assistance dog, and **87** **parents of children** on the wait list were surveyed. **Results:** Parents/guardians of children who have ASD and an assistance dog rate their child as significantly safer from environmental dangers ($p<0.001$), perceive that the public act more respectfully and responsibly towards their child ($p<0.001$), and feel more competent about managing their child ($p=0.023$) compared to **parents on the wait list.** There was an intensity of positive feeling towards assistance **dog** **interventions** with **particular focus on safety and comfort for children, and a sense of freedom** from family restrictions associated with ASD. The amount of dedication and commitment required to care for a dog were viewed as the primary constraints. **Conclusions:** Our findings indicate that **parents perceive that assistance dog interventions can be a valuable intervention** for families with children who have ASD.

Main Strengths and Limitations of this study

- This study is the first to capture the views of a large group of parents/guardians on an assistance dog intervention.
- Findings suggest that parents perceive a high value in dogs for promoting safety, security and positive public reception for children with ASD.
- This study assessed the perceptions of parents/guardians on the wait list for a dog as opposed to using a stronger randomised control trial (RCT) design, where controls are randomly assigned to another intervention.

Introduction

There is an expanding literature indicating the human mental and physical health benefits derived from interaction with companion animals.¹ The presence of animals as an intervention tool was first studied by psychotherapist Boris Levinson via a series of case studies.² At the time animals were seen as inferior replacements for human social interactions.³ Since the 1970's animals have been used as a means of improving human physical, emotional, cognitive and social functioning. Animal assisted interventions (AAI) are classified into three groupings; animal assisted activities (AAA), animal assisted therapies (AAT) and service animal programmes (SAP).⁴

Animal assisted activities are delivered by trained personnel in environments such as hospitals and educational settings with an emphasis on quality of life enhancement via recreation and education e.g., therapeutic horse riding to treat populations with physical and mental disabilities.⁵⁻⁶ Animal assisted therapies are practiced by professionals with

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3 individualised therapy goals.⁷ The emphasis is on improvements in physical, social and
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5 cognitive functioning e.g., an occupational therapist working to facilitate fine motor skills
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7 development in a child via a series of structured tasks such as grooming and feeding a cat.

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10 A meta-analysis of the literature on AAT has shown that they are associated with moderate
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12 effect sizes in improving outcomes in four areas: autism spectrum symptoms, medical
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14 difficulties, behavioural problems, and emotional well-being.⁸ A recent systematic review of
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16 the literature on AAI for ASD has indicated preliminary 'proof of concept', but highlights the
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18 needs for more rigorous research to establish a convincing evidence base.⁹ This view is
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20 upheld by another recent review pointing to the need for better research designs and larger
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22 sample sizes.¹⁰

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29 Service animal interventions (SAP) use dogs to assist people with a disability in performing
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31 daily activities. Service dogs live in-house with the people they work with. Of late
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33 assistance dogs have received growing attention as a means of aiding children with Autism
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35 Spectrum Disorder (ASD). Qualitative inquiry on the integration of assistance dogs into ten
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37 families with a child who has ASD, showed that the presence of a dog can improve quality of
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39 life for children and parents.¹¹ A study examining risks and benefits of assistance dogs using
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41 a series of structured interviews with 17 families, reported social and cognitive benefits in
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43 addition to physical and medical benefits.¹² An experimental study which assessed the
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45 effects of assistance dogs on basal salivary cortisol secretion of 42 children with ASD,
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47 demonstrated a reduction in the cortisol awakening response and the number of disruptive
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49 behavioural incidents post introduction of the dog.¹³ Assistance dogs complete a unique
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51 triad between parent/guardian and child. Typically the child is attached to the dog via a
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53 lead (leash) and belt. The dog walks with the child but takes commands from the parent
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3 (handler).¹⁴ If the child tries to step off a footpath or attempts to bolt, the dog will use all
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5 his/her power to slow the child down. Assistance dogs prohibit dangerous behaviour such
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7 as elopement (bolting) and provide a calming presence.
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12 Elopement or the tendency to 'bolt' is characteristic of ASD. Such behaviour can result in a
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14 child's exposure to dangerous traffic situations or encounters with strangers.¹⁵ Despite
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16 reports of higher mortality rates in ASD populations owing to accidents such as suffocation,
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18 drowning and injuries, research on elopement behaviour is sparse.¹⁶⁻¹⁸ If left untreated
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20 elopement may result in the need for a child to be moved to a restrictive setting.¹⁹ In a
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22 systematic review of the literature on current elopement treatments such as function based
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24 interventions, Lang and colleagues conveyed that just two of ten studies examined reported
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26 complete elimination of elopement.²⁰ Treatments that effectively eliminate elopement
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28 behaviours are warranted.
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36 Social, emotional and behavioural challenges at home and in public mean that
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38 parents/guardians of children with ASD experience stress in most areas of their lives.²¹⁻²⁴ In
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40 addition to behaviours such as elopement, public tantrums and the reaction from others are
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42 regarded as being some of the more difficult aspects of a child with ASD's behaviour.
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44 Situations can leave parents/guardians feeling judged as 'bad' parents, or feeling like a
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46 failure.²⁵ In this context assistance dogs can provide a unique support by facilitating child
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48 safety and promoting positive public reception. Outings to public places can become less
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50 stressful and families can enjoy greater freedom and mobility. Given the resource
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52 implications of assistance dog interventions for ASD, there is a need to assess the value of
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54 acceptability and likely uptake of services.
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5 Currently there are 188 service animal interventions registered with the standards body
6 Assistance Dogs International (ADI). These interventions include guide dogs for the blind,
7 hearing dogs for the hard of hearing, and service dogs for people with other disabilities
8 including ASD. In this study we measured parents/guardians ratings on: (a) the impact of
9 having an assistance dog on child safety from environmental hazards, (b) public acceptance
10 and awareness of ASD, (c) sense of competence with managing a child with ASD and (d)
11 levels of caregiver strain. We also obtained parents/guardians views on the primary
12 benefits and constraints of having an assistance dog.
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27 **Methods**

28 **Study Design and Participants**

29 Our study was based in the primary care setting, within the context of a specific national
30 assistance dog intervention in the Republic of Ireland. All children who receive an
31 assistance dog from this centre have been formally diagnosed with ASD via the Irish Health
32 Services Executive (HSE) using standard tools such as the ADOS (Autism Diagnostic
33 Observation Schedule), the ADI-R (Autism Diagnostic Interview) and the DISCO (Diagnostic
34 Interview for Social Communication). Parents/guardians with an assistance dog (N=205)
35 and parents/guardians on the waiting list for an assistance dog (N=107) were eligible to take
36 part in the study. Expedited ethical approval was granted from the Clinical Research Ethics
37 Committee of the Cork Teaching Hospitals. Data were gathered between October 2012 and
38 March 2013.
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57 **Measures**

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3 Parents/guardians were asked to complete a four part questionnaire (Table 1). Part one
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5 examined child demographics. Part two measured parents/guardians sense of competence
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7 for managing a child with ASD using Perceived Competence Scales (PCS)²⁶ ($\alpha = 0.876$, 7
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9 point scales: low-high competence). The PCS is a measure of one of three fundamental
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11 psychological needs within Self Determination Theory.²⁷⁻²⁸ Like other measures within
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13 behavioural change theory, items on the PCS are typically written to be specific to the
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15 relevant behaviour or domain being examined. A sample item from the PCS we used for this
16
17 study is 'I am able to do my own routine caring for my child with autism'. Part two also
18
19 assessed levels of strain using the Caregiver Strain Questionnaire CGSQ²⁹ ($\alpha = 0.940$, 5 point
20
21 scales: low-high strain), which has been validated to assess burden among caregivers of
22
23 children with autism.³⁰ The CGSQ asked participants to consider the past 6 months in terms
24
25 of the problems presented by items such as: 'interruption of personal time resulting from
26
27 your child's emotional or behavioural problem (Objective Strain)', 'how embarrassed did
28
29 you feel about your child's emotional or behavioural problem (Subjective Externalised
30
31 Strain)' and 'How worried did you feel about your child's future (Subjective Internalised
32
33 Strain)'.
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43 Part three of the questionnaire examined perceptions of child safety from environmental
44
45 hazards such as traffic, dangerous materials and outdoor spaces ($\alpha=0.928$, 7 point scales:
46
47 low-high safety/security). Participants were asked to rate how strongly they agreed or
48
49 disagreed with respect to their child's safety and security over the past 3 months e.g., 'I am
50
51 confident that my child with autism is secure from environmental hazards when we go on
52
53 walks in our neighbourhood.' Part three also assessed parents/guardians ratings on the
54
55 general public's acceptance of their child ($\alpha=0.940$, 7 point scales: low-high acceptance). In
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3 this case participants were asked to rate the public's perception of their child over the past
4
5 three months on items such as 'I am sure that people make allowances for my child with
6
7 autism when we are in a restaurant'. Scales for part three were developed with reference
8
9 to the format and structure of the Neighbourhood Environment Walkability Scale – Youth,³¹
10
11 and via consultation with parents and author MC, who is a psychologist specialising in
12
13 children with ASD. Part four asked participants to list their views of the main
14
15 benefits/constraints of having an assistance dog via 'free text'. Those on the waiting list
16
17 were asked to give the benefits/constraints that they feel a dog will bring.
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24 **Pilot**

25
26 We piloted the questionnaire with eight parents/guardians, four of which have an assistance
27
28 dog and four who are on the waiting list. Minor modifications were made to the final
29
30 questionnaire on the basis of their responses.
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36 **Procedures**

37
38 The primary caregiver from each family with an assistance dog, and each family on the
39
40 waiting list received a postal questionnaire from the contact person at the assistance dog
41
42 centre. In the interests of confidentiality, the researchers at University College Cork did not
43
44 have access to names and addresses of participants. The assistance dog's centre did not
45
46 have access to the completed questionnaires. Each questionnaire pack contained a consent
47
48 form with study details, a questionnaire, a stamped addressed envelope, and an envelope
49
50 marked 'Research'. Participants were requested to place completed questionnaires in the
51
52 envelope marked 'Research' and to seal it. They were asked to place the sealed envelope
53
54 together with the signed consent form in the stamped addressed envelope, and to post
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3 back to the assistance dog centre. Participants were assured that participation in the study
4
5 would have no impact on their status with the centre, and that staff at the centre would
6
7 have no access to the survey data.
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10 11 12 **Data Analysis**

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16
17 Descriptive statistics are reported using frequencies tables. Chi Square tests were used to
18
19 test for differences between the categorical demographic variables. T-tests were used to
20
21 examine differences between parents of children with an assistance dog and those waiting
22
23 to receive one, within the data on competence, caregiver strain (CGSQ), environmental
24
25 hazards and public awareness. We then fitted a linear regression that included having a dog
26
27 or being on the wait list as a dichotomous variable and each of gender, age, home location
28
29 and education as factors.
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35
36 Qualitative data were analysed via open coding, followed by a process of categorisation
37
38 which facilitated the emergence of themes. Author LB analysed the qualitative data initially
39
40 and author LD completed a second analysis and cross check.
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43
44

45 **Results**

46 47 **Demographics**

48
49 A total of 134 parents/guardians with an assistance dog (65% response), and 87
50
51 parents/guardians from the wait list (81% response) completed the questionnaire. A large
52
53 proportion of participants with a dog have children over the age of ten (40%) compared to
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3 just three participants from the wait list. For this reason we eliminated the 'over tens' from
4
5 further analysis in this paper.
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10 A breakdown of the demographic characteristics of participants' children is in Table 2. A
11 majority are male (87.5% with dog; 91.7% waiting list) and similar percentages have other
12 medical conditions in addition to ASD (35% with dog; 32.1% wait list). Other conditions
13 include mild to moderate learning difficulties, ADHD, asthma and epilepsy. The largest
14 group live in suburban areas (41.3% with dog; 57% wait list) followed by the countryside
15 (45% with dog; 34% wait list). Over half of the children with a dog are verbal (52.5%) and
16 under half of those waiting for a dog are verbal (42%). There are differences in types of
17 school attended between participants whose children have an assistance dog and those
18 who do not yet have a dog. These are reflective of the remaining age differences between
19 the two groups post removal of the over tens from the total sample. The main difference is
20 that 61.3% of children with a dog attend a special school for ASD compared to 35.7% of the
21 wait list. Conversely 34.5% of children on the wait list are in a special class in primary school
22 compared to 21.3% who have a dog.
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43 With regard to conventional interventions received there are some descriptive differences
44 between participants whose children have an assistance dog and those on the wait list for a
45 dog (Table 2). There is a less than 10% difference between the groups for regular speech
46 and language therapy (47.5% with dog; 38.1% wait list) and regular occupational therapy
47 (46.3% with dog; 38.1% wait list). Similar percentages from both groups have a resource
48 teacher (25% with dog; 26.2% wait list), and there is a 12% difference with regard to special
49 needs assistants (80% with dog; 67.9% wait list)
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5 There are significant differences between profiles of children who have a dog and children
6 waiting for a dog with respect to age and schooling. There are no significant differences
7
8 between the groups for other conditions in addition to ASD, whether a child is verbal or
9
10 nonverbal, conventional interventions and home location.
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14 15 16 17 **Environmental Hazards & Public Awareness**

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19 The environmental hazards scales are summarized in Table 3. Ratings are from low
20
21 perceived safety to high safety. T-test results showed that mean ratings are significantly
22
23 higher ($p<0.001$) for parents/guardians whose children have a dog (32.43) than for those on
24
25 the waiting list (22.97). These differences remain significant after adjusting for gender, age,
26
27 home location and school type ($p<0.001$). We did however find a significant interaction
28
29 between school types and whether children have a dog. Although there are significant
30
31 differences between the rating of parents/guardians with a dog and those on the waiting list
32
33 for children attending a special school for autism (mean difference=6.62: 95%CI 0.639,
34
35 12.61), the effect is not as large as it is for children attending a primary school (mean
36
37 difference=12.53: 95%CI 4.16, 20.90) or a special class in a primary school (mean
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39 difference=19.49: 5%CI 13.171, 25.821).
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48 The range of scores from the public perception scales (Table 3) are from low to high, with
49
50 higher scores indicating a perception from parents/guardians that people act more
51
52 respectfully and responsibly towards children with ASD when in public settings. T test
53
54 results showed that parents/guardians mean ratings are significantly higher ($p<0.001$) for
55
56 those whose children have an assistance dog (15.87) than for the wait list (10.67). For the
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3 most part these differences remain significant after adjusting for gender, age, home location
4
5 and education level ($p < 0.001$). However, there was a significant interaction between type
6
7 of school attended and whether children have an assistance dog. Although there are
8
9 significant differences between the ratings of parents/guardians with a dog and those on
10
11 the waiting list where their children attend a special school for autism (mean
12
13 difference=6.65: 95%CI 3.79, 9.51), and a special class in primary school (mean
14
15 difference=7.01: 95%CI 2.88, 11.13), there is no significant difference in the ratings of
16
17 parents/guardians who have a child in a main stream primary school ($p=0.09$).
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24 **Perceived Competence and Caregiver Strain**

25
26 A summary of results from parents/guardians perceived competencies with regard to caring
27
28 for and managing their child with ASD are in Table 3. T-test results show that mean scores
29
30 for parents/guardians whose children have an assistance dog (19.75), are significantly higher
31
32 (p=0.02) in terms of perceived competencies than those on the waiting list (17.91). This
33
34 difference remained significant after adjusting for gender, age, home location and education
35
36 level ($p=0.02$). Results from the Caregiver Strain Questionnaire (CGSQ) (Table 3) show that
37
38 parents/guardians who have a dog rated slightly lower levels of strain than those on the
39
40 wait list. However we found no significant differences between the groups with regard to
41
42 any of the individual items on the scales, or the summarized scores for 'objective strain',
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44 'subjective internalized strain', and 'subjective externalized strain'.
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55 **Benefits and Constraints**

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3 Qualitative data were analysed using a thematic approach and constant comparison
4
5 techniques by authors LB and LD. Each participant response was reviewed and codes were
6
7 assigned to each 'segment of meaning'. Open codes were assigned to representative
8
9 categories. The process of coding and categorisation facilitated the emergence of themes
10
11 from within the data. Initial qualitative analysis was performed by LB, and these results
12
13 were cross-checked and refined by LD. We analysed the first and second listed benefits and
14
15 constraints of having an assistance dog. Data beyond the first two benefits and constraints
16
17 are sparse and not reported.
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23
24 Three themes were identified under 'benefits'. These were; physical factors, relationship
25
26 factors and family factors (Figure 1). 'Physical factors' is divided into four categories and
27
28 focuses on how assistance dogs can keep a child safe whilst facilitating parents' ability to
29
30 manage: *"A sense of security & protection for our daughter especially walking in local*
31
32 *environments"* (parent of girl 7-9yo with a dog), *"(Dog) will stop child from bolting from*
33
34 *home"* (parent of boy 4-6yo on waiting list). For 3 out of 4 categories, this theme is evenly
35
36 dispersed between parents who have a dog and waiting list controls. For the fourth
37
38 category 'no bolt', more parents/guardians from the waiting list state the benefit of the dog
39
40 being able to stop the child from eloping. 'Relationship factors' is grouped into two
41
42 categories and centres on the direct positive relationship between the child with ASD and
43
44 his/her assistance dog: *"She is his very best friend"* (parent of boy 4-6yo with a dog), *"It*
45
46 *might calm him down instead of him head banging the windows"* (parent of boy 4-6yo on
47
48 *waiting list*). The categories making up this theme are almost evenly dispersed between
49
50 parents/guardians who have a dog and waiting list controls. 'Family factors' is split into five
51
52 categories and is about how day to day family and social life is affected by the introduction
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3 of an assistance dog: *"Ability to do maybe ordinary things and go to ordinary places"* (parent
4 of boy 7-9yo on waiting list), *"a sense of responsibility, for example he can feed the dog"*
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10
11 among parents/guardians with a dog and those on the waiting list. For example benefits
12 listed by those with a dog formed more of the category 'visibility', which is about public
13 reception and awareness of ASD. Benefits listed by parents/guardians on the waiting list
14 formed more of the categories 'social' and 'emotion and stress'. 'Social' is about a child
15 with ASD's sociability with family and outside the home. 'Emotion and stress' is about levels
16 of emotion/stress in the family, and to a lesser extent the ability of the child to express
17 emotion.
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29 Four themes emerged from the data on constraints. These were; 'change factors',
30 'relationship factors', 'limiting factors' and 'no constraints' (Figure 2). Change factors has
31 three categories and focuses on life style challenges that parents/guardians experience or
32 anticipate experiencing when they have an assistance dog: *"Its' like an additional child in the*
33 *family"*(parent of boy 4-6yo with a dog), *"To make time to go for walks everyday"* (parent of
34 *boy 7-9yo on waiting list)*. The categories comprising this theme are quite evenly dispersed
35 between parents/guardians of children with a dog and those on the waiting list. Slightly
36 more parents/guardians waiting for a dog list 'dedication', which is the time and effort given
37 to care for the dog as a main constraint. As with the benefits themes, 'relationship factors'
38 is about the direct relationship between the child with ASD and the dog: *"My son may not*
39 *connect with the dog"* (parent of boy 4-6yo on waiting list), *"my concern is when the dog has*
40 *to retire, how will my child cope?"* (parent of boy 7-9yo with a dog). More
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3 concerned about how the dog will be accepted by the child and other family members. The
4
5 third theme 'limiting factors' has four associated categories and centres on day to day
6
7 constraints of having a dog on family life; *"Extra expense for food, vet bills etc"* (parent of
8
9 boy 7-9yo with a dog), *"it will be a bit difficult to travel"* (parent of boy 4-6yo on waiting list).
10
11
12 There are large differences in the dispersal of two of the categories within this theme. In
13
14 particular, more parents/guardians whose children have a dog contributed to the category
15
16 'clean' , which is about day to day hygiene activities related to the dog e.g., dog hair in the
17
18 house and dealing with dog toileting. More parents/guardians on the waiting list
19
20 contributed to a category on 'holidays', which expressed concerns about going on holidays
21
22 with the dog. The final theme 'no constraints' has just one category. This was a category in
23
24 which parents/guardians stated no issues for concern or anticipated drawbacks; *"There are*
25
26 *none....our dog is a valuable and much loved addition to the family"* (parent of boy 7-9yo
27
28 *with a dog)*, *"don't anticipate any, feeling very positive about it"* (parent of boy 4-6yo on
29
30 *waiting list*). This category was almost evenly dispersed between parents whose children
31
32 have a dog and those on the waiting list.
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41 Discussion

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43 Our study is the first to capture the views of a large group of parents/guardians on an
44
45 assistance dog **intervention**. Quantitative findings indicate the value of dogs in promoting
46
47 safety, security and positive public reception for children with ASD. They also suggest that
48
49 the presence of an assistance dog **may** make parents/guardians feel more competent with
50
51 managing their child. Qualitative findings indicate the role assistance dogs play in
52
53 promoting child safety, calmness and provision of friendship. They also highlight the role
54
55 the dog has in facilitating 'normal' family functioning, such as being able to visit a shopping
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3 centre. Constraints associated with having a dog relate to specific lifestyle changes
4
5 experienced by parents/guardians and the larger family group, such as dedicated care of the
6
7 dog.
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12 There are several study limitations. Firstly, our findings are based on self-reports and
13
14 parents/guardians personal perceptions and are thus subject to participant overestimation,
15
16 recall bias and possible subject expectancy effects. Also since we did not include any
17
18 objective measures, we cannot know if parents perceptions reflect reality e.g., were
19
20 children actually safer and did the public actually view them more positively when
21
22 accompanied by an assistance dog. Secondly, there were differences in children's ages and
23
24 type of schools attended between our two sample groups which resulted in removal of the
25
26 over tens from our analyses and a reduction in sample size. Thirdly we did not assess the
27
28 views of parents/guardians who are not registered with the assistance dog centre. Our
29
30 results therefore can only be relevant to parents who are open to the possibility of having
31
32 an assistance dog. A fourth limitation of the study is that we assessed the perceptions of
33
34 waiting list controls as opposed to using a RCT design, where controls are randomly assigned
35
36 to another intervention. Ideally we would employ a planned activity, another animal such
37
38 as a cat, or a robotic dog as a control. Such a design was not feasible however and the
39
40 current data do provide insights.
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50 Recognition of the value animal interventions play in promoting human health is gaining
51
52 momentum. Animal interventions have been shown to produce increases in self-efficacy
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54 and coping in psychiatric patients³²⁻³³ promote recovery from ill health^{34, 3, 35}, and improve
55
56 academic performance, adaptive functioning and behavioural/emotional problems with
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3 special education adolescents.³⁶ Autism spectrum disorder is one of the areas within which
4
5 animal interventions have had most success.⁸ This is particularly the case for assistance dog
6
7 interventions, since dogs not only provide a possible mechanism for promoting
8
9 improvements in social and behavioural functioning, they also play a part in control of
10
11 elopement and promotion of child safety. Once a child is attached to a dog **via the leash**
12
13 **and belt system** they cannot 'bolt'. In this study parents/guardians with a dog rated their
14
15 child as considerably more safe from environmental hazards than did waiting list controls.
16
17 We did find a reportable interaction between having an assistance dog, type of school
18
19 attended and parents/guardians ratings. This interaction indicated a lesser albeit significant
20
21 effect of having a dog for parents/guardians whose children attend a special school for ASD.
22
23 The smaller effect may be due to the specific care that children and families receive from
24
25 ASD schools. Currently there are no interventions that can successfully eliminate elopement
26
27 among children with ASD.²⁰ Our quantitative findings support the role of assistance dogs in
28
29 providing this service. Our qualitative findings provide additional validation with safety and
30
31 security being the most frequently stated benefit of having a dog.
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41 Behavioural, social and emotional difficulties that encompass the lives of children with ASD
42
43 can impact on parents/guardians wellbeing.²¹⁻²² Our findings suggest that assistance dogs
44
45 can provide parents/guardians with a higher sense of competency with regard to managing
46
47 their child than waiting list controls. This result may reflect added supports dogs provide in
48
49 public settings. Indeed public tantrums and reactions from the public are regarded as one
50
51 of the more difficult aspects of a child with ASD's behaviour.²⁵ Qualitative results from this
52
53 study highlight the role that an assistance dog has in promoting public awareness and
54
55 acceptance of ASD. Quantitative results suggest that parents/guardians whose children
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3 have assistance dogs rate the public's perception of their child as more positive. Our
4
5 regression analysis did show an interaction between having an assistance dog and type of
6
7 school attended. On examination we found that whilst the ratings of parents/guardians
8
9 remained significantly different where their children attend a special school for autism or a
10
11 special class in primary school, they were not significantly so where children attend a main
12
13 stream primary school. Such a result may reflect a lack of awareness/acceptance of ASD in
14
15 main stream schools.
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22 Our findings from the caregiver strain questionnaire (CSGQ) show no significant differences
23
24 between parents/guardians who have a child with a dog, and those waiting to receive a dog.
25
26 There are three sub scales within the CSGQ. 'Objective strain' deals with the caregiver
27
28 burden on day to day tasks related to care, 'subjective internalized strain' deals with
29
30 negative feelings internal to the caregiver, and 'subjective externalized strain' deals with
31
32 negative feelings by the caregiver towards the child. We considered two reasons which may
33
34 explain the lack of any real differences between the groups with regard to caregiver strain.
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38 Firstly, it is known that being a parent/guardian of a child with ASD can affect quality of life
39
40 with respect to levels of care and support required, and the resulting impacts on family
41
42 finance and family time.³⁷⁻³⁸ In our study parents/guardians expressed that the dedication
43
44 required to care for a dog is a main constraint. Assistance dogs require feeding, exercise,
45
46 affection, grooming, regular company and financial expenditure. The added tasks of looking
47
48 after an assistance dog may not therefore impact positively upon levels of caregiver strain.
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53 Secondly, we noticed that our sample scores on the CSGQ were generally less positive than
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55 scores from parents/guardians who took part in the most recent CSGQ validation study.³⁰
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57 This may reflect a lower provision of services for families of children with autism in the
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2
3 Republic of Ireland. It is interesting to note that although there were no significant
4
5 differences between parents/guardians who have a dog and those on the wait list for a dog
6
7 with respect to caregiver strain, there were significant differences with respect to perceived
8
9 competence. Why do parents/guardians with a dog feel more competent but no less
10
11 strained? A possible explanation is that the process and actual event of getting an
12
13 assistance dog, and the specific procedures followed with respect to working with the dog,
14
15 may make parents/guardians feel more competent. Having a dog may add more structure
16
17 to parent's management technique without necessarily reducing levels of strain associated
18
19 with having a child with ASD.
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27 The ability of assistance dogs to provide a sense of calm and comfort for children with ASD is
28
29 documented.^{11,13} Qualitative results from this study lend support to this view.
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31 Parents/guardians with an assistance dog frequently mentioned the dogs' ability to promote
32
33 calmness in their child. Those on the waiting list anticipated ways in which the dog would
34
35 aid their child in times of distress. Previous research has recognised the role that dogs have
36
37 in facilitating social development in children with ASD.^{12, 36 & 39} Our qualitative findings
38
39 point to the idea that assistance dogs can act as a 'bridge' between children and the physical
40
41 and social environment. However, more parents/guardians on the waiting list for a dog
42
43 wrote about the anticipated ability of a dog to promote social development in their children
44
45 than those with a dog. Those with a dog wrote more about the increased public awareness
46
47 and acceptance of their child as a main benefit. It may be that although parents waiting for
48
49 a dog anticipate changes in social interaction, this does not emerge as the most important
50
51 benefit once they actually get a dog. That assistance dogs may facilitate social interaction in
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53 children with ASD is not in dispute. However, this role may be more suited to animal
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3 assisted therapy (AAT), where a trained therapist may work with a dog to reach specific
4
5 cognitive or behavioural goals for a child. Parents/guardians listed constraints of having an
6
7 assistance dog were centred on the lifestyle changes. Such changes include the care and
8
9 costs required to ensure a dogs' health and wellbeing in addition to the restrictions
10
11 associated with the dogs' requirements for exercise and companionship. It is important to
12
13 recognise that each parent/guardian has a different level of tolerance for specific canine
14
15 behaviours.⁴⁰ Whilst many of the parents/guardians in our study discounted the constraints
16
17 of having a dog, some were explicit about their concerns. More of those with an assistance
18
19 dog expressed concern about the increase in housekeeping tasks, and specific hygiene
20
21 activities associated with having a dog in the family home. Parents/guardians with children
22
23 on the wait list were more concerned about whether the dog will be accepted by the child
24
25 and family, and logistics during family holiday time. Our results suggest that some of the
26
27 anticipated constraints do not necessarily emerge as the most important constraints once a
28
29 dog is placed in the home.
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38 Conclusions

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40 Our findings indicate that parents/guardians perceive assistance dog interventions are
41
42 valuable in the treatment of ASD, particularly in relation to the control of elopement. They
43
44 also perceive that assistance dogs help to promote calmness and provide a source of
45
46 comfort for children.
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48

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50
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52
53 or not for profit sectors.
54
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Table 1 Questionnaire subsections, details and measures.

Section	Details	Measure
Part 1. Demographics	<ol style="list-style-type: none"> Gender, age, other medical conditions, age of diagnosis, home location. Education, learning level, verbal/non verbal Interventions and therapies received 	Tick boxes, yes/no options, free text.
Part 2. Parenting & Autism	<ol style="list-style-type: none"> Perceived competence From: Self Determination Theory <i>Deci & Ryan (1985 & 2000)</i> Caregiver strain questionnaire From: <i>Brannan et al (1997) & Khanna et al., (2011)</i> <i>Objective strain</i> <i>Subjective internalised strain</i> <i>Subjective externalised strain</i> 	<p>Four items on a 7-point scale</p> <p>21 items on a 5 point scale.</p> <p>11 items</p> <p>6 items</p> <p>4 items</p>
Part 3. Environment & Public	<ol style="list-style-type: none"> Environment safety and security Adapted from scale structures: <i>Rosenberg et al., (2009)</i> Public Perception 	<p>Eight items on a 7-point scale.</p> <p>Four items on a 7-point scale.</p>
Part 4. Benefits & constraints	<ol style="list-style-type: none"> Benefits of having an assistance dog Constraints of having an assistance dog 	Free text.

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For peer review only

Table 2 Participant Characteristics (With Dog n=80, Waiting list for Dog n=84)

<i>Characteristics</i>		<i>With Dog N (%)</i>	<i>Waiting for Dog N (%)</i>	<i>P-value</i>
Gender	Male	70 (87.5)	77 (91.7)	*
Age	0-6 years	30 (37.5)	60 (71.4)	<0.001
	7-9 years	50 (62.5)	24 (28.6)	
Location	Town/city centre	11 (13.8)	8 (9.0)	0.217
	Suburb	33 (41.3)	47 (57.0)	
	Countryside	36 (45.0)	28 (34.0)	
Other conditions	Yes	24 (30.0)	27 (32.1)	0.767
Verbal	Yes	42 (52.5)	35 (42.0)	0.165
Education	Preschool	0	10 (11.9)	*
	Home tuition	1 (1.0)	4 (5.0)	*
	Primary	13 (16.3)	11 (31.1)	0.025
	Special class (Primary)	17 (21.3)	29 (34.5)	
	Special school (ASD)	49 (61.3)	30 (35.7)	
Interventions	Speech and Language	38 (47.5)	32 (38.1)	0.224
	Occupational Therapy	37 (46.3)	32 (38.1)	0.290
	Resource Teacher	20 (25.0)	22 (26.2)	0.861
	Special Needs Assistant	64 (80.0)	57 (67.9)	0.077

P-values are from valid chi-square tests. *not included in chi-square analysis – numbers do not meet minimum expected count.

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Table 3. Summary of results from Environmental Hazards, Public Awareness, Competence and Caregiver Strain scales.

Item	Description	Mean (95%CI)		Diff* (95% CI)	P-value
		With Dog (n=80)	Waiting Dog (n=84)		
HAZ	Environmental Hazards (range 8 -56)	32.43 (29.47: 35.39)	22.97 (20.83: 25.11)	10.9 (6.97, 14.89)	<0.001 ¹
PUBLIC	Public Acceptance(range 4 –28)	15.87 (14.23: 17.50)	10.67 (9.56:11.77)	5.80 (3.69, 7.90)	<0.001 ²
SD	Competence (range 4 – 28)	19.75 (18.74:20.77)	17.91 (16.52: 18.92)	1.97 (0.273, 3.68)	0.023
OS	Objective strain (range 11-55)	35.03 (32.81: 37.20)	35.91 (34.08:38.01)	-0.54 (-3.78, 2.70)	0.744
SIS	Subjective Internalised strain (range 6-35)	22.47 (21.21:23.60)	23.63 (22.89:25.03)	-0.81 (-2.63, 1.00)	0.380
SES	Subjective Externalised strain (range 4-20)	7.74 (7.01: 8.46)	7.88 (7.28:8.49)	-0.34 (-1.37, .69)	0.522

*Adjusted for gender, age, location, education

- 1. There was a lesser albeit significant effect of having a dog for parents/guardians whose children attend a special school for children with ASD
- 2. There is no significant difference in ratings of parents/guardians who have a child in a main stream primary school (p=0.09)

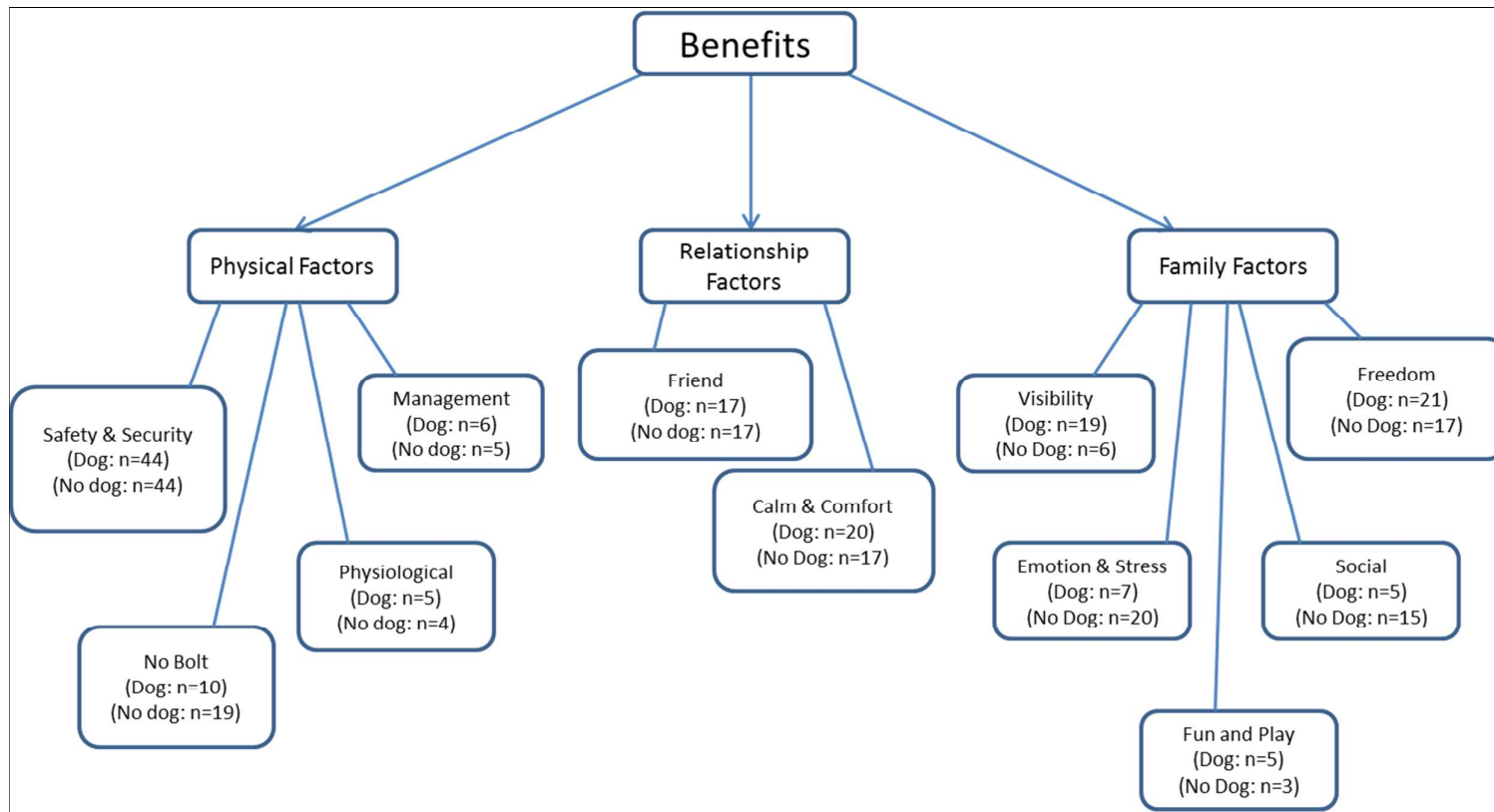


Figure 1 – Parents/Guardians perceived benefits of having an assistance dog (themes and categories)

99% of parents/guardians with a dog listed at least two benefits.

99% of parents/guardians on the wait list for a dog listed at least two benefits.

Category 'Physiological' refers to how assistance dogs can facilitate a child with respect to mobility and ambulation.

Category 'Management' refers to how assistance dogs can facilitate day to day management of their child.

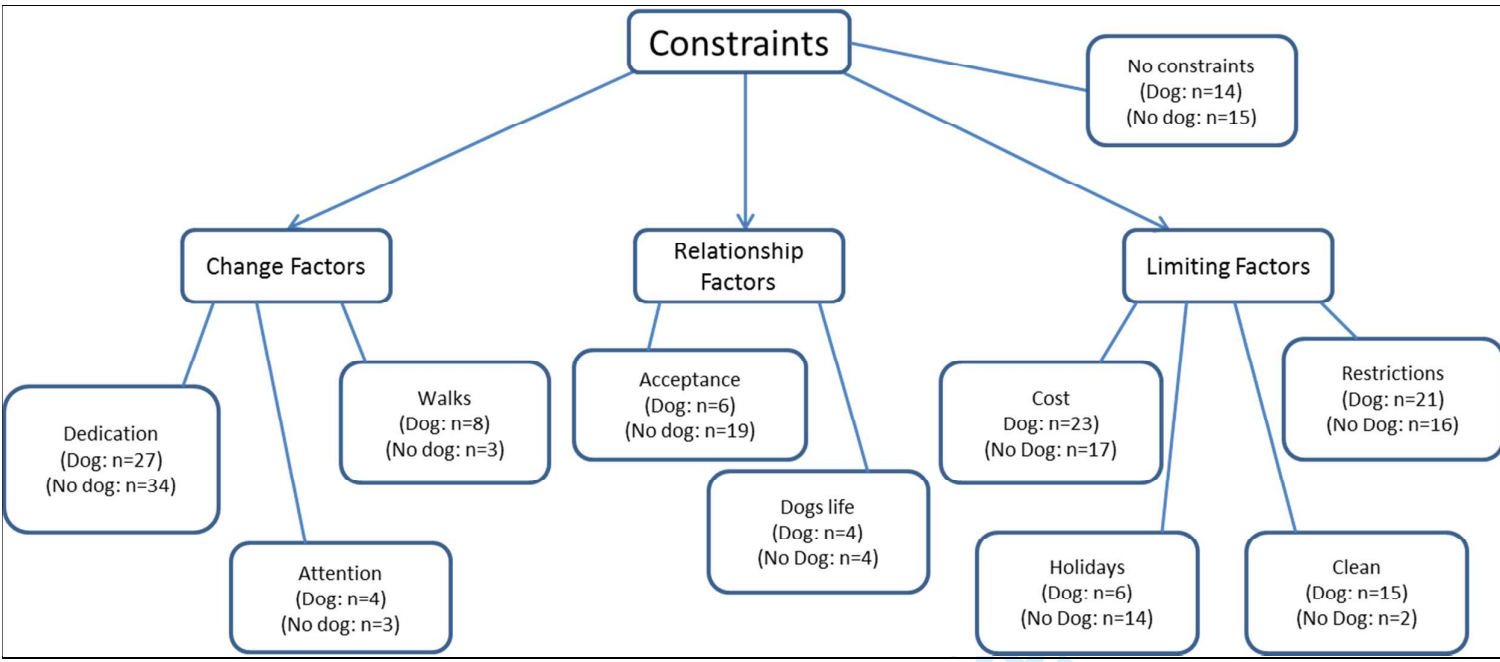


Figure 2 – Parents/Guardians perceived constraints of having assistance dog (themes and categories)

66% of parents/guardians with a dog listed at least two constraints.
 64% of parents/guardians on the wait list for a dog listed at least two constraints.
 *Please note that one category ‘other’ from the waiting list group second constraint is not included in the figure.
 Category ‘Dogs life’ refers to concerns about what happens when an assistance dog retires/dies.
 Category ‘Acceptance’ refers to challenges around family and children’s acceptance of an assistance dog.

STROBE Statement—parents perspectives on the value of assistance dogs for children with autism spectrum disorder: a cross sectional study.

	Item No	Recommendation
Title and abstract	1	(a) We have indicated the study's design with a commonly used term in the title (b) We have provided in the abstract an informative and balanced summary of what was done and what was found
Introduction		
Background/rationale	2	We have explained the scientific background and rationale for the investigation being reported
Objectives	3	Specific objectives, including any prespecified hypotheses are stated at end of the introduction
Methods		
Study design	4	We have presented key elements of study design early in the paper – details given in Methods section and at end of Introduction.
Setting	5	We have described the setting, locations, and relevant dates, including periods of recruitment, exposure, follow-up, and data collection
Participants	6	<i>Cross-sectional study</i> —We have given the eligibility criteria, and the sources and methods of selection of participants
Variables	7	We have clearly defined all outcomes, exposures, predictors, potential confounders, and effect modifiers.
Data sources/ measurement	8*	We have provided full descriptions of our measures and assessments in the methods section
Bias	9	We have addressed biases in our procedures section and in our regression analysis - adjusting for key demographic variables.
Study size	10	We sampled the total population of users of a national assistance dog's organisation. Explained in Methods section.
Quantitative variables	11	Data management techniques are described in the data analysis section at end of the Methods.
Statistical methods	12	(a) We have described all statistical methods, including those used to control for confounding – in the Methods section. (b) We have described methods used to examine subgroups and interactions in the Results section. (c) We had minimal missing data. <i>Cross-sectional study</i> —we used data analysis techniques appropriate for comparing two independent groups. (e) Describe any sensitivity analyses – we did not do a sensitivity analysis.

Continued on next page

Results

Participants	13*	(a) We have reported numbers of individuals in our cross sectional study—eg numbers potentially eligible, examined for eligibility, confirmed eligible, included in the study, and analysed (b) We omitted the over tens from our analysis for this study – described in Results section. (c) We have the maximum of 5 tables and figures included – these were considered essential and so we do not have space for a flow diagram. We are happy to provide one if requested.
Descriptive data	14*	(a) We have given characteristics of the study participants (eg demographic, clinical, social) and information on exposures and potential confounders (start of Results section) (b) We had minimal missing data.
Outcome data	15*	<i>Cross-sectional study</i> —We have reported the numbers of outcome events or summary measures in the Results section.
Main results	16	(a) We have given unadjusted and adjusted means and 95% confidence intervals. We have explained the reasons for adjustment in the results section. (b) We did not categorise continuous variables. (c) If relevant, consider translating estimates of relative risk into absolute risk for a meaningful time period – this was not relevant.
Other analyses	17	Report other analyses done—eg analyses of subgroups and interactions – main interactions are reported in the Results section and in the Discussion.

Discussion

Key results	18	We have summarised key results with reference to study objectives
Limitations	19	We have discussed limitations of the study, taking into account sources of potential bias or imprecision.
Interpretation	20	We have given a cautious overall interpretation of results considering objectives, limitations, multiplicity of analyses, results from similar studies, and other relevant evidence
Generalisability	21	We have discussed the generalisability (external validity) of the study results at the end of the Discussion.

Other information

Funding	22	This study was not funded from any particular source. It was done at University College Cork and by kind permission of the Irish Guide Dogs for the Blind. They assisted us in contacting their service users. We did not have access to their service users lists. They did not have access to the study data.
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*Give information separately for cases and controls in case-control studies and, if applicable, for exposed and unexposed groups in cohort and cross-sectional studies.

Note: An Explanation and Elaboration article discusses each checklist item and gives methodological background and published examples of transparent reporting. The STROBE checklist is best used in conjunction with this article (freely available on the Web sites of PLoS Medicine at <http://www.plosmedicine.org/>, Annals of Internal Medicine at <http://www.annals.org/>, and Epidemiology at <http://www.epidem.com/>). Information on the STROBE Initiative is available at www.strobe-statement.org.

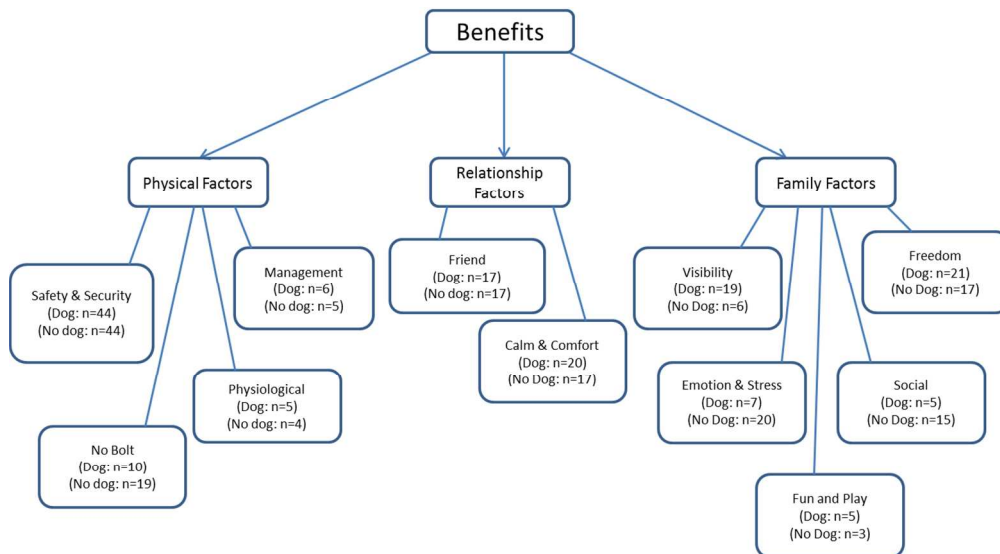


Figure 1 – Parents/Guardians perceived benefits of having an assistance dog (themes and categories)

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Category 'Physiological' refers to how assistance dogs can facilitate a child with respect to mobility and ambulation.

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Review only

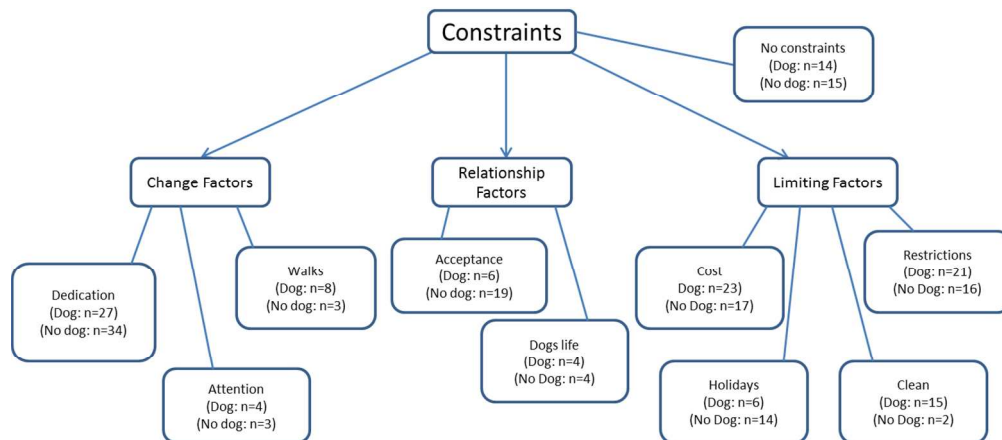


Figure 2 – Parents/Guardians perceived constraints of having assistance dog (themes and categories)

66% of parents/guardians with a dog listed at least two constraints.

64% of parents/guardians on the wait list for a dog listed at least two constraints.

*Please note that one category 'other' from the waiting list group second constraint is not included in the figure.

Category 'Dogs life' refers to concerns about what happens when an assistance dog retires/dies.
Category 'Acceptance' refers to challenges around family and children's acceptance of an assistance dog.

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BMJ Open

Parents' perspectives on the value of assistance dogs for children with autism spectrum disorder: a cross sectional study

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Primary Subject Heading:	Public health
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Manuscripts

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8 **Parents' perspectives on the value of assistance dogs for children with autism**
9 **spectrum disorder: a cross sectional study**
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35 **Key Words**

36 **Public Health, Epidemiology, Autism Spectrum Disorders, Assistance Dogs, animal assisted**
37 **interventions.**

38
39
40 **Word Count Revised Document:**

41 **Abstract = 295 words**

42 **Revised document = 5,056 words (excluding title page, references, tables,**
43 **figures and bullet pointed strengths and weaknesses)**
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50 This research received no specific grant from any funding agency in the public, commercial
51 or not for profit sector. Technical appendix, statistical code, and dataset available from the
52 corresponding author at University College Cork, who will provide a permanent home for
53 the dataset.
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ABSTRACT

Objectives: Whilst there is an emerging literature on the usefulness of assistance dogs for children with Autism Spectrum Disorder (ASD), there is a dearth of quantitative data on the value of assistance dog interventions for the family unit and family functioning. Using previously validated scales and scales developed specifically for this study, we measured parents/guardians perceptions of having an assistance dog on (a) child safety from environmental dangers, (b) public reception of ASD, (c) levels of caregiver strain and sense of competence. We also obtained open ended response data from parents/guardians on benefits and constraints of having an assistance dog.

Setting: This study was based in the primary care setting, within the context of a specific accredited assistance dog centre in Ireland. Participants: A total of 134 parents/guardians with an assistance dog, and 87 parents of children on the wait list were surveyed.

Primary and Secondary Outcome Measures: The primary outcome measures were scores on environmental hazards and public reception scales. Secondary outcome measures were scores on caregiver strain and competence scales.

Results: Parents/guardians of children who have ASD and an assistance dog rate their child as significantly safer from environmental dangers ($p < 0.001$), perceive that the public act more respectfully and responsibly towards their child ($p < 0.001$), and feel more competent about managing their child ($p = 0.023$) compared to parents on the wait list. There was a concentration of positive feeling towards assistance dog interventions with particular focus on safety and comfort for children, and a sense of freedom from family restrictions associated with ASD. The amount of dedication and commitment required to care for a dog were viewed as the primary constraints.

Conclusions: Our findings indicate that parents perceive that assistance dog interventions can be a valuable intervention for families with children who have ASD.

Main Strengths and Limitations of this study

- This study is the first to capture the views of a large group of parents/guardians on an assistance dog intervention.
- Findings suggest that parents perceive a high value in dogs for promoting safety, security and positive public reception for children with ASD.
- This study assessed the perceptions of parents/guardians on the wait list for a dog as opposed to using a stronger randomised control trial (RCT) design, where controls are randomly assigned to another intervention.

Introduction

There is an expanding literature indicating the human mental and physical health benefits derived from interaction with companion animals.¹ The presence of animals as an intervention tool was first studied by psychotherapist Boris Levinson via a series of case studies.² At the time animals were seen as inferior replacements for human social interactions.³ Since the 1970's animals have been used as a means of improving human physical, emotional, cognitive and social functioning. Animal assisted interventions (AAI) are classified into three groupings; animal assisted activities (AAA), animal assisted therapies (AAT) and service animal programmes (SAP).⁴

Animal assisted activities are delivered by trained personnel in environments such as hospitals and educational settings with an emphasis on quality of life enhancement via recreation and education e.g., therapeutic horse riding to treat populations with physical and mental disabilities.⁵⁻⁶ Animal assisted therapies are practiced by professionals with individualised therapy goals.⁷ The emphasis is on improvements in physical, social and cognitive functioning e.g., an occupational therapist working to facilitate fine motor skills development in a child via a series of structured tasks such as grooming and feeding a cat. A meta-analysis of the literature on AAT has shown that they are associated with moderate effect sizes in improving outcomes in four areas: autism spectrum symptoms, medical difficulties, behavioural problems, and emotional well-being.⁸ A recent systematic review of the literature on AAI for ASD has indicated preliminary 'proof of concept', but highlights the needs for more rigorous research to establish a convincing evidence base.⁹ This view is

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3 upheld by another recent review pointing to the need for better research designs and larger
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5 sample sizes.¹⁰
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10 Service animal interventions (SAP) use dogs to assist people with a disability in performing
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12 daily activities. Service dogs live in-house with the people they work with. Of late
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14 assistance dogs have received growing attention as a means of aiding children with Autism
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16 Spectrum Disorder (ASD) . Qualitative inquiry on the integration of assistance dogs into ten
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18 families with a child who has ASD, showed that the presence of a dog can improve quality of
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20 life for children and parents.¹¹ A study examining risks and benefits of assistance dogs using
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22 a series of structured interviews with 17 families, reported social and cognitive benefits in
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24 addition to physical and medical benefits.¹² An experimental study which assessed the
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26 effects of assistance dogs on basal salivary cortisol secretion of 42 children with ASD,
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28 demonstrated a reduction in the cortisol awakening response and the number of disruptive
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30 behavioural incidents post introduction of the dog.¹³ Assistance dogs complete a unique
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32 triad between parent/guardian and child. Typically the child is attached to the dog via a
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34 lead (leash) and belt. The dog walks with the child but takes commands from the parent
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36 (handler).¹⁴ If the child tries to step off a footpath or attempts to bolt, the dog will use all
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38 his/her power to slow the child down. Assistance dogs prohibit dangerous behaviour such
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40 as elopement (bolting) and provide a calming presence.
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50 Elopement or the tendency to 'bolt' is characteristic of ASD. Such behaviour can result in a
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52 child's exposure to dangerous traffic situations or encounters with strangers.¹⁵ Despite
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54 reports of higher mortality rates in ASD populations owing to accidents such as suffocation,
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56 drowning and injuries, research on elopement behaviour is sparse.¹⁶⁻¹⁸ If left untreated
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3 elopement may result in the need for a child to be moved to a restrictive setting.¹⁹ In a
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5 systematic review of the literature on current elopement treatments such as function based
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7 interventions, Lang and colleagues conveyed that just two of ten studies examined reported
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9 complete elimination of elopement.²⁰ Treatments that effectively eliminate elopement
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11 behaviours are warranted.
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17 Social, emotional and behavioural challenges at home and in public mean that
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19 parents/guardians of children with ASD experience stress in most areas of their lives.²¹⁻²⁴ In
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21 addition to behaviours such as elopement, public tantrums and the reaction from others are
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23 regarded as being some of the more difficult aspects of a child with ASD's behaviour.
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27 Situations can leave parents/guardians feeling judged as 'bad' parents, or feeling like a
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29 failure.²⁵ In this context assistance dogs can provide a unique support by facilitating child
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31 safety and promoting positive public reception. Outings to public places can become less
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33 stressful and families can enjoy greater freedom and mobility. Given the resource
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35 implications of assistance dog interventions for ASD, there is a need to assess the value of
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37 acceptability and likely uptake of services.
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43 Currently there are 188 service animal interventions registered with the standards body
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45 Assistance Dogs International (ADI). These interventions include guide dogs for the blind,
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47 hearing dogs for the hard of hearing, and service dogs for people with other disabilities
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49 including ASD. In this study we measured parents/guardians ratings on: (a) the impact of
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51 having an assistance dog on child safety from environmental hazards, (b) public acceptance
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53 and awareness of ASD, (c) sense of competence with managing a child with ASD and (d)
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3 levels of caregiver strain. We also obtained parents/guardians views on the primary
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10 **Methods**

11 **Study Design and Participants**

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14 Our study was based in the primary care setting, within the context of a specific national
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16 assistance dog intervention in the Republic of Ireland. All children who receive an
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18 assistance dog from this centre have been formally diagnosed with ASD via the Irish Health
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20 Services Executive (HSE) using standard tools such as the ADOS (Autism Diagnostic
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22 Observation Schedule), the ADI-R (Autism Diagnostic Interview) and the DISCO (Diagnostic
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24 Interview for Social Communication). Outside formal diagnosis, certain conditions such
25
26 having a child with particularly strong aggression issues may preclude participation on the
27
28 assistance dog programme.
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35
36 Parents/guardians with an assistance dog (N=205) and parents/guardians on the waiting list
37
38 for an assistance dog (N=107) were eligible to take part in the study. Expedited ethical
39
40 approval was granted from the Clinical Research Ethics Committee of the Cork Teaching
41
42 Hospitals. Data were gathered between October 2012 and March 2013.
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48 **Measures**

49
50 Parents/guardians were asked to complete a four part questionnaire (Table 1). Part one
51
52 examined child demographics. Part two measured parents/guardians sense of competence
53
54 for managing a child with ASD using Perceived Competence Scales (PCS)²⁶ ($\alpha = 0.876$, 7
55
56 point scales: low-high competence). The PCS is a measure of one of three fundamental
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1
2
3 psychological needs within Self Determination Theory.²⁷⁻²⁸ Like other measures within
4
5 behavioural change theory, items on the PCS are typically written to be specific to the
6
7 relevant behaviour or domain being examined. A sample item from the PCS we used for this
8
9 study is 'I am able to do my own routine caring for my child with autism'. Part two also
10
11 assessed levels of strain using the Caregiver Strain Questionnaire CGSQ²⁹ ($\alpha = 0.940$, 5 point
12
13 scales: low-high strain), which has been validated to assess burden among caregivers of
14
15 children with autism.³⁰ The CGSQ asked participants to consider the past 6 months in terms
16
17 of the problems presented by items such as: 'interruption of personal time resulting from
18
19 your child's emotional or behavioural problem (Objective Strain)', 'how embarrassed did
20
21 you feel about your child's emotional or behavioural problem (Subjective Externalised
22
23 Strain)' and 'How worried did you feel about your child's future (Subjective Internalised
24
25 Strain)'.
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34 Part three of the questionnaire examined perceptions of child safety from environmental
35
36 hazards such as traffic, dangerous materials and outdoor spaces ($\alpha=0.928$, 7 point scales:
37
38 low-high safety/security). Participants were asked to rate how strongly they agreed or
39
40 disagreed with respect to their child's safety and security over the past 3 months e.g., 'I am
41
42 confident that my child with autism is secure from environmental hazards when we go on
43
44 walks in our neighbourhood.' Part three also assessed parents/guardians ratings on the
45
46 general public's acceptance of their child ($\alpha=0.940$, 7 point scales: low-high acceptance). In
47
48 this case participants were asked to rate the public's perception of their child over the past
49
50 three months on items such as 'I am sure that people make allowances for my child with
51
52 autism when we are in a restaurant'. Scales for part three were developed with reference
53
54 to the format and structure of the Neighbourhood Environment Walkability Scale – Youth,³¹
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1
2
3 and via consultation with parents and author MC, who is a psychologist specialising in
4
5 children with ASD. Part four asked participants to list their views of the main
6
7 benefits/constraints of having an assistance dog via 'free text'. Those on the waiting list
8
9 were asked to give the benefits/constraints that they feel a dog will bring.
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14 **Pilot**

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17 We piloted the questionnaire with eight parents/guardians, four of which have an assistance
18
19 dog and four who are on the waiting list. Minor modifications were made to the final
20
21 questionnaire on the basis of their responses.
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26 **Procedures**

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28
29 The primary caregiver from each family with an assistance dog, and each family on the
30
31 waiting list received a postal questionnaire from the contact person at the assistance dog
32
33 centre. In the interests of confidentiality, the researchers at University College Cork did not
34
35 have access to names and addresses of participants. The assistance dog's centre did not
36
37 have access to the completed questionnaires. Each questionnaire pack contained a consent
38
39 form with study details, a questionnaire, a stamped addressed envelope, and an envelope
40
41 marked 'Research'. Participants were requested to place completed questionnaires in the
42
43 envelope marked 'Research' and to seal it. They were asked to place the sealed envelope
44
45 together with the signed consent form in the stamped addressed envelope, and to post
46
47
48 back to the assistance dog centre. Participants were assured that participation in the study
49
50 would have no impact on their status with the centre, and that staff at the centre would
51
52 have no access to the survey data.
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Data Analysis

Descriptive statistics are reported using frequencies tables. Chi Square tests were used to test for differences between the categorical demographic variables. T-tests were used to examine differences between parents of children with an assistance dog and those waiting to receive one, within the data on competence, caregiver strain (CGSQ), environmental hazards and public awareness. We then fitted a linear regression that included having a dog or being on the wait list as a dichotomous variable and each of gender, age, home location and education as factors.

Qualitative data were analysed via open coding, followed by a process of categorisation which facilitated the emergence of themes. Author LB analysed the qualitative data initially and author LD completed a second analysis and cross check.

Results

Demographics

A total of 134 parents/guardians with an assistance dog (65% response), and 87 parents/guardians from the wait list (81% response) completed the questionnaire. A large proportion of participants with a dog have children over the age of ten (40%) compared to just three participants from the wait list. For this reason we eliminated the 'over tens' from further analysis in this paper.

1
2
3 A breakdown of the demographic characteristics of participants' children is in Table 2. A
4
5 majority are male (87.5% with dog; 91.7% wait list) and similar percentages have other
6
7 medical conditions in addition to ASD (35% with dog; 32.1% wait list). Other conditions
8
9 include mild to moderate learning difficulties, ADHD, asthma and epilepsy. The largest
10
11 group live in suburban areas (41.3% with dog; 57% wait list) followed by the countryside
12
13 (45% with dog; 34% wait list). Over half of the children with a dog are verbal (52.5%) and
14
15 under half of those waiting for a dog are verbal (42%). There are differences in types of
16
17 school attended between participants whose children have an assistance dog and those
18
19 who do not yet have a dog. These are reflective of the remaining age differences between
20
21 the two groups post removal of the over tens from the total sample. The main difference is
22
23 that 61.3% of children with a dog attend a special school for ASD compared to 35.7% of the
24
25 wait list. Conversely 34.5% of children on the wait list are in a special class in a main stream
26
27 primary school compared to 21.3% who have a dog.
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36 With regard to conventional interventions received there are some descriptive differences
37
38 between participants whose children have an assistance dog and those on the wait list for a
39
40 dog (Table 2). There is a less than 10% difference between the groups for regular speech
41
42 and language therapy (47.5% with dog; 38.1% wait list) and regular occupational therapy
43
44 (46.3% with dog; 38.1% wait list). Similar percentages from both groups have a resource
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46 teacher (25% with dog; 26.2% wait list), and there is a 12% difference with regard to special
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48 needs assistants (80% with dog; 67.9% wait list)
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55 There are significant differences between profiles of children who have a dog and children
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57 waiting for a dog with respect to age and schooling. There are no significant differences
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3 between the groups for other conditions in addition to ASD, whether a child is verbal or
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5 nonverbal, conventional interventions and home location.
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8 9 10 **Environmental Hazards & Public Awareness**

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12 The environmental hazards scales are summarized in Table 3 and details of individual items
13
14 are in Supplementary Table 1. Ratings are from low perceived safety to high safety. T-test
15
16 results showed that mean ratings are significantly higher ($p < 0.001$) for parents/guardians
17
18 whose children have a dog (32.43) than for those on the waiting list (22.97). These
19
20 differences remain significant after adjusting for gender, age, home location and school type
21
22 ($p < 0.001$). We did however find a significant interaction between school types and
23
24 whether children have a dog. Although there are significant differences between the rating
25
26 of parents/guardians with a dog and those on the waiting list for children attending a special
27
28 school for autism (mean difference=6.62: 95%CI 0.639, 12.61), the effect is not as large as it
29
30 is for children attending a primary school (mean difference=12.53: 95%CI 4.16, 20.90) or a
31
32 special class in a primary school (mean difference=19.49: 5%CI 13.171, 25.821).
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40 The range of scores from the public perception scales (Table 3 and Supplementary Table 2)
41
42 are from low to high, with higher scores indicating a perception from parents/guardians that
43
44 people act more respectfully and responsibly towards children with ASD when in public
45
46 settings. T test results showed that parents/guardians mean ratings are significantly higher
47
48 ($p < 0.001$) for those whose children have an assistance dog (15.87) than for the wait list
49
50 (10.67). For the most part these differences remain significant after adjusting for gender,
51
52 age, home location and education level ($p < 0.001$). However, there was a significant
53
54 interaction between type of school attended and whether children have an assistance dog.
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3 Although there are significant differences between the ratings of parents/guardians with a
4
5 dog and those on the waiting list where their children attend a special school for autism
6
7 (mean difference=6.65: 95%CI 3.79, 9.51), and a special class in primary school (mean
8
9 difference=7.01: 95%CI 2.88, 11.13), there is no significant difference in the ratings of
10
11 parents/guardians who have a child in a main stream primary school (p=0.09).
12
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14 15 16 17 **Perceived Competence and Caregiver Strain**

18
19 A summary of results from parents/guardians perceived competencies with regard to caring
20
21 for and managing their child with ASD are in Table 3. Details of individual items are in
22
23 Supplementary Table 2. T-test results show that mean scores for parents/guardians whose
24
25 children have an assistance dog (19.75), are significantly higher (p=0.
26
27 02) in terms of perceived competencies than those on the waiting list (17.91). This
28
29 difference remained significant after adjusting for gender, age, home location and education
30
31 level (p=0.02). Results from the Caregiver Strain Questionnaire (CGSQ) (Table 3) show that
32
33 parents/guardians who have a dog rated slightly lower levels of strain than those on the
34
35 wait list. However we found no significant differences between the groups with regard to
36
37 any of the individual items on the scales, or the summarized scores for 'objective strain',
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39 'subjective internalized strain', and 'subjective externalized strain'.
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48 **Benefits and Constraints**

49
50 Qualitative data were analysed using a thematic approach and constant comparison
51
52 techniques by authors LB and LD. Each participant response was reviewed and codes were
53
54 assigned to each 'segment of meaning'. Open codes were assigned to representative
55
56 categories. The process of coding and categorisation facilitated the emergence of themes
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3 from within the data. Initial qualitative analysis was performed by LB, and these results
4
5 were cross-checked and refined by LD. We analysed the first and second listed benefits and
6
7 constraints of having an assistance dog. Data beyond the first two benefits and constraints
8
9 are sparse and not reported.
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14 Three themes were identified under 'benefits'. These were; physical factors, relationship
15
16 factors and family factors (Figure 1). 'Physical factors' is divided into four categories and
17
18 focuses on how assistance dogs can keep a child safe whilst facilitating parents' ability to
19
20 manage: *"A sense of security & protection for our daughter especially walking in local*
21
22 *environments"* (parent of girl 7-9yo with a dog), *"(Dog) will stop child from bolting from*
23
24 *home"* (parent of boy 4-6yo on waiting list). For 3 out of 4 categories, this theme is evenly
25
26 dispersed between parents who have a dog and waiting list controls. For the fourth
27
28 category 'no bolt', more parents/guardians from the waiting list state the benefit of the dog
29
30 being able to stop the child from eloping. 'Relationship factors' is grouped into two
31
32 categories and centres on the direct positive relationship between the child with ASD and
33
34 his/her assistance dog: *"She is his very best friend"* (parent of boy 4-6yo with a dog), *"It*
35
36 *might calm him down instead of him head banging the windows"* (parent of boy 4-6yo on
37
38 *waiting list*). The categories making up this theme are almost evenly dispersed between
39
40 parents/guardians who have a dog and waiting list controls. 'Family factors' is split into five
41
42 categories and is about how day to day family and social life is affected by the introduction
43
44 of an assistance dog: *"Ability to do maybe ordinary things and go to ordinary places"* (parent
45
46 *of boy 7-9yo on waiting list)*, *"a sense of responsibility, for example he can feed the dog"*
47
48 *(parent of boy 4-6yo with a dog)*. There were differences in the dispersal of this theme
49
50 among parents/guardians with a dog and those on the waiting list. For example benefits
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3 listed by those with a dog formed more of the category 'visibility', which is about public
4
5 reception and awareness of ASD. Benefits listed by parents/guardians on the waiting list
6
7 formed more of the categories 'social' and 'emotion and stress'. 'Social' is about a child
8
9 with ASD's sociability with family and outside the home. 'Emotion and stress' is about levels
10
11 of emotion/stress in the family, and to a lesser extent the ability of the child to express
12
13 emotion.
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18
19 Four themes emerged from the data on constraints. These were; 'change factors',
20
21 'relationship factors', 'limiting factors' and 'no constraints' (Figure 2). Change factors has
22
23 three categories and focuses on life style challenges that parents/guardians experience or
24
25 anticipate experiencing when they have an assistance dog: *"Its' like an additional child in the*
26
27 *family"*(parent of boy 4-6yo with a dog), *"To make time to go for walks everyday"* (parent of
28
29 *boy 7-9yo on waiting list*). The categories comprising this theme are quite evenly dispersed
30
31 between parents/guardians of children with a dog and those on the waiting list. Slightly
32
33 more parents/guardians waiting for a dog list 'dedication', which is the time and effort given
34
35 to care for the dog as a main constraint. As with the benefits themes, 'relationship factors'
36
37 is about the direct relationship between the child with ASD and the dog: *"My son may not*
38
39 *connect with the dog"* (parent of boy 4-6yo on waiting list), *"my concern is when the dog has*
40
41 *to retire, how will my child cope?"* (parent of boy 7-9yo with a dog). More
42
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46
47 parents/guardians on the waiting list make up the category 'acceptance', which is
48
49 concerned about how the dog will be accepted by the child and other family members. The
50
51 third theme 'limiting factors' has four associated categories and centres on day to day
52
53 constraints of having a dog on family life; *"Extra expense for food, vet bills etc"* (parent of
54
55 *boy 7-9yo with a dog*), *"it will be a bit difficult to travel"* (parent of boy 4-6yo on waiting list).
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3 There are large differences in the dispersal of two of the categories within this theme. In
4
5 particular, more parents/guardians whose children have a dog contributed to the category
6
7 'clean' , which is about day to day hygiene activities related to the dog e.g., dog hair in the
8
9 house and dealing with dog toileting. More parents/guardians on the waiting list
10
11 contributed to a category on 'holidays', which expressed concerns about going on holidays
12
13 with the dog. The final theme 'no constraints' has just one category. This was a category in
14
15 which parents/guardians stated no issues for concern or anticipated drawbacks; *"There are*
16
17 *none....our dog is a valuable and much loved addition to the family"* (parent of boy 7-9yo
18
19 *with a dog)*, *"don't anticipate any, feeling very positive about it"* (parent of boy 4-6yo on
20
21 *waiting list*). This category was almost evenly dispersed between parents whose children
22
23 have a dog and those on the waiting list.
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31 Discussion

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33 Our study is the first to capture the views of a large group of parents/guardians on an
34
35 assistance dog intervention. Quantitative findings indicate the value of dogs in promoting
36
37 safety, security and positive public reception for children with ASD. They also suggest that
38
39 the presence of an assistance dog may make parents/guardians feel more competent with
40
41 managing their child. Qualitative findings indicate the role assistance dogs play in
42
43 promoting child safety, calmness and provision of friendship. They also highlight the role
44
45 the dog has in facilitating 'normal' family functioning, such as being able to visit a shopping
46
47 centre. Constraints associated with having a dog relate to specific lifestyle changes
48
49 experienced by parents/guardians and the larger family group, such as dedicated care of the
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51 dog.
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3 There are several study limitations. Firstly, our findings are based on self-reports and
4
5 parents/guardians personal perceptions and are thus subject to participant overestimation,
6
7 recall bias and possible subject expectancy effects. Also since we did not include any
8
9 objective measures, we cannot know if parents perceptions reflect reality e.g., were
10
11 children actually safer and did the public actually view them more positively when
12
13 accompanied by an assistance dog. Secondly, there were differences in children's ages and
14
15 type of schools attended between our two sample groups which resulted in removal of the
16
17 over tens from our analyses and a reduction in sample size. Thirdly we did not assess the
18
19 views of parents/guardians who are not registered with the assistance dog centre. Our
20
21 results therefore can only be relevant to parents who are open to the possibility of having
22
23 an assistance dog. A fourth limitation of the study is that we assessed the perceptions of
24
25 waiting list controls as opposed to using a RCT design, where controls are randomly assigned
26
27 to another intervention. Ideally we would employ a planned activity, another animal such
28
29 as a cat, or a robotic dog as a control. Such a design was not feasible however and the
30
31 current data do provide insights.
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41 Recognition of the value animal interventions play in promoting human health is gaining
42
43 momentum. Animal interventions have been shown to produce increases in self-efficacy
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45 and coping in psychiatric patients³²⁻³³ promote recovery from ill health^{34, 3, 35}, and improve
46
47 academic performance, adaptive functioning and behavioural/emotional problems with
48
49 special education adolescents.³⁶ Autism spectrum disorder is one of the areas within which
50
51 animal interventions have had most success.⁸ This is particularly the case for assistance dog
52
53 interventions, since dogs not only provide a possible mechanism for promoting
54
55 improvements in social and behavioural functioning, they also play a part in control of
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3 elopement and promotion of child safety. Once a child is attached to a dog via the leash
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5 and belt system they cannot 'bolt'. In this study parents/guardians with a dog rated their
6
7 child as considerably more safe from environmental hazards than did waiting list controls.
8
9
10 We did find a reportable interaction between having an assistance dog, type of school
11
12 attended and parents/guardians ratings. This interaction indicated a lesser albeit significant
13
14 effect of having a dog for parents/guardians whose children attend a special school for ASD.
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16
17 The smaller effect may be due to the specific care that children and families receive from
18
19 ASD schools. Currently there are no interventions that can successfully eliminate elopement
20
21 among children with ASD.²⁰ Our quantitative findings support the role of assistance dogs in
22
23 providing this service. Our qualitative findings provide additional validation with safety and
24
25 security being the most frequently stated benefit of having a dog.
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31 Behavioural, social and emotional difficulties that encompass the lives of children with ASD
32
33 can impact on parents/guardians wellbeing.²¹⁻²² Our findings suggest that assistance dogs
34
35 can provide parents/guardians with a higher sense of competency with regard to managing
36
37 their child than waiting list controls. This result may reflect added supports dogs provide in
38
39 public settings. Indeed public tantrums and reactions from the public are regarded as one
40
41 of the more difficult aspects of a child with ASD's behaviour.²⁵ Qualitative results from this
42
43 study highlight the role that an assistance dog has in promoting public awareness and
44
45 acceptance of ASD. Quantitative results suggest that parents/guardians whose children
46
47 have assistance dogs rate the public's perception of their child as more positive. Our
48
49 regression analysis did show an interaction between having an assistance dog and type of
50
51 school attended. On examination we found that whilst the ratings of parents/guardians
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53 remained significantly different where their children attend a special school for autism or a
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3 special class in primary school, they were not significantly so where children attend a main
4
5 stream primary school. Such a result may reflect a lack of awareness/acceptance of ASD in
6
7 main stream schools.
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11
12 Our findings from the caregiver strain questionnaire (CSGQ) show no significant differences
13
14 between parents/guardians who have a child with a dog, and those waiting to receive a dog.

15
16 There are three sub scales within the CSGQ. 'Objective strain' deals with the caregiver
17
18 burden on day to day tasks related to care, 'subjective internalized strain' deals with
19
20 negative feelings internal to the caregiver, and 'subjective externalized strain' deals with
21
22 negative feelings by the caregiver towards the child. We considered two reasons which may
23
24 explain the lack of any real differences between the groups with regard to caregiver strain.
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26

27
28 Firstly, it is known that being a parent/guardian of a child with ASD can affect quality of life
29
30 with respect to levels of care and support required, and the resulting impacts on family
31
32 finance and family time.³⁷⁻³⁸ In our study parents/guardians expressed that the dedication
33
34 required to care for a dog is a main constraint. Assistance dogs require feeding, exercise,
35
36 affection, grooming, regular company and financial expenditure. The added tasks of looking
37
38 after an assistance dog may not therefore impact positively upon levels of caregiver strain.
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42 Secondly, we noticed that our sample scores on the CSGQ were generally less positive than
43
44 scores from parents/guardians who took part in the most recent CSGQ validation study.³⁰
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46

47
48 This may reflect a lower provision of services for families of children with autism in the
49
50 Republic of Ireland. It is interesting to note that although there were no significant
51
52 differences between parents/guardians who have a dog and those on the wait list for a dog
53
54 with respect to caregiver strain, there were significant differences with respect to perceived
55
56 competence. Why do parents/guardians with a dog feel more competent but no less
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1
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3 strained? A possible explanation is that the process and actual event of getting an
4
5 assistance dog, and the specific procedures followed with respect to working with the dog,
6
7 may make parents/guardians feel more competent. Having a dog may add more structure
8
9 to parent's management technique without necessarily reducing levels of strain associated
10
11 with having a child with ASD.
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17 The ability of assistance dogs to provide a sense of calm and comfort for children with ASD is
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19 documented.^{11, 13} Qualitative results from this study lend support to this view.
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22 Parents/guardians with an assistance dog frequently mentioned the dogs' ability to promote
23
24 calmness in their child. Those on the waiting list anticipated ways in which the dog would
25
26 aid their child in times of distress. Previous research has recognised the role that dogs have
27
28 in facilitating social development in children with ASD.^{12, 36 & 39} Our qualitative findings
29
30 point to the idea that assistance dogs can act as a 'bridge' between children and the physical
31
32 and social environment. However, more parents/guardians on the waiting list for a dog
33
34 wrote about the anticipated ability of a dog to promote social development in their children
35
36 than those with a dog. Those with a dog wrote more about the increased public awareness
37
38 and acceptance of their child as a main benefit. It may be that although parents waiting for
39
40 a dog anticipate changes in social interaction, this does not emerge as the most important
41
42 benefit once they actually get a dog. That assistance dogs may facilitate social interaction in
43
44 children with ASD is not in dispute. However, this role may be more salient in animal
45
46 assisted therapy (AAT), where a trained therapist may work with a dog to reach specific
47
48 cognitive or behavioural goals for a child. Parents/guardians listed constraints of having an
49
50 assistance dog were centred on the lifestyle changes. Such changes include the care and
51
52 costs required to ensure a dogs' health and wellbeing in addition to the restrictions
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2
3 associated with the dogs' requirements for exercise and companionship. It is important to
4
5 recognise that each parent/guardian has a different level of tolerance for specific canine
6
7 behaviours.⁴⁰ Whilst many of the parents/guardians in our study discounted the constraints
8
9 of having a dog, some were explicit about their concerns. More of those with an assistance
10
11 dog expressed concern about the increase in housekeeping tasks, and specific hygiene
12
13 activities associated with having a dog in the family home. Parents/guardians with children
14
15 on the wait list were more concerned about whether the dog will be accepted by the child
16
17 and family, and logistics during family holiday time. Our results suggest that some of the
18
19 anticipated constraints do not necessarily emerge as the most important constraints once a
20
21 dog is placed in the home. Differences in expectations highlight the importance of working
22
23 with families to best understand their needs and concerns both before and after obtaining
24
25 an assistance dog.
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33 **Conclusions**

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36 Our findings indicate that parents/guardians perceive assistance dog interventions are
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38 valuable in the treatment of ASD, particularly in relation to the control of elopement. They
39
40 also perceive that assistance dogs help to promote calmness and provide a source of
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42 comfort for children.
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Competing Interests

There are no competing interests. This study was an independent University led project. Families with an assistance dog from the Irish Guide Dogs for the Blind, and families on the waiting list for a dog took part in the study.

Contributorship Statement

-Louise Burgoyne was the lead researcher and was involved in the design, implementation, analysis and reporting of the study.

-Lisa Dowling took part of the project as her final year medical project. She was involved in the qualitative analysis and interpretation together with the overall reporting of the study and approval of the manuscript.

-Anthony (Tony) Fitzgerald is the study statistician responsible for interpretation of the quantitative data and final approval of the manuscript.

-Micaela Connolly is a psychologist specializing in children with autism. She was involved in the study design and was clinical adviser to the group throughout the course of research. She was also involved in the study reporting and approval of the manuscript.

-John Browne is a psychologist and health services researcher. He was involved in the study analysis critical review and approval of the manuscript.

-Ivan J Perry was the main project supervisor. He was responsible for overseeing the project from start to finish and approved the final manuscript.

Data Sharing Statement

Technical appendix, statistical code, and dataset available from the corresponding author at University College Cork, who will provide a permanent home for the dataset.

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Table 1 Questionnaire subsections, details and measures.

Section	Details	Measure
Part 1. Demographics	<ol style="list-style-type: none"> Gender, age, other medical conditions, age of diagnosis, home location. Education, learning level, verbal/non verbal Interventions and therapies received 	Tick boxes, yes/no options, free text.
Part 2. Parenting & Autism	<ol style="list-style-type: none"> Perceived competence From: Self Determination Theory <i>Deci & Ryan (1985 & 2000)</i> Caregiver strain questionnaire From: <i>Brannan et al (1997) & Khanna et al., (2011)</i> <i>Objective strain</i> <i>Subjective internalised strain</i> <i>Subjective externalised strain</i> 	<p>Four items on a 7-point scale</p> <p>21 items on a 5 point scale.</p> <p>11 items</p> <p>6 items</p> <p>4 items</p>
Part 3. Environment & Public	<ol style="list-style-type: none"> Environment safety and security Adapted from scale structures: <i>Rosenberg et al., (2009)</i> Public Perception 	<p>Eight items on a 7-point scale.</p> <p>Four items on a 7-point scale.</p>
Part 4. Benefits & constraints	<ol style="list-style-type: none"> Benefits of having an assistance dog Constraints of having an assistance dog 	Free text.

Table 2 Participant Characteristics (With Dog n=80, Waiting list for Dog n=84)

<i>Characteristics</i>		<i>With Dog N (%)</i>	<i>Waiting for Dog N (%)</i>	<i>P-value</i>
Gender	Male	70 (87.5)	77 (91.7)	–
Age	0-6 years	30 (37.5)	60 (71.4)	<0.001
	7-9 years	50 (62.5)	24 (28.6)	
Location	Town/city centre	11 (13.8)	8 (9.0)	0.217
	Suburb	33 (41.3)	47 (57.0)	
	Countryside	36 (45.0)	28 (34.0)	
Other conditions	Yes	24 (30.0)	27 (32.1)	0.767
Verbal	Yes	42 (52.5)	35 (42.0)	0.165
Education	Preschool	0	10 (11.9)	–
	Home tuition	1 (1.0)	4 (5.0)	–
	Primary	13 (16.3)	11 (31.1)	0.025
	Special class (Primary)	17 (21.3)	29 (34.5)	
	Special school (ASD)	49 (61.3)	30 (35.7)	
Interventions	Speech and Language	38 (47.5)	32 (38.1)	0.224
	Occupational Therapy	37 (46.3)	32 (38.1)	0.290
	Resource Teacher	20 (25.0)	22 (26.2)	0.861
	Special Needs Assistant	64 (80.0)	57 (67.9)	0.077

P-values are from valid chi-square tests.

‘–’ Not included in chi-square analysis as numbers do not meet minimum expected count.

Table 3. Summary of results from Environmental Hazards, Public Awareness, Competence and Caregiver Strain scales.

Item	Description	Mean (95%CI)		Diff* (95% CI)	P-value
		With Dog (n=80)	Waiting Dog (n=84)		
HAZ	Environmental Hazards (range 8 -56)	32.43 (29.47: 35.39)	22.97 (20.83: 25.11)	10.9 (6.97, 14.89)	<0.001 ¹
PUBLIC	Public Acceptance(range 4 –28)	15.87 (14.23: 17.50)	10.67 (9.56:11.77)	5.80 (3.69, 7.90)	<0.001 ²
SD	Competence (range 4 – 28)	19.75 (18.74:20.77)	17.91 (16.52: 18.92)	1.97 (0.273, 3.68)	0.023
OS	Objective strain (range 11-55)	35.03 (32.81: 37.20)	35.91 (34.08:38.01)	-0.54 (-3.78, 2.70)	0.744
SIS	Subjective Internalised strain (range 6-35)	22.47 (21.21:23.60)	23.63 (22.89:25.03)	-0.81 (-2.63, 1.00)	0.380
SES	Subjective Externalised strain (range 4-20)	7.74 (7.01: 8.46)	7.88 (7.28:8.49)	-0.34 (-1.37, .69)	0.522

*Adjusted for gender, age, location, education

1. There was a lesser albeit significant effect of having a dog for parents/guardians whose children attend a special school for children with ASD
2. There is no significant difference in ratings of parents/guardians who have a child in a main stream primary school (p=0.09)

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9 **Figure 1** – Parents/Guardians perceived benefits of having an assistance dog (themes and categories)

10
11 99% of parents/guardians with a dog listed at least two benefits.

12 99% of parents/guardians on the wait list for a dog listed at least two benefits.

13 Category 'Physiological' refers to how assistance dogs can facilitate a child with respect to mobility and ambulation.

14 Category 'Management' refers to how assistance dogs can facilitate day to day management of their child.

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17 **Figure 2** – Parents/Guardians perceived constraints of having assistance dog (themes and categories)

18 66% of parents/guardians with a dog listed at least two constraints.

19 64% of parents/guardians on the wait list for a dog listed at least two constraints.

20 *Please note that one category 'other' from the waiting list group second constraint is not included in the figure.

21 Category 'Dogs life' refers to concerns about what happens when an assistance dog retires/dies.

22 Category 'Acceptance' refers to challenges around family and children's acceptance of an assistance dog.
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8 **Parents' perspectives on the value of assistance dogs for children with autism**
9 **spectrum disorder: a cross sectional study**
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16 **Institution: Department of Epidemiology & Public Health, University College Cork (UCC).**

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35 **Key Words**

36 **Public Health, Epidemiology, Autism Spectrum Disorders, Assistance Dogs, animal assisted**
37 **interventions.**

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50 This research received no specific grant from any funding agency in the public, commercial
51 or not for profit sector. Technical appendix, statistical code, and dataset available from the
52 corresponding author at University College Cork, who will provide a permanent home for
53 the dataset.
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Main Strengths and Limitations of this study

- This study is the first to capture the views of a large group of parents/guardians on an assistance dog intervention.
- Findings suggest that parents perceive a high value in dogs for promoting safety, security and positive public reception for children with ASD.
- This study assessed the perceptions of parents/guardians on the wait list for a dog as opposed to using a stronger randomised control trial (RCT) design, where controls are randomly assigned to another intervention.

Introduction

There is an expanding literature indicating the human mental and physical health benefits derived from interaction with companion animals.¹ The presence of animals as an intervention tool was first studied by psychotherapist Boris Levinson via a series of case studies.² At the time animals were seen as inferior replacements for human social interactions.³ Since the 1970's animals have been used as a means of improving human physical, emotional, cognitive and social functioning. Animal assisted interventions (AAI) are classified into three groupings; animal assisted activities (AAA), animal assisted therapies (AAT) and service animal programmes (SAP).⁴

Animal assisted activities are delivered by trained personnel in environments such as hospitals and educational settings with an emphasis on quality of life enhancement via recreation and education e.g., therapeutic horse riding to treat populations with physical and mental disabilities.⁵⁻⁶ Animal assisted therapies are practiced by professionals with

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3 individualised therapy goals.⁷ The emphasis is on improvements in physical, social and
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5 cognitive functioning e.g., an occupational therapist working to facilitate fine motor skills
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7 development in a child via a series of structured tasks such as grooming and feeding a cat.
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10 A meta-analysis of the literature on AAT has shown that they are associated with moderate
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12 effect sizes in improving outcomes in four areas: autism spectrum symptoms, medical
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14 difficulties, behavioural problems, and emotional well-being.⁸ A recent systematic review of
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16 the literature on AAI for ASD has indicated preliminary ‘proof of concept’, but highlights the
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18 needs for more rigorous research to establish a convincing evidence base.⁹ This view is
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20 upheld by another recent review pointing to the need for better research designs and larger
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22 sample sizes.¹⁰
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29 Service animal interventions (SAP) use dogs to assist people with a disability in performing
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31 daily activities. Service dogs live in-house with the people they work with. Of late
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33 assistance dogs have received growing attention as a means of aiding children with Autism
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35 Spectrum Disorder (ASD) . Qualitative inquiry on the integration of assistance dogs into ten
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37 families with a child who has ASD, showed that the presence of a dog can improve quality of
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39 life for children and parents.¹¹ A study examining risks and benefits of assistance dogs using
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41 a series of structured interviews with 17 families, reported social and cognitive benefits in
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43 addition to physical and medical benefits.¹² An experimental study which assessed the
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45 effects of assistance dogs on basal salivary cortisol secretion of 42 children with ASD,
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47 demonstrated a reduction in the cortisol awakening response and the number of disruptive
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49 behavioural incidents post introduction of the dog.¹³ Assistance dogs complete a unique
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51 triad between parent/guardian and child. Typically the child is attached to the dog via a
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53 lead (leash) and belt. The dog walks with the child but takes commands from the parent
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3 (handler).¹⁴ If the child tries to step off a footpath or attempts to bolt, the dog will use all
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5 his/her power to slow the child down. Assistance dogs prohibit dangerous behaviour such
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7 as elopement (bolting) and provide a calming presence.
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12 Elopement or the tendency to 'bolt' is characteristic of ASD. Such behaviour can result in a
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14 child's exposure to dangerous traffic situations or encounters with strangers.¹⁵ Despite
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16 reports of higher mortality rates in ASD populations owing to accidents such as suffocation,
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18 drowning and injuries, research on elopement behaviour is sparse.¹⁶⁻¹⁸ If left untreated
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20 elopement may result in the need for a child to be moved to a restrictive setting.¹⁹ In a
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22 systematic review of the literature on current elopement treatments such as function based
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24 interventions, Lang and colleagues conveyed that just two of ten studies examined reported
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26 complete elimination of elopement.²⁰ Treatments that effectively eliminate elopement
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28 behaviours are warranted.
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36 Social, emotional and behavioural challenges at home and in public mean that
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38 parents/guardians of children with ASD experience stress in most areas of their lives.²¹⁻²⁴ In
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40 addition to behaviours such as elopement, public tantrums and the reaction from others are
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42 regarded as being some of the more difficult aspects of a child with ASD's behaviour.
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44 Situations can leave parents/guardians feeling judged as 'bad' parents, or feeling like a
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46 failure.²⁵ In this context assistance dogs can provide a unique support by facilitating child
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48 safety and promoting positive public reception. Outings to public places can become less
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50 stressful and families can enjoy greater freedom and mobility. Given the resource
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52 implications of assistance dog interventions for ASD, there is a need to assess the value of
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54 acceptability and likely uptake of services.
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Currently there are 188 service animal interventions registered with the standards body Assistance Dogs International (ADI). These interventions include guide dogs for the blind, hearing dogs for the hard of hearing, and service dogs for people with other disabilities including ASD. In this study we measured parents/guardians ratings on: (a) the impact of having an assistance dog on child safety from environmental hazards, (b) public acceptance and awareness of ASD, (c) sense of competence with managing a child with ASD and (d) levels of caregiver strain. We also obtained parents/guardians views on the primary benefits and constraints of having an assistance dog.

Methods

Study Design and Participants

Our study was based in the primary care setting, within the context of a specific national assistance dog intervention in the Republic of Ireland. All children who receive an assistance dog from this centre have been formally diagnosed with ASD via the Irish Health Services Executive (HSE) using standard tools such as the ADOS (Autism Diagnostic Observation Schedule), the ADI-R (Autism Diagnostic Interview) and the DISCO (Diagnostic Interview for Social Communication). **Outside formal diagnosis, certain conditions such having a child with particularly strong aggression issues may preclude participation on the assistance dog programme.**

Parents/guardians with an assistance dog (N=205) and parents/guardians on the waiting list for an assistance dog (N=107) were eligible to take part in the study. Expedited ethical

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3 approval was granted from the Clinical Research Ethics Committee of the Cork Teaching
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5 Hospitals. Data were gathered between October 2012 and March 2013.
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10 **Measures**

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12 Parents/guardians were asked to complete a four part questionnaire (Table 1). Part one
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14 examined child demographics. Part two measured parents/guardians sense of competence
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16 for managing a child with ASD using Perceived Competence Scales (PCS)²⁶ ($\alpha = 0.876$, 7
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18 point scales: low-high competence). The PCS is a measure of one of three fundamental
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20 psychological needs within Self Determination Theory.²⁷⁻²⁸ Like other measures within
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22 behavioural change theory, items on the PCS are typically written to be specific to the
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24 relevant behaviour or domain being examined. A sample item from the PCS we used for this
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26 study is 'I am able to do my own routine caring for my child with autism'. Part two also
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28 assessed levels of strain using the Caregiver Strain Questionnaire CGSQ²⁹ ($\alpha = 0.940$, 5 point
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30 scales: low-high strain), which has been validated to assess burden among caregivers of
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32 children with autism.³⁰ The CGSQ asked participants to consider the past 6 months in terms
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34 of the problems presented by items such as: 'interruption of personal time resulting from
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36 your child's emotional or behavioural problem (Objective Strain)', 'how embarrassed did
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38 you feel about your child's emotional or behavioural problem (Subjective Externalised
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40 Strain)' and 'How worried did you feel about your child's future (Subjective Internalised
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42 Strain)'.
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53 Part three of the questionnaire examined perceptions of child safety from environmental
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55 hazards such as traffic, dangerous materials and outdoor spaces ($\alpha=0.928$, 7 point scales:
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57 low-high safety/security). Participants were asked to rate how strongly they agreed or
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3 disagreed with respect to their child's safety and security over the past 3 months e.g., 'I am
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5 confident that my child with autism is secure from environmental hazards when we go on
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7 walks in our neighbourhood.' Part three also assessed parents/guardians ratings on the
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9 general public's acceptance of their child ($\alpha=0.940$, 7 point scales: low-high acceptance). In
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11 this case participants were asked to rate the public's perception of their child over the past
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13 three months on items such as 'I am sure that people make allowances for my child with
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15 autism when we are in a restaurant'. Scales for part three were developed with reference
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17 to the format and structure of the Neighbourhood Environment Walkability Scale – Youth,³¹
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19 and via consultation with parents and author MC, who is a psychologist specialising in
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21 children with ASD. Part four asked participants to list their views of the main
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23 benefits/constraints of having an assistance dog via 'free text'. Those on the waiting list
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25 were asked to give the benefits/constraints that they feel a dog will bring.
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33 **Pilot**

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35 We piloted the questionnaire with eight parents/guardians, four of which have an assistance
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37 dog and four who are on the waiting list. Minor modifications were made to the final
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39 questionnaire on the basis of their responses.
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45 **Procedures**

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47 The primary caregiver from each family with an assistance dog, and each family on the
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49 waiting list received a postal questionnaire from the contact person at the assistance dog
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51 centre. In the interests of confidentiality, the researchers at University College Cork did not
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53 have access to names and addresses of participants. The assistance dog's centre did not
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55 have access to the completed questionnaires. Each questionnaire pack contained a consent
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3 form with study details, a questionnaire, a stamped addressed envelope, and an envelope
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5 marked 'Research'. Participants were requested to place completed questionnaires in the
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7 envelope marked 'Research' and to seal it. They were asked to place the sealed envelope
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9 together with the signed consent form in the stamped addressed envelope, and to post
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11 back to the assistance dog centre. Participants were assured that participation in the study
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13 would have no impact on their status with the centre, and that staff at the centre would
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15 have no access to the survey data.
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21 **Data Analysis**

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23 Descriptive statistics are reported using frequencies tables. Chi Square tests were used to
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25 test for differences between the categorical demographic variables. T-tests were used to
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27 examine differences between parents of children with an assistance dog and those waiting
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29 to receive one, within the data on competence, caregiver strain (CGSQ), environmental
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31 hazards and public awareness. We then fitted a linear regression that included having a dog
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33 or being on the wait list as a dichotomous variable and each of gender, age, home location
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35 and education as factors.
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43 Qualitative data were analysed via open coding, followed by a process of categorisation
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45 which facilitated the emergence of themes. Author LB analysed the qualitative data initially
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47 and author LD completed a second analysis and cross check.
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Results

Demographics

A total of 134 parents/guardians with an assistance dog (65% response), and 87 parents/guardians from the wait list (81% response) completed the questionnaire. A large proportion of participants with a dog have children over the age of ten (40%) compared to just three participants from the wait list. For this reason we eliminated the 'over tens' from further analysis in this paper.

A breakdown of the demographic characteristics of participants' children is in Table 2. A majority are male (87.5% with dog; 91.7% wait list) and similar percentages have other medical conditions in addition to ASD (35% with dog; 32.1% wait list). Other conditions include mild to moderate learning difficulties, ADHD, asthma and epilepsy. The largest group live in suburban areas (41.3% with dog; 57% wait list) followed by the countryside (45% with dog; 34% wait list). Over half of the children with a dog are verbal (52.5%) and under half of those waiting for a dog are verbal (42%). There are differences in types of school attended between participants whose children have an assistance dog and those who do not yet have a dog. These are reflective of the remaining age differences between the two groups post removal of the over tens from the total sample. The main difference is that 61.3% of children with a dog attend a special school for ASD compared to 35.7% of the wait list. Conversely 34.5% of children on the wait list are in a special class in a main stream primary school compared to 21.3% who have a dog.

With regard to conventional interventions received there are some descriptive differences between participants whose children have an assistance dog and those on the wait list for a

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3 dog (Table 2). There is a less than 10% difference between the groups for regular speech
4
5 and language therapy (47.5% with dog; 38.1% wait list) and regular occupational therapy
6
7 (46.3% with dog; 38.1% wait list). Similar percentages from both groups have a resource
8
9 teacher (25% with dog; 26.2% wait list), and there is a 12% difference with regard to special
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11 needs assistants (80% with dog; 67.9% wait list)
12
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16
17 There are significant differences between profiles of children who have a dog and children
18
19 waiting for a dog with respect to age and schooling. There are no significant differences
20
21 between the groups for other conditions in addition to ASD, whether a child is verbal or
22
23 nonverbal, conventional interventions and home location.
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28 29 **Environmental Hazards & Public Awareness**

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31 The environmental hazards scales are summarized in Table 3 and details of individual items
32
33 are in Supplementary Table 1. Ratings are from low perceived safety to high safety. T-test
34
35 results showed that mean ratings are significantly higher ($p < 0.001$) for parents/guardians
36
37 whose children have a dog (32.43) than for those on the waiting list (22.97). These
38
39 differences remain significant after adjusting for gender, age, home location and school type
40
41 ($p < 0.001$). We did however find a significant interaction between school types and
42
43 whether children have a dog. Although there are significant differences between the rating
44
45 of parents/guardians with a dog and those on the waiting list for children attending a special
46
47 school for autism (mean difference=6.62: 95%CI 0.639, 12.61), the effect is not as large as it
48
49 is for children attending a primary school (mean difference=12.53: 95%CI 4.16, 20.90) or a
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51 special class in a primary school (mean difference=19.49: 5%CI 13.171, 25.821).
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3 The range of scores from the public perception scales (Table 3 and Supplementary Table 2)
4
5 are from low to high, with higher scores indicating a perception from parents/guardians that
6
7 people act more respectfully and responsibly towards children with ASD when in public
8
9 settings. T test results showed that parents/guardians mean ratings are significantly higher
10
11 ($p<0.001$) for those whose children have an assistance dog (15.87) than for the wait list
12
13 (10.67). For the most part these differences remain significant after adjusting for gender,
14
15 age, home location and education level ($p<0.001$). However, there was a significant
16
17 interaction between type of school attended and whether children have an assistance dog.
18
19 Although there are significant differences between the ratings of parents/guardians with a
20
21 dog and those on the waiting list where their children attend a special school for autism
22
23 (mean difference=6.65: 95%CI 3.79, 9.51), and a special class in primary school (mean
24
25 difference=7.01: 95%CI 2.88, 11.13), there is no significant difference in the ratings of
26
27 parents/guardians who have a child in a main stream primary school ($p=0.09$).
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36 **Perceived Competence and Caregiver Strain**

37
38 A summary of results from parents/guardians perceived competencies with regard to caring
39
40 for and managing their child with ASD are in Table 3. Details of individual items are in
41
42 **Supplementary Table 2**. T-test results show that mean scores for parents/guardians whose
43
44 children have an assistance dog (19.75), are significantly higher ($p=0.02$) in terms of perceived competencies than those on the waiting list (17.91). This
45
46 difference remained significant after adjusting for gender, age, home location and education
47
48 level ($p=0.02$). Results from the Caregiver Strain Questionnaire (CGSQ) (Table 3) show that
49
50 parents/guardians who have a dog rated slightly lower levels of strain than those on the
51
52 wait list. However we found no significant differences between the groups with regard to
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3 any of the individual items on the scales, or the summarized scores for 'objective strain',
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5 'subjective internalized strain', and 'subjective externalized strain'.
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10 **Benefits and Constraints**

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12 Qualitative data were analysed using a thematic approach and constant comparison
13
14 techniques by authors LB and LD. Each participant response was reviewed and codes were
15
16 assigned to each 'segment of meaning'. Open codes were assigned to representative
17
18 categories. The process of coding and categorisation facilitated the emergence of themes
19
20 from within the data. Initial qualitative analysis was performed by LB, and these results
21
22 were cross-checked and refined by LD. We analysed the first and second listed benefits and
23
24 constraints of having an assistance dog. Data beyond the first two benefits and constraints
25
26 are sparse and not reported.
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34 Three themes were identified under 'benefits'. These were; physical factors, relationship
35
36 factors and family factors (Figure 1). 'Physical factors' is divided into four categories and
37
38 focuses on how assistance dogs can keep a child safe whilst facilitating parents' ability to
39
40 manage: *"A sense of security & protection for our daughter especially walking in local*
41
42 *environments" (parent of girl 7-9yo with a dog), "(Dog) will stop child from bolting from*
43
44 *home" (parent of boy 4-6yo on waiting list). For 3 out of 4 categories, this theme is evenly*
45
46 *dispersed between parents who have a dog and waiting list controls. For the fourth*
47
48 *category 'no bolt', more parents/guardians from the waiting list state the benefit of the dog*
49
50 *being able to stop the child from eloping. 'Relationship factors' is grouped into two*
51
52 *categories and centres on the direct positive relationship between the child with ASD and*
53
54 *his/her assistance dog: "She is his very best friend" (parent of boy 4-6yo with a dog), "It*
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3 *might calm him down instead of him head banging the windows” (parent of boy 4-6yo on*
4 *waiting list). The categories making up this theme are almost evenly dispersed between*
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parents/guardians who have a dog and waiting list controls. ‘Family factors’ is split into five categories and is about how day to day family and social life is affected by the introduction of an assistance dog: “Ability to do maybe ordinary things and go to ordinary places” (parent of boy 7-9yo on waiting list), “a sense of responsibility, for example he can feed the dog” (parent of boy 4-6yo with a dog). There were differences in the dispersal of this theme among parents/guardians with a dog and those on the waiting list. For example benefits listed by those with a dog formed more of the category ‘visibility’, which is about public reception and awareness of ASD. Benefits listed by parents/guardians on the waiting list formed more of the categories ‘social’ and ‘emotion and stress’. ‘Social’ is about a child with ASD’s sociability with family and outside the home. ‘Emotion and stress’ is about levels of emotion/stress in the family, and to a lesser extent the ability of the child to express emotion.

Four themes emerged from the data on constraints. These were; ‘change factors’, ‘relationship factors’, ‘limiting factors’ and ‘no constraints’ (Figure 2). Change factors has three categories and focuses on life style challenges that parents/guardians experience or anticipate experiencing when they have an assistance dog: *“Its’ like an additional child in the family”(parent of boy 4-6yo with a dog), “To make time to go for walks everyday” (parent of boy 7-9yo on waiting list). The categories comprising this theme are quite evenly dispersed between parents/guardians of children with a dog and those on the waiting list. Slightly more parents/guardians waiting for a dog list ‘dedication’, which is the time and effort given to care for the dog as a main constraint. As with the benefits themes, ‘relationship factors’*

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2
3 is about the direct relationship between the child with ASD and the dog: *“My son may not*
4 *connect with the dog” (parent of boy 4-6yo on waiting list), “my concern is when the dog has*
5 *to retire, how will my child cope?” (parent of boy 7-9yo with a dog). More*
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9
10 parents/guardians on the waiting list make up the category ‘acceptance’, which is
11
12 concerned about how the dog will be accepted by the child and other family members. The
13
14 third theme ‘limiting factors’ has four associated categories and centres on day to day
15
16 constraints of having a dog on family life; *“Extra expense for food, vet bills etc” (parent of*
17 *boy 7-9yo with a dog), “it will be a bit difficult to travel” (parent of boy 4-6yo on waiting list).*
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21
22 There are large differences in the dispersal of two of the categories within this theme. In
23
24 particular, more parents/guardians whose children have a dog contributed to the category
25
26 ‘clean’, which is about day to day hygiene activities related to the dog e.g., dog hair in the
27
28 house and dealing with dog toileting. More parents/guardians on the waiting list
29
30 contributed to a category on ‘holidays’, which expressed concerns about going on holidays
31
32 with the dog. The final theme ‘no constraints’ has just one category. This was a category in
33
34 which parents/guardians stated no issues for concern or anticipated drawbacks; *“There are*
35 *none....our dog is a valuable and much loved addition to the family” (parent of boy 7-9yo*
36 *with a dog), “don’t anticipate any, feeling very positive about it” (parent of boy 4-6yo on*
37 *waiting list).* This category was almost evenly dispersed between parents whose children
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Discussion

Our study is the first to capture the views of a large group of parents/guardians on an assistance dog intervention. Quantitative findings indicate the value of dogs in promoting safety, security and positive public reception for children with ASD. They also suggest that

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2
3 the presence of an assistance dog may make parents/guardians feel more competent with
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5 managing their child. Qualitative findings indicate the role assistance dogs play in
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7 promoting child safety, calmness and provision of friendship. They also highlight the role
8
9 the dog has in facilitating 'normal' family functioning, such as being able to visit a shopping
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11 centre. Constraints associated with having a dog relate to specific lifestyle changes
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13 experienced by parents/guardians and the larger family group, such as dedicated care of the
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15 dog.
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22 There are several study limitations. Firstly, our findings are based on self-reports and
23
24 parents/guardians personal perceptions and are thus subject to participant overestimation,
25
26 recall bias and possible subject expectancy effects. Also since we did not include any
27
28 objective measures, we cannot know if parents perceptions reflect reality e.g., were
29
30 children actually safer and did the public actually view them more positively when
31
32 accompanied by an assistance dog. Secondly, there were differences in children's ages and
33
34 type of schools attended between our two sample groups which resulted in removal of the
35
36 over tens from our analyses and a reduction in sample size. Thirdly we did not assess the
37
38 views of parents/guardians who are not registered with the assistance dog centre. Our
39
40 results therefore can only be relevant to parents who are open to the possibility of having
41
42 an assistance dog. A fourth limitation of the study is that we assessed the perceptions of
43
44 waiting list controls as opposed to using a RCT design, where controls are randomly assigned
45
46 to another intervention. Ideally we would employ a planned activity, another animal such
47
48 as a cat, or a robotic dog as a control. Such a design was not feasible however and the
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50 current data do provide insights.
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3 Recognition of the value animal interventions play in promoting human health is gaining
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5 momentum. Animal interventions have been shown to produce increases in self-efficacy
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7 and coping in psychiatric patients³²⁻³³ promote recovery from ill health^{34, 3, 35}, and improve
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9 academic performance, adaptive functioning and behavioural/emotional problems with
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11 special education adolescents.³⁶ Autism spectrum disorder is one of the areas within which
12
13 animal interventions have had most success.⁸ This is particularly the case for assistance dog
14
15 interventions, since dogs not only provide a possible mechanism for promoting
16
17 improvements in social and behavioural functioning, they also play a part in control of
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19 elopement and promotion of child safety. Once a child is attached to a dog via the leash
20
21 and belt system they cannot 'bolt'. In this study parents/guardians with a dog rated their
22
23 child as considerably more safe from environmental hazards than did waiting list controls.
24
25 We did find a reportable interaction between having an assistance dog, type of school
26
27 attended and parents/guardians ratings. This interaction indicated a lesser albeit significant
28
29 effect of having a dog for parents/guardians whose children attend a special school for ASD.
30
31 The smaller effect may be due to the specific care that children and families receive from
32
33 ASD schools. Currently there are no interventions that can successfully eliminate elopement
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35 among children with ASD.²⁰ Our quantitative findings support the role of assistance dogs in
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37 providing this service. Our qualitative findings provide additional validation with safety and
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39 security being the most frequently stated benefit of having a dog.
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50 Behavioural, social and emotional difficulties that encompass the lives of children with ASD
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52 can impact on parents/guardians wellbeing.²¹⁻²² Our findings suggest that assistance dogs
53
54 can provide parents/guardians with a higher sense of competency with regard to managing
55
56 their child than waiting list controls. This result may reflect added supports dogs provide in
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3 public settings. Indeed public tantrums and reactions from the public are regarded as one
4
5 of the more difficult aspects of a child with ASD's behaviour.²⁵ Qualitative results from this
6
7 study highlight the role that an assistance dog has in promoting public awareness and
8
9 acceptance of ASD. Quantitative results suggest that parents/guardians whose children
10
11 have assistance dogs rate the public's perception of their child as more positive. Our
12
13 regression analysis did show an interaction between having an assistance dog and type of
14
15 school attended. On examination we found that whilst the ratings of parents/guardians
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17 remained significantly different where their children attend a special school for autism or a
18
19 special class in primary school, they were not significantly so where children attend a main
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21 stream primary school. Such a result may reflect a lack of awareness/acceptance of ASD in
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23 main stream schools.
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31 Our findings from the caregiver strain questionnaire (CSGQ) show no significant differences
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33 between parents/guardians who have a child with a dog, and those waiting to receive a dog.
34
35 There are three sub scales within the CSGQ. 'Objective strain' deals with the caregiver
36
37 burden on day to day tasks related to care, 'subjective internalized strain' deals with
38
39 negative feelings internal to the caregiver, and 'subjective externalized strain' deals with
40
41 negative feelings by the caregiver towards the child. We considered two reasons which may
42
43 explain the lack of any real differences between the groups with regard to caregiver strain.
44
45 Firstly, it is known that being a parent/guardian of a child with ASD can affect quality of life
46
47 with respect to levels of care and support required, and the resulting impacts on family
48
49 finance and family time.³⁷⁻³⁸ In our study parents/guardians expressed that the dedication
50
51 required to care for a dog is a main constraint. Assistance dogs require feeding, exercise,
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53 affection, grooming, regular company and financial expenditure. The added tasks of looking
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3 after an assistance dog may not therefore impact positively upon levels of caregiver strain.

4
5 Secondly, we noticed that our sample scores on the CSGQ were generally less positive than
6
7 scores from parents/guardians who took part in the most recent CSGQ validation study.³⁰

8
9 This may reflect a lower provision of services for families of children with autism in the
10
11 Republic of Ireland. It is interesting to note that although there were no significant
12
13 differences between parents/guardians who have a dog and those on the wait list for a dog
14
15 with respect to caregiver strain, there were significant differences with respect to perceived
16
17 competence. Why do parents/guardians with a dog feel more competent but no less
18
19 strained? A possible explanation is that the process and actual event of getting an
20
21 assistance dog, and the specific procedures followed with respect to working with the dog,
22
23 may make parents/guardians feel more competent. Having a dog may add more structure
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25 to parent's management technique without necessarily reducing levels of strain associated
26
27 with having a child with ASD.
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36 The ability of assistance dogs to provide a sense of calm and comfort for children with ASD is
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38 documented.^{11, 13} Qualitative results from this study lend support to this view.

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40 Parents/guardians with an assistance dog frequently mentioned the dogs' ability to promote
41
42 calmness in their child. Those on the waiting list anticipated ways in which the dog would
43
44 aid their child in times of distress. Previous research has recognised the role that dogs have
45
46 in facilitating social development in children with ASD.^{12, 36 & 39} Our qualitative findings
47
48 point to the idea that assistance dogs can act as a 'bridge' between children and the physical
49
50 and social environment. However, more parents/guardians on the waiting list for a dog
51
52 wrote about the anticipated ability of a dog to promote social development in their children
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54 than those with a dog. Those with a dog wrote more about the increased public awareness
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3 and acceptance of their child as a main benefit. It may be that although parents waiting for
4
5 a dog anticipate changes in social interaction, this does not emerge as the most important
6
7 benefit once they actually get a dog. That assistance dogs may facilitate social interaction in
8
9 children with ASD is not in dispute. However, this role may be more salient in animal
10
11 assisted therapy (AAT), where a trained therapist may work with a dog to reach specific
12
13 cognitive or behavioural goals for a child. Parents/guardians listed constraints of having an
14
15 assistance dog were centred on the lifestyle changes. Such changes include the care and
16
17 costs required to ensure a dogs' health and wellbeing in addition to the restrictions
18
19 associated with the dogs' requirements for exercise and companionship. It is important to
20
21 recognise that each parent/guardian has a different level of tolerance for specific canine
22
23 behaviours.⁴⁰ Whilst many of the parents/guardians in our study discounted the constraints
24
25 of having a dog, some were explicit about their concerns. More of those with an assistance
26
27 dog expressed concern about the increase in housekeeping tasks, and specific hygiene
28
29 activities associated with having a dog in the family home. Parents/guardians with children
30
31 on the wait list were more concerned about whether the dog will be accepted by the child
32
33 and family, and logistics during family holiday time. Our results suggest that some of the
34
35 anticipated constraints do not necessarily emerge as the most important constraints once a
36
37 dog is placed in the home. Differences in expectations highlight the importance of working
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39 with families to best understand their needs and concerns both before and after obtaining
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41 an assistance dog.
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Conclusions

Our findings indicate that parents/guardians perceive assistance dog interventions are valuable in the treatment of ASD, particularly in relation to the control of elopement. They also perceive that assistance dogs help to promote calmness and provide a source of comfort for children.

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Table 1 Questionnaire subsections, details and measures.

Section	Details	Measure
Part 1. Demographics	<ol style="list-style-type: none"> Gender, age, other medical conditions, age of diagnosis, home location. Education, learning level, verbal/non verbal Interventions and therapies received 	Tick boxes, yes/no options, free text.
Part 2. Parenting & Autism	<ol style="list-style-type: none"> Perceived competence From: Self Determination Theory <i>Deci & Ryan (1985 & 2000)</i> Caregiver strain questionnaire From: <i>Brannan et al (1997) & Khanna et al., (2011)</i> <i>Objective strain</i> <i>Subjective internalised strain</i> <i>Subjective externalised strain</i> 	<p>Four items on a 7-point scale</p> <p>21 items on a 5 point scale.</p> <p>11 items</p> <p>6 items</p> <p>4 items</p>
Part 3. Environment & Public	<ol style="list-style-type: none"> Environment safety and security Adapted from scale structures: <i>Rosenberg et al., (2009)</i> Public Perception 	<p>Eight items on a 7-point scale.</p> <p>Four items on a 7-point scale.</p>
Part 4. Benefits & constraints	<ol style="list-style-type: none"> Benefits of having an assistance dog Constraints of having an assistance dog 	Free text.

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For peer review only

Table 2 Participant Characteristics (With Dog n=80, Waiting list for Dog n=84)

<i>Characteristics</i>		<i>With Dog N (%)</i>	<i>Waiting for Dog N (%)</i>	<i>P-value</i>
Gender	Male	70 (87.5)	77 (91.7)	–
Age	0-6 years	30 (37.5)	60 (71.4)	<0.001
	7-9 years	50 (62.5)	24 (28.6)	
Location	Town/city centre	11 (13.8)	8 (9.0)	0.217
	Suburb	33 (41.3)	47 (57.0)	
	Countryside	36 (45.0)	28 (34.0)	
Other conditions	Yes	24 (30.0)	27 (32.1)	0.767
Verbal	Yes	42 (52.5)	35 (42.0)	0.165
Education	Preschool	0	10 (11.9)	–
	Home tuition	1 (1.0)	4 (5.0)	–
	Primary	13 (16.3)	11 (31.1)	0.025
	Special class (Primary)	17 (21.3)	29 (34.5)	
	Special school (ASD)	49 (61.3)	30 (35.7)	
Interventions	Speech and Language	38 (47.5)	32 (38.1)	0.224
	Occupational Therapy	37 (46.3)	32 (38.1)	0.290
	Resource Teacher	20 (25.0)	22 (26.2)	0.861
	Special Needs Assistant	64 (80.0)	57 (67.9)	0.077

P-values are from valid chi-square tests.

‘–’ Not included in chi-square analysis as numbers do not meet minimum expected count.

Table 3. Summary of results from Environmental Hazards, Public Awareness, Competence and Caregiver Strain scales.

Item	Description	Mean (95%CI)		Diff* (95% CI)	P-value
		With Dog (n=80)	Waiting Dog (n=84)		
HAZ	Environmental Hazards (range 8 -56)	32.43 (29.47: 35.39)	22.97 (20.83: 25.11)	10.9 (6.97, 14.89)	<0.001 ¹
PUBLIC	Public Acceptance(range 4 –28)	15.87 (14.23: 17.50)	10.67 (9.56:11.77)	5.80 (3.69, 7.90)	<0.001 ²
SD	Competence (range 4 – 28)	19.75 (18.74:20.77)	17.91 (16.52: 18.92)	1.97 (0.273, 3.68)	0.023
OS	Objective strain (range 11-55)	35.03 (32.81: 37.20)	35.91 (34.08:38.01)	-0.54 (-3.78, 2.70)	0.744
SIS	Subjective Internalised strain (range 6-35)	22.47 (21.21:23.60)	23.63 (22.89:25.03)	-0.81 (-2.63, 1.00)	0.380
SES	Subjective Externalised strain (range 4-20)	7.74 (7.01: 8.46)	7.88 (7.28:8.49)	-0.34 (-1.37, .69)	0.522

*Adjusted for gender, age, location, education

1. There was a lesser albeit significant effect of having a dog for parents/guardians whose children attend a special school for children with ASD
2. There is no significant difference in ratings of parents/guardians who have a child in a main stream primary school (p=0.09)

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Figure 1 – Parents/Guardians perceived benefits of having an assistance dog (themes and categories)

99% of parents/guardians with a dog listed at least two benefits.
99% of parents/guardians on the wait list for a dog listed at least two benefits.
Category 'Physiological' refers to how assistance dogs can facilitate a child with respect to mobility and ambulation.
Category 'Management' refers to how assistance dogs can facilitate day to day management of their child.

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7 Figure 2 – Parents/Guardians perceived constraints of having assistance dog (themes and categories)
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9 66% of parents/guardians with a dog listed at least two constraints.

10 64% of parents/guardians on the wait list for a dog listed at least two constraints.

11 *Please note that one category 'other' from the waiting list group second constraint is not included in the figure.

12 Category 'Dogs life' refers to concerns about what happens when an assistance dog retires/dies.

13 Category 'Acceptance' refers to challenges around family and children's acceptance of an assistance dog.
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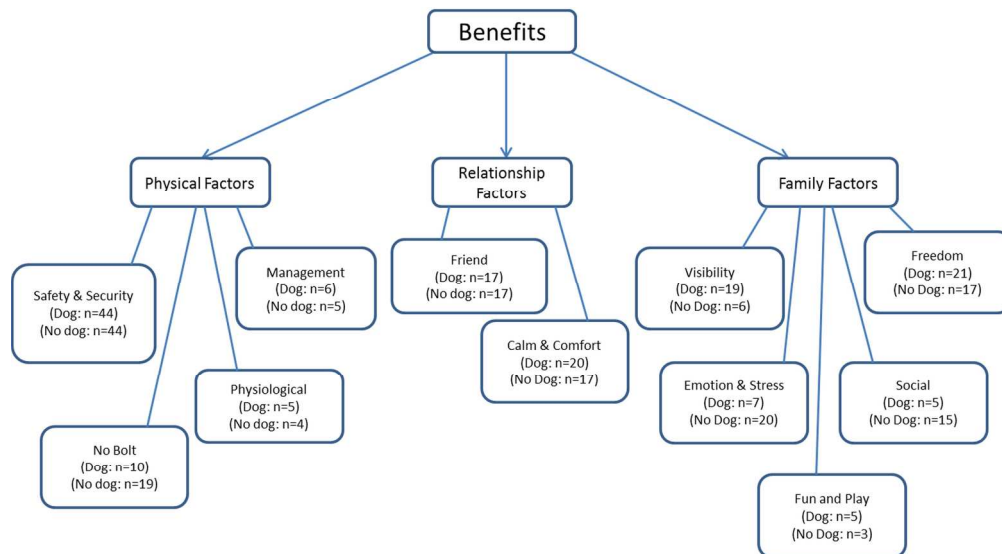


Figure 1 – Parents/Guardians perceived benefits of having an assistance dog (themes and categories)

99% of parents/guardians with a dog listed at least two benefits.

99% of parents/guardians on the wait list for a dog listed at least two benefits.

Category 'Physiological' refers to how assistance dogs can facilitate a child with respect to mobility and ambulation.

Category 'Management' refers to how assistance dogs can facilitate day to day management of their child.

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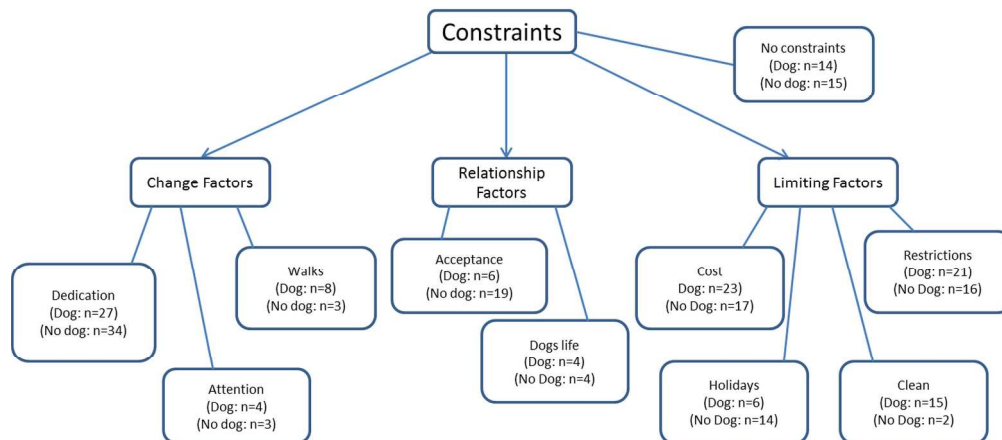


Figure 2 – Parents/Guardians perceived constraints of having assistance dog (themes and categories)

66% of parents/guardians with a dog listed at least two constraints.

64% of parents/guardians on the wait list for a dog listed at least two constraints.

*Please note that one category 'other' from the waiting list group second constraint is not included in the figure.

Category 'Dogs life' refers to concerns about what happens when an assistance dog retires/dies. Category 'Acceptance' refers to challenges around family and children's acceptance of an assistance dog.

205x90mm (300 x 300 DPI)

Review only

Supplementary Tables

Table 1. Environment Safety and Security. Instructions given to Participants. Please rate how strongly you agree or disagree with the statements below. These statements are focused on how you feel about your child's safety and security in particular public areas over the past 3 months. You can place an 'V' in the appropriate box to indicate your choice. *Environmental hazards include, traffic, dangerous materials, outdoor areas where a child could easily run away/get lost, inappropriate contact with others.*

Percentage Scores on Individual Items for Environmental Hazards Scales (7-point scale from strongly disagree to strongly agree)

Item	%	1	2	3	4	5	6	7
1 I am confident that my child with autism is secure from environmental hazards when we <u>go on walks</u>	With Dog Wait List	22.5 48.8	12.5 23.8	6.3 8.3	5.0 9.5	16.3 3.6	20.0 4.8	17.5 1.2
2 I am sure that my child with autism is secure from environmental hazards when we <u>visit a park</u>	With Dog Wait List	18.8 29.8	15.0 31.0	10.0 15.5	12.5 10.7	15.0 4.8	18.8 6.0	10.0 2.4
3 I am certain that my child with autism is secure from environmental hazards when we <u>visit friends</u>	With Dog Wait List	22.5 19.0	12.5 23.8	20.0 27.4	13.8 6.0	8.8 10.7	10.0 9.5	12.5 3.6
4 I am confident that my child with autism is secure from environmental hazards when we <u>travel in a car</u>	With Dog Wait List	6.3 11.9	7.5 13.1	16.3 19.0	7.5 10.7	20.0 11.9	22.5 17.9	20.0 15.5
5 I am convinced that my child with autism is safe from environmental hazards <u>in our home</u>	With Dog Wait List	2.5 4.8	6.3 9.5	7.5 16.7	6.3 13.1	11.3 25.9	40 15.5	26.3 15.5
6 I am sure that my child with autism is safe from environmental hazards <u>in a shopping centre</u>	With Dog Wait List	25.6 46.4	11.5 25.0	12.8 10.7	12.8 6.0	17.9 8.3	9.0 2.4	10.3 1.2
7 I am confident that my child with autism is safe from environmental hazards <u>in a restaurant</u>	With Dog Wait List	21.8 38.1	17.9 22.6	11.5 17.9	9.0 10.7	16.7 8.3	14.1 2.4	9.0 0
8 In general I <u>feel calm</u> that my child with autism is safe from environmental hazards	With Dog Wait List	19.2 46.4	16.7 21.4	12.8 15.5	12.8 3.6	10.3 2.4	15.4 8.3	12.8 2.4

Table 2. Public Perception. Instructions given to Participants. These statements are focused on how you rate the public's perception of your child over the past 3 months. Please note: To 'make allowances' means that people react responsibly and respectfully towards you and your child when you are out in public.

Percentage Scores on Individual Items for Public Perception Scales (7-point scale from strongly disagree to strongly agree)

Item	%	1	2	3	4	5	6	7
1 I feel confident that people make allowances for my child with autism when we are <u>in a shopping area</u>	With Dog Wait List	10.3 26.5	14.1 28.9	16.7 18.1	17.9 15.7	10.3 8.4	15.4 2.4	15.4 0
2 I am sure that people make allowances for my child with autism when we are <u>in a restaurant</u>	With Dog Wait List	12.8 38.1	19.2 29.8	17.9 10.7	17.9 11.9	5.1 6.0	14.1 3.6	12.8 0
3 I am certain that people make allowances for my child with autism when we are <u>in a park</u>	With Dog Wait List	17.9 20.2	9.0 21.4	20.5 26.2	17.9 10.7	12.8 11.9	11.5 6.0	10.3 3.6
4 I am sure that people make allowances for my child with autism when we are <u>out walking</u>	With Dog Wait List	10.0 19.3	11.3 28.9	13.8 14.5	17.5 19.3	15.0 8.4	17.5 8.4	15.0 1.2

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Table 3. Perceived Competence. Instructions given to participants. Please respond to each of the following items in terms of how true they are for you with respect to being a parent of a child with autism. You can circle the number which represents how true you feel each statement is.

Percentage Scores on Individual Items for Perceived Competence Scales (7-point scale from 'not at all true' to 'very true')

Item		1	2	3	4	5	6	7
1 I feel confident in my abilities to manage my child with autism	With Dog	1.3	2.5	6.3	18.8	35.0	27.5	8.8
	Wait List	1.2	7.1	16.7	26.2	26.2	14.3	8.3
2 I am capable of dealing with my child with autism	With Dog	1.3	2.5	5.0	15.0	25.0	38.8	12.5
	Wait List	1.2	4.8	14.3	22.6	28.6	17.9	10.7
3 I am able to do my own routine caring for my child with autism	With Dog	2.5	7.5	10.0	23.8	18.8	27.5	10.0
	Wait List	8.3	10.7	13.1	21.4	20.2	11.9	14.3
4 I am able to meet the challenges of being a parent of a child with autism	With Dog	2.5	3.8	11.3	17.5	31.3	30.0	3.8
	Wait List	6.0	4.8	21.4	10.7	26.2	20.2	10.7

STROBE Statement—parents perspectives on the value of assistance dogs for children with autism spectrum disorder: a cross sectional study.

	Item No	Recommendation
Title and abstract	1	(a) We have indicated the study's design with a commonly used term in the title (b) We have provided in the abstract an informative and balanced summary of what was done and what was found
Introduction		
Background/rationale	2	We have explained the scientific background and rationale for the investigation being reported
Objectives	3	Specific objectives, including any prespecified hypotheses are stated at end of the introduction
Methods		
Study design	4	We have presented key elements of study design early in the paper – details given in Methods section and at end of Introduction.
Setting	5	We have described the setting, locations, and relevant dates, including periods of recruitment, exposure, follow-up, and data collection
Participants	6	<i>Cross-sectional study</i> —We have given the eligibility criteria, and the sources and methods of selection of participants
Variables	7	We have clearly defined all outcomes, exposures, predictors, potential confounders, and effect modifiers.
Data sources/ measurement	8*	We have provided full descriptions of our measures and assessments in the methods section
Bias	9	We have addressed biases in our procedures section and in our regression analysis - adjusting for key demographic variables.
Study size	10	We sampled the total population of users of a national assistance dog's organisation. Explained in Methods section.
Quantitative variables	11	Data management techniques are described in the data analysis section at end of the Methods.
Statistical methods	12	(a) We have described all statistical methods, including those used to control for confounding – in the Methods section. (b) We have described methods used to examine subgroups and interactions in the Results section. (c) We had minimal missing data. <i>Cross-sectional study</i> —we used data analysis techniques appropriate for comparing two independent groups. (e) Describe any sensitivity analyses – we did not do a sensitivity analysis.

Continued on next page

Results

Participants	13*	(a) We have reported numbers of individuals in our cross sectional study—eg numbers potentially eligible, examined for eligibility, confirmed eligible, included in the study, and analysed (b) We omitted the over tens from our analysis for this study – described in Results section. (c) We have the maximum of 5 tables and figures included – these were considered essential and so we do not have space for a flow diagram. We are happy to provide one if requested.
Descriptive data	14*	(a) We have given characteristics of the study participants (eg demographic, clinical, social) and information on exposures and potential confounders (start of Results section) (b) We had minimal missing data.
Outcome data	15*	<i>Cross-sectional study</i> —We have reported the numbers of outcome events or summary measures in the Results section.
Main results	16	(a) We have given unadjusted and adjusted means and 95% confidence intervals. We have explained the reasons for adjustment in the results section. (b) We did not categorise continuous variables. (c) If relevant, consider translating estimates of relative risk into absolute risk for a meaningful time period – this was not relevant.
Other analyses	17	Report other analyses done—eg analyses of subgroups and interactions – main interactions are reported in the Results section and in the Discussion.

Discussion

Key results	18	We have summarised key results with reference to study objectives
Limitations	19	We have discussed limitations of the study, taking into account sources of potential bias or imprecision.
Interpretation	20	We have given a cautious overall interpretation of results considering objectives, limitations, multiplicity of analyses, results from similar studies, and other relevant evidence
Generalisability	21	We have discussed the generalisability (external validity) of the study results at the end of the Discussion.

Other information

Funding	22	This study was not funded from any particular source. It was done at University College Cork and by kind permission of the Irish Guide Dogs for the Blind. They assisted us in contacting their service users. We did not have access to their service users lists. They did not have access to the study data.
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*Give information separately for cases and controls in case-control studies and, if applicable, for exposed and unexposed groups in cohort and cross-sectional studies.

Note: An Explanation and Elaboration article discusses each checklist item and gives methodological background and published examples of transparent reporting. The STROBE checklist is best used in conjunction with this article (freely available on the Web sites of PLoS Medicine at <http://www.plosmedicine.org/>, Annals of Internal Medicine at <http://www.annals.org/>, and Epidemiology at <http://www.epidem.com/>). Information on the STROBE Initiative is available at www.strobe-statement.org.