Parents’ and Therapists’ Satisfaction with Four Early Childhood Power Mobility Devices

Satisfaction des parents et des thérapeutes à l’égard de quatre dispositifs d’aide à la mobilité motorisés pour jeunes enfants

Debra A Field, MHSc OT, PhD and Roslyn W Livingstone, MSc(RS), OT

Key words: Child-preschool; Occupational therapy; Paediatric; Rehabilitation; Wheelchair.

Mots clés : Ergothérapie ; fauteuil roulant ; pédiatrique ; préscolaire ; réadaptation.

Abstract

Background. Little is known about satisfaction with power mobility devices used by young children. Purpose. Parents’ and therapists’ satisfaction with four early childhood power mobility devices were examined. Method. A two-phased study, comprising Trial Phase cross-sectional design and Loan Phase one-group pretest-posttest design. Parents and therapists of children 9 months to 6 years with mobility limitations completed the Quebec User Evaluation of Satisfaction of Assistive Technology 2.0 Device Subscale (QUEST8) plus an additional device Aesthetics rating. Findings. Seventy-four parents and 42 therapists from 18 child development and rehabilitation centres participated. Parent and therapist median QUEST8 and Aesthetics scores varied across devices when trialled and over the six-month loan. Favourable median ratings had no statistically significant differences between parents and therapists. Parent ratings decreased statistically over loan period although therapists’ ratings did not. Device dimensions, safety, and aesthetics were highly rated. Implications. Similarities and differences exist among parent and therapist ratings.

Résumé

Description. On sait peu de choses sur la satisfaction à l’égard des dispositifs d’aide à la mobilité motorisés utilisés par les jeunes enfants. But. La satisfaction des parents et des thérapeutes à l’égard de quatre dispositifs d’aide à la mobilité motorisés pour jeunes enfants a été examinée. Méthodologie. Une étude en deux phases composée d’une étude transversale pour la phase d’essai et d’une étude prétête–post-test auprès d’un groupe pour la phase de prétêt. Les parents et les thérapeutes d’enfants âgés de 9 mois à 6 ans dont la mobilité est restreinte ont répondu aux 8 items portant sur la technologie du questionnaire Évaluation de la satisfaction envers une aide technique (ESAT) ainsi qu’à une évaluation de l’aspect esthétique du dispositif. Résultats. Soixante-quatorze parents et 42 thérapeutes de 18 centres de développement et de réadaptation pour enfants ont participé à l’étude. Les scores médians des parents et des thérapeutes aux deux questionnaires variaient entre les dispositifs lors de l’essai et après la période de prétêt de six mois. Pour les évaluations médianes favorables, il n’y avait pas de différences statistiquement significatives entre les parents et les thérapeutes. Les évaluations des parents étaient statistiquement au cours de la période de prétêt, contrairement à celles des thérapeutes. Les dimensions du dispositif, la sécurité et l’esthétique ont obtenu des évaluations très favorables. Conséquences. Il y a des similitudes et des différences entre les évaluations des parents et celles des thérapeutes.

Funding: The author(s) disclosed receipt of the following financial support for the research, of this article: This work was supported by the Posture & Mobility Group (UK), Sunny Hill Health Centre for Children, British Columbia Children’s Hospital Research Institute, Sunny Hill Foundation for Children.

Corresponding author: Debra Field, Clinical Associate Professor, Department of Occupational Science & Occupational Therapy, University of British Columbia, T325 - 2211 Wesbrook Mall, Vancouver, BC, V6T 2B5. Email: debra.field@ubc.ca; dfield@cw.bc.ca
Introduction

Little is known about satisfaction with features of power mobility devices, yet these devices are being recommended in clinical practice to promote learning and overall development in young children. Given the increasing device options available for young children, it is critical to understand parents’ and therapists’ perspectives. Parents’ and therapists’ satisfaction with four early childhood power mobility devices were examined during a two-phased study. Parents and therapists of children 6 years and younger with mobility limitations were recruited from across the province. This paper’s primary objective was to examine parents’ satisfaction with four devices their child trialled during a single introductory session (Trial Phase). Secondary objectives included (i) comparing therapist ratings to those of parents, (ii) contrasting satisfaction among device features, and (iii) examining whether device satisfaction changes following a 6-month equipment loan (Loan Phase).

Independent mobility promotes learning and overall development in infants and children, but when mobility is delayed or impaired, developmental progress may be impeded (Piek, Dawson, Smith, & Gasson, 2008; Huang, 2018). Power mobility may be introduced as early as 12 months of age for children unable to walk or who are anticipated to have inefficient mobility due to a physical disability (Livingstone & Paleg, 2014), such as cerebral palsy, spina bifida or neuromuscular diseases (Livingstone & Field, 2014). Young children with mobility limitations can use powered devices such as switch-adapted ride-on toys, wheelchairs or other mobility devices to explore and learn about their environment, play, and interact with others (Huang, 2018; Feldner, Logan & Galloway, 2016).

A recent mixed-methods evidence synthesis found strong support for a positive impact of power mobility on children’s movement and mobility, and moderate support for impact on participation, play and social interaction (Bray et al., 2020). The highest level of evidence supporting power mobility use for children aged 6 years and younger is a randomized control trial including 28 children with complex disabilities (Canadian Agency for Drugs and Technologies in Health, 2015; Jones, McEwen, & Neas, 2012). After one year, statistically significant differences in overall development between the intervention and control groups were found, along with no negative impact on motor development from power wheelchair use (Jones, et al., 2012). Another recent systematic review also suggested a potentially positive impact from power mobility interventions on young children’s social skills (Cheung, Meadan, & Yang, 2020).

Research is beginning to evaluate the different types of power mobility devices available for young children with mobility limitations. A scoping review evaluated impact of modified ride-on toy cars (James, Pfaff, & Jeffries, 2019) while individual studies have investigated other novel powered devices (Evans & Baines, 2017; Plummer, Logan, & Morress, 2021). Research has contributed insights into parents’ and therapists’ perspectives on device features affecting young children’s power mobility use (Livingstone & Field, 2015; Gudjonsdottir, & Gudmundsdottir, 2021). Limitations such as price, size and weight, transportation requirements, maintenance, social acceptance and aesthetics have been reported in the literature and continue to be problematic (Feldner et al., 2016). Similarly, a mapping review of inclusive paediatric mobility design over the last 50 years identified problems related to desirability, feasibility and viability of wheeled mobility interventions for children (O’Sullivan & Nickpour, 2020).

The Quebec User Evaluation of Satisfaction with assistive Technology (QUEST) was developed to measure satisfaction with assistive technology devices (Demers, Weiss-Lambrou, & Ska, 2002; Demers, Weiss-Lambrou, & Ska, 2000). QUEST 2.0 consists of two subscales: Assistive Device (8 items evaluating device features) and Services (4 items evaluating service delivery) (Demers, Weiss-Lambrou et al., 2002; Demers et al., 2000). Several studies have used the QUEST to examine adults’ satisfaction with their wheeled mobility (Barlow, Liu, & Sekulic, 2009; Arthanat, Wu, Bauer, Lenker, & Nochański, 2009; Demers, Monette, LaPierre, Arnold, & Wolfson, 2002; Chan, & Chan, 2007; Weiss-Lambrou, Tremblay, LeBlanc, Lacoste, & Dansereau, 1999), yet fewer have examined satisfaction with paediatric power mobility devices (Gudjonsdottir & Gudmundsdottir, 2021; Benedict, Lee, Marrujo, & Farel, 1999; Tefft, Guerette & Furumasu, 2011). Limited research comparing features and acceptability...
of powered mobility devices for young children raises questions regarding the features most important to consider.

Given the advances in power mobility technologies and increasing options available for young children, it is critical to understand parents’ and therapists’ perspectives. The primary objective of this paper was to report parents’ satisfaction with four devices their child trialled during a single exploratory session (Trial Phase). Secondary objectives included (i) comparing therapist ratings to those of parents, (ii) contrasting satisfaction among device features, and (iii) examining whether device satisfaction changes following a 6-month equipment loan (Loan Phase). To our knowledge, this is the first study to explore parent and therapist impressions using QUEST 2.0 of four different power mobility devices designed for young children.

Method

Participants. This paper compares power mobility device satisfaction among four devices as part of a larger two-phased study that explored power mobility use with children, 6 years-of-age and younger (see Figure 1 for overview) (Livingstone, Bone & Field, 2020; Livingstone & Field, 2020; Livingstone & Field, 2021). Participants were recruited from child development centres and paediatric rehabilitation centres across the province (Livingstone, Bone & Field, 2020). Trial Phase, a cross-sectional design, used convenience sampling to recruit young children with mobility limitations, their parents and occupational therapist or physical therapist (hereafter referred to as ‘therapist’). They were introduced to four different power mobility devices during a single play-based ‘Power Mobility Day’ session, including Wizzybuga (www.designability.org.uk), Bugzi b (www.meru.org.uk), Invacare Tiger Cubc (now discontinued from www.invacare.com; hereafter referred to as Cubc) and a switch-adapted ride-on toy car (various models; referred to hereafter as Card) (Livingstone, Bone & Field, 2020) (please refer to the device websites for product descriptions). Loan Phase, an exploratory one-group pre-test-posttest design included a sub-sample of participants purposefully sampled from Trial Phase to receive a 6-month loan of one of the four devices. Children with different diagnoses, ages, clinical profiles and locations were sought to be representative of clinical caseloads across the province (Livingstone & Field, 2020; Livingstone & Field, 2021).

Inclusion criteria. Parent/primary caregiver and paediatric therapist willing to:

- consider power mobility for use by their child/client aged 6 months - 6 years with a diagnosis or clinical presentation suggesting inability or inefficient mobility in early childhood;
- participate in one Power Mobility Day, a novel, 1–1½ hour play-based session;
- participate in a 6-month power mobility device loan.

For ease of reading, ‘parent’ will be used to imply primary caregiver (e.g., foster parents and grandparents) who were included with written consent of the legal guardian.

University and Institutional Ethics Review Boards granted ethics approval and all participating parents and therapists provided written informed consent.

Data collection. Prior to device introduction, parents completed a study-specific socio-demographic form to collect child, family and environmental descriptors. Data were also collected from therapists describing their paediatric experience.

At the end of the Power Mobility Day session, researchers facilitated independent completion by parents and therapists of the QUEST 2.0 Assistive Device subscale (Demers, Weiss-Lambrou et al., 2002; Demers et al., 2000) (hereafter referred to as QUEST8) to rate satisfaction with each of the four devices trialled. The eight items included dimensions, weight, ease of adjustment, safety and security, durability, ease of use, comfort and effectiveness. The subscales can be scored separately and evidence supports their reliability and validity (Demers, Weiss-Lambrou et al., 2002; Demers et al., 2000; Demers, Monette et al., 2002; Tefft et al., 2011; Kenny & Gowran, 2014). Items were rated on a 5-point ordinal scale ranging from 1 (not satisfied at all) to 5 (very satisfied). Since literature and our clinical experience suggests that aesthetics may be an important feature that parents and therapists consider (Feldner et al., 2016; Livingstone & Field, 2015; Gudjonsdottir & Gudmundsdottir, 2021; O’Sullivan & Nickpour, 2020), we also asked participants to rate satisfaction with device aesthetics. QUEST developers acknowledge that additional questions can be added if scored separately using the same 5-point ordinal scale (Demers, Weiss-Lambrou et al., 2002). Summary satisfaction scores include total and average scores (total score/items completed).

During Loan Phase, the QUEST8 along with the additional question rating Aesthetics were again independently completed at device loan start and end by each parent and therapist. Device loaned was based on parents’ first or second choice during the Trial Phase, dependent on device availability and their child’s functional abilities. The device was individualized for each child with appropriate postural supports and access method (joystick switches). Parents and therapists were trained in device use and training suggestions were provided. Researchers provided additional support as needed during the loan. Additional details can be found in related publications (Livingstone, Bone & Field, 2020; Livingstone & Field, 2020; Livingstone & Field, 2021). Power analysis for a one-group sample Wilcoxon signed-rank test (matched pairs) was conducted using G*POWER to determine a sufficient sample size using an alpha of 0.05, a power of 0.80, a medium effect size (d = 0.5) and two tails (Faul, Erdfelder, Buchner, & Lang, 2009). Based on these assumptions, the desired sample size was 35.

Data analyses. Data was managed using REDCap (Harris, Taylor, Thielke, Gonzalez, & Conde, 2009), a secure web application, then checked and exported to R version 3.5.1 (R Core Team, 2018) for all statistical analyses. Descriptive analyses summarized participants’ characteristics, children’s profiles,
### Table 1
**Participant Characteristics.**

| Phase          | Parent Accompanying Child | Parent Primary Language | Parent Highest Education Achieved | n (%) |
|----------------|---------------------------|-------------------------|-----------------------------------|-------|
|                | Phase                     |                         |                                   |       |
| **Mother**     | Trial Phase               | 62 (82.7)               | English                           | 69 (92.0) Did not attend | 1 (1.3) |
|                | Loan Phase                | 39 (84.8)               | Punjabi                           | 43 (93.5) Attended Secondary | 0 (0)   |
| **Father**     | Trial Phase               | 10 (13.3)               | Punjabi                           | 2 (2.7) Secondary graduate | 7 (9.4) |
|                | Loan Phase                | 5 (10.9)                |                                    | 0 (0)   | 5 (10.9) |
| **Grandparent**| Trial Phase               | 1 (1.3)                 | Russian                           | 1 (1.3) Secondary graduate | 17 (22.7) |
|                | Loan Phase                | 0                       |                                    | 1 (2.2) | 12 (26.1) |
| **Foster parent**| Trial Phase               | 2 (2.7)                 | Turkish                           | 1 (1.3) Post-secondary education | 27 (36.0) |
|                | Loan Phase                | 1 (2.2)                 |                                    | 0 (0)   | 13 (28.3) |
| **Farsi**      | Trial Phase               | 1 (1.3)                 | Farsi                             | 1 (1.3) Under-graduate degree | 16 (21.3) |
|                | Loan Phase                | 1 (2.2)                 |                                    | 1 (2.2) | 12 (26.1) |
| **Arabic**     | Trial Phase               | 1 (1.3)                 | Arabic                            | 1 (1.3) Graduate degree | 6 (8.0) |
|                | Loan Phase                | 1 (2.2)                 |                                    | 1 (5.3) | 4 (8.7)   |
| **Total**      | Trial Phase               | 75 (100)                |                                    |        |
|                | Loan Phase                | 46 (100)                |                                    |        |

| Therapist Accompanying Child | n (%) | Therapist number with more than one child in study | n (%) | Therapist Paediatric Rehabilitation Experience (years) | n (%) |
|------------------------------|-------|----------------------------------------------------|-------|------------------------------------------------------|-------|
| **Trial Phase**              |       |                                                    |       |                                                      |       |
| OT                           | 25 (59.5)* | OT | 11 (26.2) | < 5 years | 8* (19.0) |
| PT                           | 18 (42.9)* | PT | 11 (26.2) | ≥ 5 years | 35* (83.3) |
| **Loan Phase**               |       |                                                    |       |                                                      |       |
| OT                           | 13 (68.4) | OT | 5 (26.3) | < 5 years | 3 (15.8) |
| PT                           | 6 (31.6)  | PT | 1 (5.3)  | ≥ 5 years | 16 (84.2) |
| **Total**                    | 42 (100)|                                                    | 19 (100)|                                                      |       |

Note: *n* = sample size; % = percentage; ≥ = equal or greater than < = less than.
Table 2.
Trial Phase Parent and Therapist QUEST8 and Aesthetics Summary Scores.

|                      | Wizzybug<sup>a</sup> | Bugzib<sup>b</sup> | Car<sup>d</sup> | Cub<sup>c</sup> |
|----------------------|----------------------|-------------------|----------------|----------------|
| Parents              | n = 72               | n = 70            | n = 70         | n = 71         |
| Therapists           | n = 64               | n = 64            | n = 61         | n = 63         |
| QUEST8 Parent Median | 34.5 [4.31]          | 32.5 [4.06]       | 31.0 [3.88]    | 31.0 [3.88]    |
|                      | 32; 38               | 28; 36            | 24.25; 33.5    | 27; 33.5       |
|                      | (6)                  | (8)               | (9.25)         | (6.5)          |
| Minimum; Maximum     | 8; 40                | 19; 40            | 8; 40          | 0; 40          |

Kruskal-Wallis rank sum test
chi-squared = 20.51, df = 3, p < 0.000<sup>*</sup>

Pairwise Conover Test with Bonferroni correction
(n = 70)
Wizzybug<sup>a</sup>-Bugzib<sup>b</sup> 0.064
Wizzybug<sup>a</sup>-Car<sup>d</sup> 0.002<sup>*</sup>
Wizzybug<sup>a</sup>-Cub<sup>c</sup> <0.001<sup>*</sup>
Bugzib<sup>b</sup>-Car<sup>d</sup> 1.000
Bugzib<sup>b</sup>-Cub<sup>c</sup> 0.509
Car<sup>d</sup>-Cub<sup>c</sup> 1.000

QUEST8 Therapist Median
Total Score [Average Score] 33.5 [4.19] 31.0 [3.88] 29.0 [3.63] 30.0 [3.75]

1<sup>st</sup> Quartile; 3<sup>rd</sup> Quartile
(Inter Quartile Range) 31; 36.25 29; 34.25 25.25; 32 27.5; 32
(5.25) (5.25) (6.75) (4.5)

Minimum; Maximum 21; 40 19; 40 0; 38 19; 38

Mann Whitney U test with continuity correction
(2-sided) p = 0.19 0.38 0.05 0.76
Cl<sub>95</sub> -1.723987e-05 -1.000018 3.528923e-05 4.000039e + 0.000030
CI<sub>95</sub> 2.000038e + 2.999979 0.00 0.000011

Parents n = 72 n = 70 n = 70 n = 70
Therapists n = 64 n = 64 n = 61 n = 63

Aesthetics Parent Median Score 5 4 5 3
1<sup>st</sup> Quartile; 3<sup>rd</sup> Quartile
(Inter Quartile Range) 4.5 4.5 4.5 2.3
(1) (1) (1) (1)

Kruskal-Wallis rank sum test
chi-squared = 105.04, df = 3, p < 0.001

Pairwise Conover Test with Bonferroni correction
(n = 70)
Wizzybug<sup>a</sup>-Bugzib<sup>b</sup> 0.17<sup>*</sup>
Wizzybug<sup>a</sup>-Car<sup>d</sup> <0.001<sup>*</sup>
Wizzybug<sup>a</sup>-Cub<sup>c</sup> <0.001<sup>*</sup>
Bugzib<sup>b</sup>-Car<sup>d</sup> 0.15<sup>*</sup>
Bugzib<sup>b</sup>-Cub<sup>c</sup> 0.937
Car<sup>d</sup>-Cub<sup>c</sup> 0.612

(continued)
### Table 2.
Continued

|                      | Wizzybug\(^a\) | Bugzib\(^b\) | Car\(^d\) | Cub\(^c\) |
|----------------------|----------------|--------------|-----------|-----------|
| Minimum; Maximum     |                |              |           |           |
| Aesthetics Therapist Median Score | 5 | 4 | 5 | 3 |
| 1\(^{st}\) Quartile; 3\(^{rd}\) Quartile (Inter Quartile Range) | 4:5 | 4:5 | 4:5 | 2:3 |
| Minimum; Maximum     | 3:5            | 3:5          | 1:5       | 1:5       |

Mann Whitney U\(^{\text{I}}\) test with continuity correction (2-sided)

|                      | \(p = 0.10\) | \(p = 0.11\) | \(p = 0.71\) | \(p = 0.61\) |
|----------------------|--------------|--------------|--------------|--------------|
| CI\(_{95}\)          | -8.529341e-05 | -1.167342e-05 | -6.529606e-05 | -4.827715e-05 |
| CI\(_{95}\)          | 2.117652e-05  | 2.394738e-05  | 2.394738e-05  | 2.071049e-05  |

Note. \(n = 70\); \(\epsilon^2 = 2.341\);
Kruskal-Wallis rank sum test
\(\chi^2\) = 140.48, df = 3, \(p < 0.001\)

Pairwise Conover Test with Bonferroni correction
(n = 70)

\(Wizzybug^a\)-Bugzib\(^b\) 0.019*
\(Wizzybug^a\)-Car\(^d\) 1.000
\(Wizzybug^a\)-Cub\(^c\) <0.001*
\(Bugzib^b\)-Car\(^d\) 0.002*
\(Bugzib^b\)-Cub\(^c\) <0.001*
\(Car^d\)-Cub\(^c\) <0.001*

\(\epsilon^2 = 2.341\)

Note: \(n = \) sample size; \(df = \) degrees of freedom; \(\epsilon^2 = \) Epsilon squared effect size estimate for Kruskal Wallis test; CI\(_{95}\) = 95% confidence interval; \(^* = \) statistically significant difference at \(p < 0.05\); \(p = \) calculated probability value.
QUEST8 and Aesthetics scores and, depending on data type, included frequencies, percentages, range, measures of central tendency and dispersion. Non-parametric inferential tests were selected since measures used primarily ordinal data (McCrum-Gardner, 2008). To address both our primary and first secondary objectives, visual analysis of descriptive data and the Kruskal-Wallis test compared Trial Phase QUEST8 and Aesthetics median ratings across devices for parents as well as for therapists (McCrum-Gardner, 2008). Our null hypothesis assumed median satisfaction scores would be the same for all four devices. An estimate of effect size was calculated using epsilon-squared ($\epsilon^2 = H(n+1)/(n^2-1)$) where $H$ is the test estimate and $n$ represents total number of observations (Tomczak, & Tomczak, 2014). The effect size was interpreted as follows: $<0.08 =$ small; $0.08 < 0.26 =$ medium; $\geq 0.26 =$ large (Mangiafico, 2016). If the null hypothesis was rejected, post-hoc-Conover tests with Bonferroni correction were completed to examine pairwise comparisons (adjusting for multiple post-hoc calculations and minimizing false positive occurrence).

To compare parent and therapist scores, Mann Whitney U test, 2-sided with continuity correction, tested the null

![Figure 2. Comparison of Trial Phase parent and therapist QUEST8 and aesthetics scores by device.](image)

| Table 3 | Trial Phase Frequency Count Comparison by Device of QUEST8 and Aesthetics Items Rated 4 (Quite Satisfied) or 5 (Very Satisfied) by Parents. |
|---------|---------------------------------------------------------------------------------------------------------------------------------|
|         | Wizzybug$^a$                                                                                                                  |
|         | Bugzi$^b$                                                                                                                    |
|         | Car$^c$                                                                                                                       |
|         | Cub$^c$                                                                                                                       |
| n       | 72 (n = 71)                                                                                                                  |
| n       | 70                                                                               |
| n       | 70                                                                               |
| n       | 70                                                                               |
| Dimensions | 67 | 48 | 39 | 43 |
| Weight | 56 | 46 | 43 | 15 |
| Ease of adjustment | 59 | 47 | 40 | 41 |
| Safety | 67 | 64 | 53 | 62 |
| Durability | 64 | 55 | 39 | 61 |
| Ease of use | 56 | 48 | 48 | 48 |
| Comfort | 58$^a$ | 56 | 46 | 55 |
| Effectiveness | 57$^a$ | 40 | 36 | 43 |
| Aesthetics | 66 | 54 | 65 | 15 |

Note. highest, second, third ranked scores.

| Table 4 | Trial Phase Frequency Count Comparison by Device of QUEST8 and Aesthetics Items Rated 4 (Quite Satisfied) or 5 (Very Satisfied) by Therapists. |
|---------|---------------------------------------------------------------------------------------------------------------------------------|
|         | Wizzybug$^a$                                                                                                                  |
|         | Bugzi$^b$                                                                                                                    |
|         | Car$^c$                                                                                                                       |
|         | Cub$^c$                                                                                                                       |
| n       | 64                                                                               |
| n       | 64                                                                               |
| n       | 61                                                                               |
| n       | 63                                                                               |
| Dimensions | 59 | 52 | 31 | 32 |
| Weight | 50 | 44 | 41 | 9 |
| Ease of adjustment | 52 | 41 | 31 | 34 |
| Safety | 57 | 53 | 33 | 58 |
| Durability | 59 | 46 | 30 | 55 |
| Ease of use | 49 | 42 | 42 | 42 |
| Comfort | 56 | 51 | 36 | 49 |
| Effectiveness | 45 | 34 | 28 | 38 |
| Aesthetics | 62 | 58 | 59 | 5 |

Note. highest, second, third ranked scores.
hypotheses that parent and therapist median satisfaction would be the same across devices for Trial Phase QUEST8 and Aesthetics scores (McCrum-Gardner, 2008). Effect size, estimated using the formula $z/\sqrt{n}$ (Tomczak & Tomczak, 2014), was interpreted as follows: $<0.3$ = small; $0.3$–$0.5$ = moderate; $>0.5$ = large (Cohen, 1988). To address our secondary objective comparing device features, we examined frequency counts of those rated as 4 (quite satisfied) and 5 (very satisfied) for each device. To address our secondary objective examining satisfaction change over time, Wilcoxon signed-rank test for dependent samples compared Loan Phase QUEST8 and Aesthetics scores from loan start to end. Significance levels for all analyses were $p \leq 0.05$, unless otherwise noted.

### Findings

Of those families approached to participate in the Trial Phase, 75/81 consented to participate. Seventy-five children aged 9 months to 5 years 8 months (mean 32.45 months; SD 14.08) were enrolled in Trial Phase, with 38 males and 37 females. Cerebral palsy was the most common child diagnosis. Although all 75 parents signed consent forms, one child did not try any devices so their data (along with their parents’ and therapists’ data) was not included in our analyses. Seventy-four children, their parents and therapists took part in one of 18 Power Mobility Days in nine communities.

As a second phase of our research, 49/74 parents were approached to participate in the Loan Phase and 46 consented along with their therapists. Children’s mean age at loan-start was 40.43 (SD 15.66) and ranged from 13 to 68 months. Cerebral palsy was again the most common diagnosis ($n = 33; 71.74\%$). Mean loan-length was 192.4 days (SD 42.79), ranging from 92 to 294 days. Table 1 describes parent and therapist characteristics. Parent respondents were primarily mothers and the majority had post-secondary education. More occupational therapists than physical therapists participated, with the majority having greater than 5 years paediatric rehabilitation experience. Twenty-two therapists in Trial Phase and six in Loan Phase had more than one child in the study. One parent did not complete all demographic information in Trial Phase, while some children had a change of therapists between Trial Phase and Loan Phase, and/or within Loan Phase, resulting in sample size differences across analyses.

### Table 5.

**Loan Phase QUEST8 and Aesthetics Satisfaction Ratings from Loan Start to End.**

| Measure      | Loan Start | Loan End | Pre:post$^a$ | Effect size | (pseudo)median change |
|--------------|------------|----------|--------------|-------------|----------------------|
|              | n          | median total score | n          | median total score | Pre:post$^a$ | z             | $r_s$ (CI95) | (pseudo)median change (CI95) |
|              |            | [average score] |            | [average score] |            |              |              |                             |
|              |            | 1$^{st}$ & 3rd quartiles |            | 1$^{st}$ & 3rd quartiles |            |              |              |                             |
|              | Minimum; Maximum |          | Minimum; Maximum |          |             |              |              |                             |
| QUEST8 Parent | 46 | 36 [4.50] | 45 | 33 [4.13] | - $^*$ | 0.34 | (0.15–0.58) | 2.999 |
|              | 33; 38 (5) | 30; 37 (7) |            |              |              |              |              |                             |
|              | 27; 40 | 22; 40 |            |              |              |              |              |                             |
| QUEST8 Therapist | 37 | 35 [4.38] | 45 | 35.5 [4.44] |            | - | 0.326 |              |
|              | 32; 37 (5) | 30.75; 38 (7.25) |            |              |              |              |              |                             |
| Mann Whitney U (2-sided) | p = 0.173 | | p = 0.541 | | Cl$_{95}$ | | -6.396505e-05 | 2.999972e + 00 |
| Aesthetics Parent | 46 | 5.00 | 45 | 5.00 | - | - | - | - |
|              | 4; 5 (1.00) | 4; 5 (1.00) | 5 | 1; 5 | 0.105 | Cl$_{95}$ | Cl$_{95}$ |
| Aesthetics Therapist | 37 | 5.00 | 37 | 5.00 | - | - | - | - |
|              | 4; 5 (1.00) | 4; 5 (0.00) | 5 | 5 | 0.1198 | Cl$_{95}$ | Cl$_{95}$ |
| Mann Whitney U (2-sided) | p = 0.879 | | p = 0.084 | | Cl$_{95}$ | | -4.182000e-05 | 5.028356e-06 |
| Note. n = sample size; IQR = inter-quartile range; $^*$ = Wilcoxon signed rank test; $^a$ = statistically significant difference at $p < 0.05$; p = calculated probability value; z = Mann Whitney U test effect size; Cl$_{95}$ = 95% confidence interval; ‘-‘ = equal to; $r_s$ = Spearman’s rank order correlation coefficients (rho); QUEST8: Quebec Evaluation of Satisfaction with assistive Technology 2.0 device sub-scale; Aesthetics: Aesthetics question used with QUEST rating scale.
Table 2 presents Trial Phase summary scores for the 8-item device subscale and the additional Aesthetics question for parents (primary objective) and therapists (secondary objective). Figure 2 illustrates boxplot comparisons of parents’ and therapists’ QUEST8 and Aesthetics median scores by device for Trial Phase. For QUEST8 median total scores parent scores ranged within 3.5 points, while therapist scores ranged within 4.5 points. Distribution of Aesthetics median scores ranged from 3 to 5 for both groups. Table 2 presents Kruskal-Wallis test results and large effect size estimates providing support for the alternate hypothesis that median QUEST8 total scores and Aesthetics scores were not equal across devices. Conover Test results with Bonferroni correction for pairwise comparisons of devices identified statistically differing QUEST8 and Aesthetics median scores for both parents and therapists.

Table 3 identifies device features with which parents were most satisfied, including Wizzybug’s safety dimensions and safety, Bugzi’s and Cub’s safety, and Car’s aesthetics. Table 4 identifies therapists’ highest-rated features as Wizzybug’s safety, Bugzi’s and Car’s aesthetics, and Cub’s safety.

Table 5 illustrates change in satisfaction over the course of the Loan Phase loan. There were no statistically significant differences between Loan Phase parents’ and therapists’ ratings at each time point, although over the course of the loan parent QUEST8 scores decreased while therapist QUEST8 scores remained stable, as did parent and therapist Aesthetics median scores. Figure 3 illustrates Loan Phase boxplot comparisons at loan-start and end.

**Discussion**

To address our primary objective, most parents were satisfied with device features for QUEST8 and Aesthetics ratings of Wizzybugs, Bugzis, Cars and Cub’s after participating in an introductory trial session, although satisfaction ratings were variable across the four devices. In regards to our first secondary objective, therapist satisfaction ratings for QUEST8 and Aesthetics were similar to parent ratings. Although QUEST8 score spread was somewhat less, differences in therapists’ Aesthetics median ratings mirrored parents’ ratings.

Our QUEST8 scores are in line with other studies, although equipment and measurement approaches differ somewhat. In a study evaluating different service delivery models, mean QUEST 12-item total scores included both Device and Services subscales and ranged from 3.89 (CI95 3.48–4.30) to 4.18 (CI95 3.62–4.74) (Barlow et al., 2009). A recent survey of children 7–18 years and parents, compared QUEST 12-item scores across walkers, manual and power wheelchairs but reported only percentage of those quite/very satisfied (Gudjonsdottir, & Gudmundsdottir, 2021). Adult studies reported QUEST 2.0 Devices subscale values (Arthanat et al., 2009, Demers, Monette et al., 2002), with one reporting a slightly lower mean device satisfaction total score of 27.69 (SD 4.57) (Chan, & Chan, 2007). Variation between study results may be expected with differing measurement approaches; our study had parents rating their child’s device features, bringing in another difference. Given our positively skewed data, parents and therapists in our study were generally satisfied with the four devices. This aligns with the developer’s
statement that average scores ≥4.0 for mobility devices suggest an acceptable level of device satisfaction (Demers et al., 2000).

For our secondary objective contrasting feature satisfaction, parents rated safety and durability most highly across devices although aesthetics and comfort were also important; while therapists rated aesthetics highly (for all but Cub”), along with safety, durability and device dimensions. Our results are comparable to a study of caregiver satisfaction with assistive technology device use (including powered mobility) for preschool children, where appearance, safety, effectiveness, and durability were most highly rated (Benedict et al., 1999). Similarly, safety, durability, and appearance were rated highest in another study (Weiss-Lambrou et al., 1999) while a further rated size, safety and ease of use highest (Gudjonsdottir, & Gudmundsdottir, 2021). Weight and ease of adjustment were rated least satisfied in that same study (Gudjonsdottir & Gudmundsdottir, 2021).

Interestingly, for our secondary objective examining change in satisfaction from loan-start to end, there was a statistically significant difference in parent QUEST8 satisfaction scores with a moderate effect size, although this change was not observed for therapists, nor did Aesthetics ratings change in either group. The slight decrease in parent QUEST8 satisfaction likely represents a more practical appreciation of the device following real-life experience, although the loan-end median score of 4.13 indicates that parents were still ‘quite satisfied’. Devices were predominantly selected by parents, and access method and postural supports were individualized for child abilities, suggesting the device was suitable for each child.

Our results are similar to another pre-post study involving 23 children under 6 years of age: after 4–6 months of powered wheelchair use, parents’ average QUEST 2.0 satisfaction ratings were quite satisfied (score of 4) and very satisfied (score of 5), for six of eight device-related items although weight and ease of adjustment ratings were lower (Tefft et al., 2011). Our study’s therapists’ (unchanged) ratings may have been influenced by prior device experience or reduced device interactions throughout the loan in comparison with parents (Livingstone & Field, 2020; Livingstone & Field, 2021). Curiously, when QUEST8 and Aesthetic satisfaction ratings were compared between parents and therapists both at loan-start and at loan-end, scores did not differ statistically from each other, perhaps because both groups were generally satisfied with device features. This perhaps may be explained partly by the loaned device being of the parents’ own choice.

Our respondents’ satisfaction with Aesthetics may be attributed somewhat to the novel device designs, as discussed in a qualitative paper highlighting parents’ and therapists’ perspectives of their Power Mobility Day (Trial Phase) experience (Livingstone, Field, Sanderson, Pineau, & Zwicker, 2020). Others have described how parents appreciated that the toy car avoided the attention associated with specialized equipment, because it was much like typical children’s toys (Pritchard-Wiart et al., 2019). A similar sentiment was suggested with Wizzybug”; that it was ‘designed to invoke fun and play associated with children’s ride-on toys as opposed to the medical aesthetic of some mobility devices’ (Evans & Bains, 2017, p.144). Our quantitative results regarding satisfaction with device features are (for the most part) supported by parents’ and therapists’ perspectives reported in paediatric qualitative literature (Bray et al., 2020; Evans & Bains, 2017, Livingstone & Field, 2015; Livingstone, Field et al., 2020; Pritchard-Wiart et al., 2019). Of note, is the differing priorities that our parents and therapists placed on features across the four devices in regards to suitability for their child. This reinforces the importance of fit between child, device and environment when learning to use a power mobility device and integrating it into the child’s and family’s life (Bray et al., 2020; Benedict et al., 1999; Tefft et al., 2011).

**Limitations.** Our convenience sample and differing numbers of trials across devices lessen generalizability of results. Limited therapist availability (and therapist change during Loan Phase) reduced complete pairs available for therapist and parent score comparisons and may have influenced results. Additionally, therapists with more than one client participating in the study may have had some response bias. Some items such as ease of use or effectiveness may be scored in relation to either parent or child use, leading to differing interpretations between respondents. Due to our study’s clinical nature, power mobility practice time was not controlled and varied due to multiple factors, likely influencing results. Future mixed methods studies using more rigorous experimental research designs are recommended to address questions raised. We acknowledge that satisfaction is a subjective construct that is not easily measured, controlled or explained by manipulation of variables using more rigorous experimental study designs. However, as we implement studies with additional controls (using control groups or by repeated measures of children’s device use and/or collection of explanatory variables associated with device use), it will be critical to elicit parent and therapist perspectives using qualitative methods to gain insights into what influences their satisfaction with a power mobility device.

**Conclusion**

Findings suggest that parents’ and therapists’ initial satisfaction with device features were positive, although there was some variability across the four powered mobility devices. Parents’ and therapists’ priorities across devices varied, although safety, durability, aesthetics, comfort and dimensions were most valued. Despite variability among parents’ and therapists’ satisfaction ratings, median score differences between these two groups for each device did not differ significantly. Over an extended device loan period, parents’ satisfaction with some features decreased as they began using the devices in everyday life. However, parent & therapist QUEST and Aesthetics ratings remained favourable. Device features are an important consideration when introducing power mobility for young children, in order to optimize its fit with the child’s and family’s life. Trial and loan opportunities may enhance parent satisfaction and engagement with power mobility use for children with delayed or limited mobility. This is the first study to explore quantitatively similarities and differences between
parent and therapist impressions of four different paediatric power mobility devices.

**Key Messages**

- Device feature satisfaction is important to consider when providing power mobility devices for young children as they may influence device acceptance and use in daily life.
- Parents’ and therapists’ perspectives of device features may differ, yet both perspectives are valuable when determining suitability of device for young children.
- Satisfaction with power mobility device features may vary depending on child, family and therapist experiences.
- There are benefits of trialing several different devices, and considering parents’ choice before providing a mobility device for a longer loan period.

**Declaration of Conflicting Interests**

The author(s) declared no potential conflicts of interest with respect to the research, authorship, and/or publication of this article.

**ORCID iD**

Debra A Field https://orcid.org/0000-0001-5281-0265

**References**

Arthanat, S., Wu, Y. W. B., Bauer, S. M., Lenker, J. A., & Nochajski, S. M. (2009). Development of the usability scale for assistive technology-wheeled mobility: A preliminary psychometric evaluation. *Technology and Disability, 21*(3), 79–95. https://doi.org/10.3233/TAD-2009-0275

Barlow, I. G., Liu, L., & Sekulic, A. (2009). Wheelchair seating assessment and intervention: A comparison between telerehabilitation and face to face service. *International Journal of Telerehabilitation*, 1(1), 17–27. https://doi.org/10.5195/ijt.2009.868

Benedict, R. E., Lee, J. P., Marrujo, S. K., & Farel, A. M. (1999). Assistive devices as an early childhood intervention: Evaluating outcomes. *Technology and Disability, 11*(1-2), 79–90. https://doi.org/10.3233/TAD-1999-111-211

Bray, N., Kolehmainen, N., McAnuff, J., Tanner, L., Tuersley, L., Beyer, F., & Craig, D. (2020). Powered mobility interventions for young children with mobility limitations to aid participation and positive development: The EMPoWER evidence synthesis. *Health Technology Assessment, 24*(50), 1–194. https://doi.org/10.3310/hta24500

Canadian Agency for Drugs and Technologies in Health (2015). Power Mobility Technologies for Children Aged Six Years and Under with Disability or Mobility Limitation: Clinical Effectiveness and Guidelines. Retrieved from https://www.cadth.ca/power-mobility-technologies-children-aged-six-years-and-under-disability-or-mobility-limitation.

Chan, S. C., & Chan, A. P. (2007). User satisfaction, community participation and quality of life among Chinese wheelchair users with spinal cord injury: A preliminary study. *Occupational Therapy International, 14*(3), 123–143. https://doi.org/10.1002/oti.228

Cheung, W. C., Meadan, H., & Yang, H. W. (2020). Effects of powered mobility device interventions on social skills for children with disabilities: A systematic review. *Journal of Developmental and Physical Disabilities, 32*(6), 855–876. https://doi.org/10.1007/s10882-020-09729-x

Cohen, J. (1988). *Statistical power analysis for the behavioral sciences* (2nd Ed). Erbaum.

Demers, L., Monette, M., LaPierre, Y., Arnold, D. L., & Wolfson, C. (2002). Reliability, validity and applicability of the quebec user evaluation of satisfaction with assistive technology (QUEST 2.0) for adults with multiple sclerosis. *Disability and Rehabilitation, 24*(1-3), 21–30. https://doi.org/10.1080/09638280110066352

Demers, L., Weiss-Lambrou, R., & Ska, B. (2000). The Quebec User Evaluation of Satisfaction with Assistive Technology (QUEST) Manual. Retrieved from https://www.midis.org/content/quebec-user-evaluation-satisfaction-assistive-technology-quest.

Demers, L., Weiss-Lambrou, R., & Ska, B. (2002). The Quebec user evaluation of satisfaction with assistive technology (QUEST 2.0): An overview and recent progress. *Technology and Disability, 14*(3), 101–105. https://doi.org/10.3233/TAD-2002-14304

Evans, N., & Baines, R. (2017). Trends, goals and outcomes for children and families using early powered mobility in a charitable loan scheme. *Journal of Enabling Technologies, 11*(4), 138–147. https://doi.org/10.1108/JET-08-2017-0032

Faul, F., Erdfelder, E., Buchner, A., & Lang, A. G. (2009). Statistical power analyses using G*power 3.1: Tests for correlation and regression analyses. *Behavioral Research Methods, 41*(4), 1149–1160. https://doi.org/10.3758/BRM.41.4.1149

Feldner, H. A., Logan, S. W., & Galloway, J. C. (2016). Why the time is right for a radical paradigm shift in early powered mobility: The role of powered mobility technology devices, policy and stakeholders. *Disability and Rehabilitation: Assistive Technology, 11*(2), 89–102. https://doi.org/10.3109/17483107.2015.1079651

Gudjonssdotir, B., & Gudmundssdotir, S. B. (2021). Mobility devices for children with physical disabilities: Use, satisfaction and impact on participation. *Disability and Rehabilitation: Assistive Technology, 1–8*. https://doi.org/10.1080/17483107.2021.1913519

Harris, P. A., Taylor, R., Thielke, R., Gonzalez, N., & Conde, J. G. (2009). Research electronic data capture (REDCap)-A metadata-driven methodology and workflow process for providing translational research informatics support. *Journal of Biomedical Informatics, 42*(2), 377–381. https://doi.org/10.1016/j.jbi.2008.08.010

Huang, H. H. (2018). Perspectives on early power mobility training, motivation, and social participation in young children with motor disabilities. *Frontiers in Psychology, 8*, 2330. https://doi.org/10.3389/fpsyg.2017.02330

James, D., Pfaff, J., & Jeffries, L. M. (2019). Modified ride-on cars as early mobility for children with mobility limitations: A scoping review. *Physical & Occupational Therapy in Pediatrics, 39*(5), 525–542. https://doi.org/10.1080/01942638.2018.1547808

Jones, M., McEwen, I., & Neas, B. (2012). Effects of power wheelchairs on the development and function of young children with...
severe motor impairments. *Pediatric Physical Therapy*, 24(2), 131–140. https://doi.org/10.1097/PEP.0b013e31824c5fde

Kenny, S., & Gowran, R. J. (2014). Outcome measures for wheelchair and seating provision: A critical appraisal. *British Journal of Occupational Therapy*, 77(2), 67–77. https://doi.org/10.4276/030802214X13916969447119

Livingstone, R., Bone, J., & Field, D. (2020). Beginning power mobility: An exploration of factors associated with child use of early power mobility devices and parent device preference. *Journal of Rehabilitation Assistive Technology*, 7, 1–12. https://doi.org/10.1177/2055668320926046

Livingstone, R., & Field, D. (2014). Systematic review of power mobility outcomes for infants, children and adolescents with mobility limitations. *Clinical Rehabilitation*, 28(10), 954–964. https://doi.org/10.1177/0269215514531262

Livingstone, R., & Field, D. (2015). The child and family experience of power mobility: A qualitative synthesis. *Developmental Medicine and Child Neurology*, 57(4), 317–327. https://doi.org/10.1111/dmcn.12633

Livingstone, R., Field, D., Sanderson, C., Pineau, N., & Zwicker, J. G. (2020). Beginning power mobility: Parent and therapist perspectives. *Disability and Rehabilitation, Nov 11*, 1–10. https://doi.org/10.1080/09638288.2020.1842916

Livingstone, R., & Paleg, G. (2014). Practice considerations for the introduction and use of power mobility for children. *Developmental Medicine and Child Neurology*, 56(3), 210–221. https://doi.org/10.1111/dmcn.12245

Livingstone, R. W., & Field, D. A. (2020). Exploring change in young children’s power mobility skill following several months’ experience. *Disability and Rehabilitation: Assistive Technology, Nov 27*, 1–10. https://doi.org/10.1080/17483107.2020.1847207

Livingstone, R. W., & Field, D. A. (2021). Exploring young children’s activity and participation change following 6 months’ power mobility experience. *British Journal of Occupational Therapy, 84(11)*, 713–722. https://doi.org/10.1177/0308022620973935

Mangafico, S. (2016). Summary and analysis of extension program evaluation in R. Version 1. New Brunswick (NJ): Rutgers Cooperative extension. Retrieved from https://rcompanion.org/handbook/.

McCrum-Gardner, E. (2008). Which is the correct statistical test to use? *British Journal of Oral Maxillofacial Surgery*, 46(1), 38–41. https://doi.org/10.1016/j.bjoms.2007.09.002

O’Sullivan, C., & Nickpour, F. (2020). Drivers for change: Initial insights from mapping half a century of inclusive paediatric mobility design. In T. Ahram & C. Falcão (Eds.), *Advances in usability, user experience, wearable and assistive technology. AHFE 2020 advances in intelligent systems and computing* (vol 1217, pp 822–828). Springer.

Piek, J. P., Dawson, L., Smith, L. M., & Gasson, N. (2008). The role of early fine and gross motor development on later motor and cognitive ability. *Human Movement Science, 27(5)*, 668–681. https://doi.org/10.1016/j.humov.2007.11.002

Plummer, T., Logan, S. W., & Morress, C. (2021). Explorer Mini: Infants initial experience with a novel pediatric powered mobility device. *Physical & Occupational Therapy in Pediatrics*, 41(2), 192–208. https://doi.org/10.1080/01942638.2020.1819935

Pritchard-Wiart, L., Bragg, E., & Thompson-Hodgetts, S. (2019). The young movers project: A case series describing modified toy car use as an early movement option for young children with mobility limitations. *Physical and Occupational Therapy in Pediatrics, 39(6)*, 598–613. https://doi.org/10.1080/01942638.2019.1585403

R Core Team (2018). R: A Language and Environment for Statistical Computing. Retrieved from https://www.r-project.org/.

Tefft, D., Guerette, P., & Furumasu, J. (2011). The impact of early powered mobility on parental stress, negative emotions, and family social interactions. *Physical and Occupational Therapy in Pediatrics, 31(1)*, 4–15. https://doi.org/10.3109/01942638.2010.529005

Tomczak, M., & Tosmczak, E. (2014). The need to report effect size estimates revisited. An overview of some recommended measures of effect size. *Trends in Sport Science, 1*, 19–25. Retrieved from http://www.wbc.poznan.pl/Content/325867/5_Trends_Vol21_2014_no1_20.pdf

Weiss-Lambrou, R., Tremblay, C., LeBlanc, R., Lacoste, M., & Dansereau, J. (1999). Wheelchair seating aids: How satisfied are consumers? *Assistive Technology, 11*(1), 43–53. https://doi.org/10.1080/10400435.1999.1031984

---

**Equipment Suppliers**

a Wizzybug available from Designability (www.designability.org.uk)

b Bugzi available from MERU (www.meru.org.uk)

c Invacare Tiger Cub now discontinued from Invacare (www.invacare.com)

d Ride-on toy car - various models (such as Mini Cooper car) available at toy stores such as ToysRUs (www.toysrus.ca/en/6V-Mini-Cooper-Coupe—Black/1DF2371F.html)