A randomized control trial feasibility evaluation of an *m*Health intervention for wheelchair skill training among middle-aged and older adults

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23   **Abstract**

25   **Background.** Providing mobility skills training to manual wheelchair (MWC) users can have a
26   positive impact on community participation, confidence and quality of life. Often such training is
27   restricted or not provided at all because of the expense of, and limited access to, occupational
28   and physical therapists before and after discharge. This is particularly true among middle-aged
29   and older adults, who often have limited access to rehabilitation services and require more time
30   to learn motor skills. A MWC skills training monitored home program, delivered using a
31   computer tablet (mHealth), was developed as an alternative approach to service delivery. The
32   purpose of this study was to evaluate the feasibility of implementing this *m*Health MWC skills
33   training program among middle-aged and older adults.
34   **Methods.** A 2 x 2 factorial design randomized control trial (RCT) was used to compare the
35   *m*Health intervention and control groups, with additional wheeling time as a second factor.
36   Community-dwelling MWC users aged 55 and older, who had used their MWC for less than 2
37   years and propelled with two hands, were recruited. Feasibility outcomes related to process,
38   resources, management and treatment criteria were collected.
39   **Results.** Eighteen participants were recruited, with a retention rate of 94%. Mean (± sd) duration
40   for the first and second in-person training sessions were 90.1 ± 20.5 and 62.1 ± 5.5 minutes,
41   respectively. In the treatment group, 78% achieved the minimum amount of home training (i.e.
42   300 minutes) over four weeks and 56% achieved the preferred training threshold (i.e. 600
43   minutes). Trainers reported only 7 minor protocol deviations. No tablets were lost or damaged
44   and there was one incident of tablet malfunction. No injuries or adverse incidents were reported
45   during data collection or training activities. Participants indicated 98% agreement on the post-
46   treatment benefit questionnaire.
47   **Discussion.** Overall, the study protocol enabled implementation of the intervention in a safe,
48   efficient and acceptable manner. Participant recruitment proved to be challenging, particularly
49   gaining access to individuals who might benefit. Resource issue demands were acceptable for
50   administration of the intervention; data collection was more time-consuming than anticipated but
51   could be reduced with minor revisions. Participant retention and home program treatment
52   adherence was high; both participant and trainer burden was acceptable. Treatment group
53   participants reported a positive experience and clinical benefits from training program. The
54   findings suggest a full-scale RCT evaluating the clinical impact of the EPIC Wheels intervention
55   is warranted, provided the recruitment issues are addressed through collaborative partnerships
56   and active recruitment strategies.

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63 **Introduction**
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65 For those with a mobility limitation, an appropriately prescribed manual wheelchair (MWC) can
66 improve participation (Chaves et al., 2004), community mobility, and quality of life (Requejo,
67 Furumasu, & Mulroy, 2015; Winkler, Fitzgerald, Boninger, & Cooper, 2008) while reducing
68 caregiver burden and personal assistance costs (Cohen & Perling, 2015). However, the benefits
69 of MWC use are dependent upon the user's ability and confidence to operate the device safely
70 and effectively, in order to navigate the environmental barriers and obstacles they encounter
71 (Mortenson, Miller, Backman, & Oliffe, 2012; Phang, Martin Ginis, Routhier, & Lemay, 2012).
72 These wheelchair mobility skills range from basic and essential ones, such as propulsion and
73 transfers, to more complex, such as managing doors, ramps and curbs. There is evidence that
74 providing specific skills training to MWC users has a positive impact on confidence (Sakakibara,
75 Miller, Souza, Nikolova, & Best, 2013), participation (Kilkens, Post, Dallmeijer, van Asbeck, &
76 van der Woude, 2005; Mortenson, Miller, Backman, & Oliffe, 2011), mobility (Hoenig et al.,
77 2005; Lemay, Routhier, Noreau, Phang, & Ginis, 2012) and quality of life (Hosseini, Oyster,
78 Kirby, Harrington, & Boninger, 2012). Unfortunately, many MWC users receive limited
79 training, often focusing on only the most basic skills (Kirby, Keeler, Wang, Thompson, &
80 Theriault, 2015; Nelson et al., 2010). This is particularly true among middle-aged and older
81 adults (Karmarkar et al., 2009) who often have limited access to rehabilitation services (Sanford
82 et al., 2006; Tousignant, Dubuc, Hebert, & Coulombe, 2007). Lack of time and access to
83 rehabilitation services are typically implicated for this lack of training (Best, Miller, Huston,
84 Routhier, & Eng, 2016; Routhier, Kirby, Demers, Depa, & Thompson, 2012). While in hospital,
85 occupational and physical therapists often focus on interventions that target the transition home,
86 and older adults may not receive their permanent MWC until after discharge (Kirby et al., 2015).
87 Once in the community, access to out-patient services is often restricted and older adults report
88 challenges in attending out-patient therapy due to transportation access, cost, and scheduling
89 issues (Giesbrecht, Miller, Mitchell, & Woodgate, 2014; Sanford et al., 2006; Tousignant,
90 Boissy, Corriveau, & Moffet, 2006).
91
92 Some attempt has been made to deliver MWC skills training in a comprehensive and structured
93 manner, most notably the *Wheelchair Skills Training Program* (WSTP) (MacPhee et al., 2004;
94 Sakakibara et al., 2013). In most cases, a clinician with wheelchair expertise delivers the training
95 program to an individual in 5-10 sessions of 30-60 minute duration, over a period of 2-4 weeks
96 (Kirby et al., 2015; Routhier et al., 2012). The number of training sessions required typically
97 increases with older adults, where age-related changes impact motor learning processes
98 (Bonaparte, Kirby, & MacLeod, 2004; Voelcker-Rehage, 2008). This approach to training
99 requires the clinician to be available for multiple training sessions; the trainee to coordinate
100 appointments with the trainer; and the MWC user to arrange and pay for transportation to these
101 appointments. Furthermore, training in a clinic setting requires the MWC user to translate those
102 mobility skills learned into the context of their own environment, leading to apprehension around

103   attempting to navigate obstacles they encounter in their community (Walker et al., 2010).
104   Alternately, training can also occur in a community setting (Best, Kirby, Smith, & MacLeod,
105   2005). This approach allows practice in the context of use, but still requires coordinated
106   appointments and the trainer travelling to the MWC user's home and community locations for
107   multiple sessions, which is cost-prohibitive.
108
109   In response to this service gap, alternative and cost-effective approaches need to be developed to
110   improve access to, and effectiveness of, wheelchair skills training for middle-aged and older
111   adults. We developed a telerehabilitation MWC skills training intervention primarily delivered as
112   a home program using a computer tablet. In the field of rehabilitation, use of *mobile* devices such
113   as a tablet or smart phone (i.e. *m*Health) (World Health Organization, 2011) is growing (Sama,
114   Eapen, Weinfurt, Shah, & Schulman, 2014). This approach has been useful with interventions
115   targeting health literacy (O'Connor, Farrow, & Hatherly, 2014; Watkins & Xie, 2014), self-
116   management (Murray, 2012), and health behaviour change (Webb, Joseph, Yardley, & Michie,
117   2010); however, this is the first application of *m*Health we are aware of that addresses training of
118   a motor skill, specifically MWC mobility. *Enhancing Participation In the Community by*
119   *improving Wheelchair Skills* (EPIC Wheels) combines two in-person training sessions and a
120   four-week home program delivered via a tablet and monitored by the trainer. EPIC Wheels was
121   developed collaboratively with middle-aged and older adult MWC users, caregivers and
122   clinicians involved in skills training (Giesbrecht et al., 2014), and explicitly incorporates
123   principles of adult learning (Knowles, 1980) and self-efficacy theory (Bandura, 1997). Social
124   cognitive theory proposes that self-efficacy is influenced most by successful performance
125   (mastery experience), as well as observing success in comparable others (vicarious experience),
126   encouragement from valued others (verbal persuasion), and appropriate interpretation of
127   affective and physical experiences (Bandura, 1997). The tablet program includes 158 video-
128   based components that provide instruction and demonstration, as well as training activities and
129   games. User activity is uploaded to a secure server, where the trainer can monitor progress; the
130   MWC user and trainer can exchange voice messages using the EPIC Wheels application. This
131   intervention addresses some of the salient barriers to traditional MWC skills training. It
132   incorporates evidence-based content as well as instruction and monitoring by a wheelchair
133   expert, but limits the burden of time for the trainer and travel for the MWC user. In addition,
134   MWC users can practice in their actual context of use (Walker et al., 2010) and have control over
135   the pace, sequence and frequency of training (Jordan, Holden, Mason, & Foster, 2010;
136   Shaughnessy & Resnick, 2009).
137
138   Following the development phase of the EPIC Wheels program (Giesbrecht, Miller, Boyang,
139   Mitchell, & Eng, 2015), the next step was to evaluate administration and impact of the
140   intervention with the target population. Implementation and evaluation of telerehabilitation
141   interventions is still in an emergent phase (Kumar et al., 2013) and there are a number of factors
142   that could potentially impact feasibility in practice (Kairy, Lehoux, Vincent, & Visintin, 2009).

143   Adherence is essential to the success of any home program intervention (Jordan et al., 2010;
144   Shaughnessy & Resnick, 2009). A critical evaluation factor is whether participants will sustain
145   engagement in their home training with limited in-person contact and whether this training can
146   be completed safely (Altilio, Liparulo, Panella, Proietti, & Paoloni, 2015). Acceptability and
147   uptake of *m*Health by middle-aged and older adults is a potential barrier to EPIC Wheels
148   implementation; low self-efficacy and technology-related anxiety may contribute to this
149   reluctance (Chen & Chan, 2011; Laguna & Babcock, 2000). Recent data suggests that 27% of
150   Americans over 65 years own a tablet or e-book reader and 18% own a smartphone; however,
151   this population is still more reluctant than their younger counterparts to adopt this type of
152   technology and only 47% have high-speed Internet access in their home (Smith, 2014). Assistive
153   technology adoption theory suggests that reliable and consistent device performance, as well as
154   technical support when required, is critical to user uptake particularly among older adults
155   (Venkatesh, Thong, & Xu, 2012).

156

157   The impact of a rehabilitation intervention is often evaluated in a clinical trial. A randomized
158   controlled trial (RCT) provides the strongest level of evidence for treatment efficacy, but can be
159   expensive, time-consuming and difficult to implement. Recruitment and retention are among the
160   most significant challenges to conducting an RCT, and present a threat to study feasibility with
161   our target population (Hubbard et al., 2015). Middle-aged and older adults, particularly MWC
162   users, are more likely to decline participation and discontinue treatment due to co-morbidities
163   and complex health conditions (McMurdo et al., 2011; Nary, Froehlich-Grobe, & Aaronson,
164   2011). The literature reports increased prevalence of depression, apathy, cognitive impairment
165   and low self-efficacy among older adults, contributing to lower recruitment and retention rates
166   (Corcoran et al., 2016). Potential participants may be reluctant to participate or attend all
167   appointments if they must travel frequently, especially if the location is inconvenient (Page &
168   Persch, 2013) and there is insufficient reimbursement for travel costs (Blanton et al., 2006).
169   MWC users are particularly vulnerable because of financial restrictions (Nary et al., 2011),
170   dependence on para-transit services, and the additional demands placed on caregivers to
171   coordinate travel (Giesbrecht, Miller, & Woodgate, 2015; Nary et al., 2011). In addition,
172   targeting a population defined by a functional limitation (i.e. restricted mobility), rather than a
173   diagnostic condition, makes it difficult to identify and target recruitment venues (Nary et al.,
174   2011).

175

176   Therefore, before evaluating the EPIC Wheels program in a large-scale RCT, we undertook a
177   feasibility study to confirm that the proposed design would be sufficiently robust and identify
178   whether further changes would be required before moving forwards (Lancaster, 2015). The
179   purpose of this study was to evaluate the feasibility of implementing an RCT with an *m*Health
180   MWC skills training program among middle-aged and older adults. Specifically, we considered
181   four broad components of feasibility (Thabane et al., 2010). *Process* outcomes evaluated
182   participant recruitment and retention, as well as treatment adherence. *Resource* issues related to

183   the viability of collecting data and administering the intervention, and the resultant burden on
184   testers, trainers and participants. *Management* issues considered participant processing time,
185   protocol fidelity and equipment reliability. *Treatment* issues focused on participant safety and
186   perceived benefit.
187
188   **Materials & Methods**
189   **Study design**
190   One value of a randomized controlled trial is the strength of design to establish that benefit is due
191   to a *specific* treatment rather than treatment generally (e.g. a placebo benefit) through the use of a
192   control group (Moffett, 1991). In the case of the EPIC Wheels intervention, several confounding
193   factors could potentially impact mobility-related outcomes. First, an intervention focused on
194   wheelchair mobility could motivate participants to attend to wheelchair activity and use, much
195   like New Years Day can initiate increased exercise activity for some individuals. Second,
196   interaction with a trainer might increase motivation and elevate mood, potentially increasing
197   participants' attention to wheeling activity. Third, using a tablet device could influence
198   participants' engagement because of the novel delivery method. Consequently, the control group
199   intervention was configured to address these specific variables by closely matching the number,
200   duration and type of contacts with the trainer and providing a parallel intervention via a
201   computer tablet (Portney & Watkins, 2009). There is substantial research related to use of
202   cognitive and commercial computer games to effect clinical benefits in rehabilitation, although
203   the results are generally task-specific and the generalizability to functional benefits is more
204   equivocal (Kueider, Parisi, Gross, & Rebok, 2012; Pichierri, Wolf, Murer, & de Bruin, 2011).
205   Thus, cognitive training using computer games provided a conceivable intervention to improve
206   wheelchair mobility skills, thereby achieving some degree of clinical equipoise. However,
207   because the treatment group participants were required to perform specific tasks *with* their MWC
208   (which the control group participants were not), an argument could be made that any benefit
209   realized might simply be the result of increased MWC use, rather than the specific intervention.
210   To address this, an expectation of increased wheelchair use (i.e. "extra wheeling") was
211   introduced as a second intervention variable, such that participants would be randomly assigned
212   to treatment/control and extra-wheeling/no extra-wheeling. This additional factor would enable
213   between-group comparisons for the primary factor and secondary factor, as well as a potential
214   interaction effect (Portney & Watkins, 2009).
215
216   A randomized control trial was used employing a 2 x 2 factorial design. Participants were
217   allocated into four groups (i.e. EPIC Wheels with and without extra wheeling; cognitive training
218   with and without extra wheeling) using a 1:1:1:1 allocation ratio. A computer-generated
219   randomization process, with undisclosed block size and stratified by site, was used to ensure
220   comparable group size while still masking assignment. After enrolment, baseline data was
221   collected and the participant was assign to a group. An initial in-person training session was
222   scheduled with the group-specific trainer, followed by a 4-week home training program. A

223 second in-person training session was conducted at the mid-way point (i.e. after 2 weeks of home
224 training) and the tester re-administered outcome measures after the home program was complete
225 (see Figure 1). Several strategies were used to reduce the risk of bias. Research assistants
226 collecting data were blinded to the group assignment and participants were encouraged not to
227 discuss their training program. In addition, the trainer for the treatment and control groups were
228 separate individuals. Additional details on methodology are available in a previously published
229 protocol paper (Giesbrecht et al., 2013).
230
231   < Insert Figure 1 about here >
232
233 This study was approved by the Research Ethics Boards at the University of Manitoba (Approval
234 # H2012:330) and the University of British Columbia (Approval #: H12-02043) and was
235 registered as a clinical trial (ClinicalTrials.gov #NCT01740635). Participants provided written
236 informed consent at the time of enrolment.
237
238 **Participants**
239 Community-dwelling MWC users living in two Canadian cities (Winnipeg and Vancouver) were
240 recruited on a volunteer basis between March 2013 and March 2016. Initially, to optimize the
241 impact of the treatment, individuals with less than one year of MWC use were recruited. Novice
242 users are still developing routines and patterns of wheelchair use and potentially more amenable
243 to adapting their mobility techniques (Coolen et al., 2004). Over the course of the study, this
244 criterion was adjusted to <2 years of use and then subsequently removed altogether to enhance
245 recruitment efforts. Initially, participants were restricted to those ≥ 55 years old, but this criterion
246 was also modified to ≥ 50 years old to address recruitment issues. Additional criteria included
247 living in the community and being able to self-propel a MWC at least 1 hour/day inside and
248 outside of the home. Inability to communicate or complete study questionnaires in English,
249 receiving concurrent mobility training, and health conditions that contraindicated training were
250 exclusion criteria. Participants were encouraged, but not required, to have a caregiver present
251 during the in-person and home training sessions.
252
253 While the principal focus of the study was feasibility evaluation, a sample size calculation was
254 undertaken to provide an estimate for recruitment needed to detect a statistically significant
255 difference between groups on the primary clinical outcome (i.e. Wheelchair Skill Test -
256 Capacity). Using a data subset for older adult MWC users, a mean change of 9.3% (sd = 9.5%; ρ
257 = 0.49) with α set at 0.10 indicate 8 participants per group would provide 90% power using
258 ANCOVA for an RCT design; after conservatively adjusting for a 25% attrition rate, the total
259 number of participants targeted was 44 (Borm, Fransen, & Lemmens, 2007).
260
261 **Procedures**

262 Participants attended a 2-hour in-person session with their trainer. This session included an
263 orientation to the tablet and home training program. They took the tablet home with them and
264 were instructed to perform a minimum of 75 minutes of home training per week, but encouraged
265 to attempt 150 minutes/week, training 1-2 sessions/day, 15-30 minutes in length, at least 5 days
266 per week. Participants returned for a second 1-hour session two weeks later and then continued
267 with their home training program for an additional 2 weeks. To prevent attrition, the trainer
268 contacted participants by telephone at the end of weeks 1 and 3 to address any issues, provide
269 encouragement and promote adherence (Jette et al., 1998).
270
271 Participants assigned to the Extra Wheeling groups were instructed to spend 75 minutes per week
272 in unstructured wheelchair wheeling (i.e. not typical of their daily activities); this was *in addition*
273 *to* time spend with in tablet-based training.
274
275 ***Treatment Group***
276 All treatment sessions were conducted according to a written protocol. EPIC Wheels (treatment
277 group) trainers provided one hour of instruction, which included demonstration, practice and
278 feedback. Skills were progressed according to the participant's level of function. At the end of
279 one hour, trainers recommended skills to focus on during home training program based on
280 ability, safety, and relevance.
281
282 The EPIC Wheels home program included a comprehensive, structured library of educational
283 material and training activities organized in a hierarchy from simple to complex, delivered using
284 a 10" Android computer tablet. Training was provided in a multi-media format with illustrations
285 and videos, allowing detailed step-by-step guidance and demonstration. Age-appropriate actors
286 of both sexes were used to demonstrate skills in the videos, provide vicarious reinforcement
287 consistent with principles of social cognitive theory (Bandura, 1997). Participants also received a
288 small mobile Internet device that was pre-configured to provide Wi-Fi connectivity for voicemail
289 and data transfer/update capability; however, the EPIC Wheels program could operate
290 independently without Internet access for training purposes. A small platform supported the
291 tablet on the participant's lap for in-wheelchair use, using a simple strap around the subject's
292 thighs for stability. A "Progress" icon provided daily updates on the number of minutes practiced
293 per week, as well as percentage of the weekly goal, to reinforce adherence. This progress
294 information was a subset of the data uploaded regularly to the trainer's website. Messages could
295 be exchanged between subject and trainer using a voicemail function in the EPIC Wheels
296 program on their tablet and website, respectively. Trainers monitored each participant's training
297 activity by regularly visiting the website. The trainer could use this information to identify
298 adherence issues and address these through voicemail, the bi-weekly follow-up phone call, or at
299 the second training session.
300
301 ***Control Group***

302   Comparably, the control group participants met with their trainer for 2 sessions, each following a
303   written protocol, and received bi-weekly follow-up phone calls. They received a tablet pre-
304   loaded with nine commercially available games related to problem solving; word, math and
305   memory activities; and fine motor skills. Each training session was administered using a separate
306   protocol and checklist. Session one focused on benefits of engaging in computer game training
307   and the potential impact wheelchair use might have on mobility. Session two focused on
308   participants' current activities in the community and providing information on how to address
309   barriers encountered.

310

311   ***Data collection***
312   At baseline, descriptive participant characteristics were documented. A total of eight clinical
313   outcome measures were collected at baseline and post-treatment (i.e. immediately following the
314   4-week home training) following a structured written protocol, including recording of
315   administration time. The clinical outcomes, and their associated constructs, are listed in Table 1;
316   additional detail is available in a published protocol paper (Giesbrecht et al., 2013).

317

318   < Insert Table 1 about here >

319

320   **Feasibility indicators**
321   A priori measurement criteria were established for the feasibility indicators (see Table 2); these criteria
322   served as hypotheses to establish study feasibility. Indicators evaluated as "achieved" were considered
323   sufficiently robust requiring little or no adaptation. Indicators evaluated as "revise" would need to be
324   addressed before proceeding.

325   *Process* components reflected the feasibility of the various steps involved in undertaking the
326   study (Thabane et al., 2010). Site coordinators made on-going documentation of participant
327   inquiries, responses, recruitment, appointment scheduling and attendance. The threshold for
328   retention was set at 80%, as a 20% loss of data can present a threat to study validity (Brueton et
329   al., 2013). Adherence was assessed via uploaded tablet usage data (i.e. time spent in home
330   training). This included training session frequency, minutes accessing program components (e.g.
331   instructional videos, training activities, and games) and time spent training without the tablet
332   (manually inputted on the tablet). Weekly and total study period totals were compared against
333   the minimum (75 and 300 minutes, respectively) and preferred (150 and 600 minutes,
334   respectively) practice guidelines.

335   *Resource* components related to time and budget demands (Thabane et al., 2010). Testers completed
336   a data collection protocol checklist at baseline and post-treatment, and documented administration
337   time. In particular, administer time and sensitivity to change for the Health Utilities Index (HUI)
338   was of interest because of its potential application for cost-benefit analysis in future studies.

339   Trainers completed protocol checklists at each of the two training session and documented
340   administration time.

341   *Management* components dealt with personnel, equipment and data issues (Thabane et al., 2010).
342   Site coordinators documented the time between data collection and training appointments, and
343   any equipment issues during training. Trainers indicated any protocol deviations on the
344   checklists and completed a trainer post-treatment evaluation form after EPIC Wheels participants
345   had completed all training.

346   *Treatment* components related to assessment of safety, dose-specific response, and evaluation of
347   perceived benefit (Thabane et al., 2010). Adverse events were documented using the protocol
348   checklists for data collection and in-person training, and via daily tablet prompts during home
349   training. The mean EPIC Wheels treatment group change score was compared to a Minimum
350   Detectable Change of 3.0% for the primary outcome (wheelchair skill capacity). The tablet usage
351   data was used to explore potential benefits of higher treatment dosage using the minimum and
352   preferred training time thresholds. Perceived benefit for the EPIC Wheels participants was
353   assessed using a participant post-treatment questionnaire at the last data collection appointment.
354   To avoid a respondent bias, participants received the questionnaire from the site coordinator
355   (who was not involved in data collection **or delivery of the intervention) and completed it**
356   **independently in a private space.**

357

358   < Insert Table 2 about here >

359

360   **Data Analysis**
361   For *Process* components, the rates for recruitment, consent, retention and adherence were
362   calculated as frequency counts and percentages. For *Resource* components, frequency counts
363   were used to determine subject and tester burden, and trainer burden was obtained using mean
364   training session duration. For the HUI measure, mean administration time was calculated and
365   HUI scores for EPIC Wheels participants were compared pre- and post-intervention using a
366   paired *t*-test. For *Management* components, simple counts were used to tabulate days between
367   data collection and treatment initiation, tablet technical issues, and tablet downtime days. The
368   number and nature of protocol administration issues were counted and qualitatively assessed
369   with respect to changes indicated. For *Treatment* components, adverse events (in-person and
370   home training) were tabulated as simple counts. A mean change score on the primary outcome
371   (wheelchair skill capacity) was calculated for EPIC Wheels group completers. In addition,
372   differences in change score between EPIC Wheels participants achieving the preferred (600
373   minutes) training dose and those meeting the minimum (300 minutes) training dose were
374   compared using an independent samples *t*-test. Given that this was a feasibility study, all *t*-tests
375   were conducted with $\propto$ set at 0.10 to ensure a potentially beneficial treatment effect did not go

376 undetected (Type II error). Post-treatment questionnaires responses were treated as simple counts
377 summed to obtain percentages.
378
379 **Results**
380
381 *Process Indicators.* A total of 18 participants were recruited at two sites (Site 1 n = 7; Site 2 n =
382 11) over a period of 36 months, for an average of approximately one participant every two
383 months. A CONSORT flow diagram for recruitment is provided in Figure 2. A total of 55
384 individuals were contacted, 18 of who were deemed ineligible. Among the 37 eligible
385 individuals, 12 (32%) were lost to follow-up or died, 7 (19%) declined to participate, and 18
386 were enrolled for a consent rate of 49%. One participant from the EPIC Wheels group withdrew
387 shortly after enrolment due to an emergent and unrelated health issue. Of the 18 individuals who
388 consented to participate, 17 completed both data collection sessions, for a retention rate of 94%.
389 The mean (± sd) age of participants was 66.1 (± 9.5) years, ranging from 50 to 84 years, and was
390 predominantly males (n=13).
391
392   < Insert Figure 2 about here >
393
394 Seven of the 8 control group participants (88%) and nine of the 10 EPIC Wheels participants
395 (90%) attended both training sessions. For EPIC Wheels participants, a summary of the home
396 training guidelines and performance data is summarized in Table 3 and detailed training activity
397 in Table 4. Among the EPIC Wheels participants who completed the study (n=9), 78% achieved
398 the minimum amount of home training (i.e. 300 minutes) over the full four weeks and 56%
399 achieved the preferred training threshold (i.e. 600 minutes). There was considerable variation in
400 total home training time (range 105 – 1443 minutes) as well as type of training EPIC Wheels
401 participants engaged. Specifically, total time engaging in tablet-based training range from 105 to
402 1382 minutes, and time reported as skill training activity without the tablet ranged from 0 to 980
403 minutes.
404
405   < Insert Table 3 about here >
406
407 *Resource Indicators.* Data collection duration data was only available for 13 participants. At
408 baseline, the mean duration was 150.8 ± 48.1 minutes; 3 participants (31%) completed testing in
409 ≤ 2 hours. At post-treatment, 6 participants (46%) finished in ≤ 1.5 hours; the overall mean was
410 105.7 ± 47.3 minutes. The HUI administration time was available for ten study participants, with
411 a mean of 9.1 ± 4.2 minutes. A paired *t*-test comparing pre- and post-intervention HUI scores for
412 EPIC Wheels participants indicated a statistically significant improvement ($t = 2.45$, df = 8, $p =$
413 0.04). Data for the first in-person training session was available for 16 participants; all sessions
414 were conducted in less than 2 hours ($m = 90.1 ± 20.5$ minutes). For the second in-person session

415 (n=12), mean training time was 62.1 ± 5.5 minutes overall with all participants finishing in less
416 than 90 minutes.
417
418   < Insert Table 4 about here >
419
420 *Management Indicators.* The mean processing time between study enrolment and initiation of
421 the intervention was 11.3 ± 6.8 (range 4-28) days (Site 1: 13.9 ± 9.0 days; Site 2: 9.6 ± 4.8 days).
422 There was one incident of tablet malfunction (6% of participants) that required replacement for
423 an EPIC Wheels participant, resulting in the participant not having tablet access for several days;
424 this participant was still able to achieve the minimum training threshold. Several participants
425 required some assistance from the study coordinator to resolve voicemail or Wi-Fi connectivity
426 issues; however, none of these situations resulted in participants losing tablet access. No tablets
427 were lost or damaged over the course of the study. Trainer post-treatment protocol evaluation
428 forms were available for 16 participants and indicated no major protocol deviations. A total of 7
429 minor protocol deviations were reported: one participant required a minor wheelchair adjustment
430 prior to initiating training; the timing for follow-up phone calls was modified for one participant;
431 three participants required an additional in-person visit, two for assistance with tablet operation
432 and one for additional care provider spotter training; and two participants had an abbreviated
433 training session due to a conflicting appointment. Several additions to the protocol were
434 identified: ensuring the Wi-Fi device was activated prior to tablet demonstration; including data
435 logger installation in the task checklist; and providing options for participants who could not
436 tolerate the tablet holder on their lap. All post-treatment evaluations indicated the protocol was
437 clear and 87.5% confirmed the time allocated for administration was reasonable.
438
439 *Treatment Indicators.* There were no injuries or adverse incidents during any data collection
440 sessions, training sessions, or home training. The mean change score for wheelchair skill
441 capacity among all EPIC Wheels treatment group participants was 5.3 ± 7.1% and 4.6 ± 7.1% for
442 those who met the minimum training time; both values exceeded the MDC target of 3.0%. The
443 mean change score for participants meeting the preferred training dose (5.6 ± 8.4%) was higher
444 than participants meeting the minimum training dose (1.9 ± 1.7%), but did not reach a level of
445 statistical significance ($t = 0.58$, df = 5, $p = 0.59$). The results of the post-treatment questionnaire
446 for EPIC Wheels completers are summarized in Table 5. A total of 98% of question responses
447 were in agreement, with over 81% being "strongly agree".
448
449   < Insert Table 5 about here >
450
451 **Discussion**
452
453 Overall, the EPIC Wheels study demonstrated a robust protocol that enabled implementation of
454 the intervention in a safe, efficient and acceptable manner. While participant recruitment was

455   challenging, retention and adherence proved to be strong. With respect to process issues, the rate
456   of recruitment and number of participants were below the study targets. Two revisions to the
457   inclusion criteria were made to promote recruitment during the study period: lowering the
458   minimum age from 55 to 50 years and eliminating the maximum period of MWC use. A variety
459   of recruitment strategies were implemented including advertisement in a wide variety of venues
460   (e.g. hospital/ rehabilitations centres, health clinics, wheelchair vendors, senior centres, libraries,
461   rehabilitation expos); multiple expositions and engagement with occupational and physical
462   therapists who prescribe wheelchairs; local community newspaper articles and a television
463   interview; telephone invitation via a wheelchair provider program; and hiring an occupational
464   therapist part-time for dedicated recruitment activities. Monthly teleconference meetings were
465   held with study staff at both sites to provide updates, discuss implementation issues, and
466   brainstorm recruitment strategies.
467
468   One reason for the low response rate may be related to using a recruitment approach where
469   potential participants were required to initiate contact with the study coordinator, with whom
470   they were unfamiliar. The literature identifies that *passive* and *opt-in* recruitment strategies (i.e.
471   where the onus of contact rests with the participant) have substantially lower success than active
472   and opt-out strategies, where individuals are contacted directly and provide an affirmative
473   response or request no further contact (Page & Persch, 2013; Sygna, Johansen, & Ruland, 2015).
474   Another potential issue may have been MWC users' apprehension over the possibility of
475   allocation to the control group. Howard et al (2009) report that clinicians assisting with
476   recruitment may also have reservations about referring clients who might then be allocated to the
477   control arm of a study. The possibility of allocation to either arm was explicitly conveyed in the
478   consent form; in future, alternative approaches such as avoiding the term "control group" and
479   describing two training program alternatives or using a wait-list approach might be more
480   effective.
481
482   The study inclusion criteria also required participants to propel their wheelchair with two hands,
483   precluding a number of user groups such as those who exclusively foot-propel and those with
484   hemiplegia (e.g. post-stroke). The EPIC Wheels training material demonstrated bilateral
485   propulsion strategies, necessitating this inclusion criterion. It was anticipated that, after
486   demonstrating feasibility, additional content could be developed targeting a variety of
487   populations (e.g. hemiplegia, lower limb amputation, male/female specific) as well as devices
488   (e.g. power wheelchairs, scooters). Moving forward, a large-scale RCT should incorporate a
489   variety of content streams within the EPIC Wheels delivery platform to expand the potential
490   recruitment audience.
491
492   The number of individuals expressing interest via clinician referral was relatively small, despite
493   considerable effort in marketing the study to practicing therapists. This response is consistent
494   with some other studies in the literature, where authors cite health providers' lack of time in their

495   clinical work, forgetting to bring the study to their clients' attention, concerns about client
496   burden and not prioritizing study recruitment as challenges (Hubbard et al., 2015; Miller, Bakas,
497   Buelow, & Habermann, 2013; Sygna et al., 2015). Tyson et al (2015) used hospital therapists to
498   assist with recruitment and found those who were "gate keepers" (i.e. "pre-screened" clients,
499   rather than providing all eligible clients with the option of participation) had lower recruitment
500   rates; this finding appears to be particularly prevalent when recruiting older adults (McMurdo et
501   al., 2011). Hubbard et al (2015) highlight the importance of "buy-in" when including practicing
502   clinicians in recruitment for rehabilitation trials, and propose that clinicians' poor outcome
503   expectations of recruitment, consistent with social cognitive theory, influence their effort and
504   adherence to recruitment strategies. It is also possible that clinicians' outcome expectations for
505   middle-aged and older adults to benefit from wheelchair skills training influenced decisions
506   about passing along study information. We do not know whether any of these factors were
507   relevant for the therapists engaged to assist with recruitment in the EPIC Wheels study.
508   However, given the fact that therapists contacted for this study had identified being involved
509   with middle-aged and older adult MWC users on a regular basis, a better understanding of the
510   factors that impact clinician referral is desirable.
511
512   Approximately one third of eligible individuals declined to participate in the study, exceeding the
513   target parameter of <10%. A variety of reasons were given for not participating, but were
514   primarily related to the distance, cost, or lack of an escort to travel to the data collection and
515   training sessions. Since all individuals who agreed to participate ultimately provided consent, the
516   rate of refusal was acceptable. Any follow-up study should consider the economic costs of travel
517   for data collection and training session and ensure sufficient resources are available to enable
518   trainees to attend without undue hardship, or provide alternative venues that are accessible and
519   convenient (Blanton et al., 2006). The retention rate of 87.5% surpassed the feasibility criteria
520   set. It was anticipated that control group participants would be more inclined to be lost to
521   attrition; however, the only withdrawal was from the EPIC Wheels group and was due to a health
522   condition that prevented continuation in the program. One participant in the control group
523   expressed frustration with his allocation and declined the second training session, but did attend
524   the post-treatment data collection. It appears that, once enrolled, participants were engaged in the
525   study and aside from extenuating circumstances (i.e. health issues) were motivated to complete
526   the study.
527
528   The challenges with recruitment experienced in this feasibility study raise concerns about a
529   subsequent clinical trial being sufficiently powered to detect a treatment effect. Suggestions in
530   the preceding paragraphs, such as expanding the program content, could assist in broadening the
531   pool of potential participants. Increasing the number of study sites could augment the total
532   number of participants; however, the speed of recruitment will need to be addressed. The
533   avenues by which the study was advertised were diverse, but relied heavily on the MWC users
534   initiating contact. Middle-aged and older adults often feel overwhelmed during the period of

535 transition to MWC use and are often dealing with a multitude of competing demands (e.g.,
536 hospital discharge planning, purchasing adaptive equipment, accessibility issues in the home,
537 other rehabilitation therapies, etc.) (Giesbrecht, Miller, & Woodgate, 2015). We established
538 positive connections with occupational and physical therapists by providing education sessions,
539 recruitment material, and follow-up inquiries; however, despite general affirmation for the
540 training program, relatively few participants were recruited directly through clinician referral. In
541 order to optimize this recruitment source, it may be helpful to secure an advocate or "champion"
542 within the health care system, and create a formal collaboration with regional health authorities.
543 Tyson et al (2015) advocate for such an approach, suggesting on-site champions can create a
544 culture that identifies recruitment as a role for everyone and maintain enthusiasm over the course
545 of the study. This approach could introduce additional recruitment resources and contextualize
546 the training program as an option that is offered to all eligible MWC users who come in contact
547 with these health systems.
548
549 Adherence to treatment was reasonably strong for both study groups, exceeding the target of
550 85%. Among the EPIC Wheels participants, the rate of adherence to the minimum training time
551 standard (300 minutes) was above the 85% target, with 57% exceeding the preferred 600 minutes
552 of training. The patterns of training were quite variable, in terms of the number of days per week
553 and duration of practice. Participants typically chose not to practice five days every week, but
554 training sessions duration was consistently appropriate, lasting at least 15 minutes and not
555 exceeding 75 minutes. It should be noted that the program software calculates usage based on the
556 start and stop time for each video-based component. Consequently, usage data would likely
557 underestimate the total time participants spent interacting with the EPIC Wheels program, since
558 additional time would be required to navigate between video components. Participants may have
559 actually had longer "sessions" of training than the data files reflect, and may have been engaged
560 in processing training information or performing wheelchair maneuvers during periods of time
561 between video component activation.
562
563 Resource issue demands were acceptable for administration of the intervention, as the trainers
564 were largely able to conduct training sessions in the prescribed time frame, although some
565 flexibility with the length of the second training session should be integrated in a subsequent
566 study. Data collection turned out to be more time-consuming that anticipated, with the majority
567 of both baseline and post-intervention sessions exceeding the expected timeframe. While some
568 participants required more frequent rest breaks between measures, the majority of time was spent
569 administering measures. In particular, three specific tools accounted for over 80 minutes of time:
570 the WST-C (37.4 ± 15.6 minutes), the WheelCon (22.8 ± 8.0 minutes), and the WhOM (21.1 ±
571 16.5 minutes). Several strategies might be employed in future to expedite the data collection
572 process and reduce both the tester and participant burden. First, the WheelCon 3.0 is now
573 available in a revised 21-item short-form version, which shows promise as a reliable alternative
574 to the 65-item original test (Sakakibara, Miller, & Rushton, 2015). Second, future participants

575 might be provided with preparatory questions or information in advance of the data collection
576 sessions. For example, the WhOM is administered as a semi-structured questionnaire and
577 respondents identify up to ten relevant activities they perform using a wheelchair, which can be
578 time-intensive. A third option would be to provide participants with some of the measures to
579 complete in advance and then review them for accuracy and completeness at data collection.
580 Finally, the WST is also available in the WST-Q (questionnaire) version (Mountain, Kirby, &
581 Smith, 2004), evaluating both capacity (i.e. what can you do) and performance (i.e. what do you
582 do), which is highly correlated with the objective WST-C version used in this study and
583 considerably quicker to administer (~ 10 minutes) (Rushton, Kirby, & Miller, 2012).
584
585 Administration time for the HUI was within the expected parameters. There was a statistically
586 significant difference in EPIC Wheels participant HUI scores at baseline and post-treatment,
587 indicating the intervention may have a measurable impact. Given the encouraging results and
588 minimal administration burden, the HUI can be included as an outcome in subsequent trials to
589 measure health-related quality of life and potentially evaluate cost-effectiveness (Furlong, Feeny,
590 Torrance, & Barr, 2001; Horsman, Furlong, Feeny, & Torrance, 2003).
591
592 Regarding management issues, the tablet and related equipment proved to be quite robust with
593 no loss or damage reported and minimal downtime during the training intervention.
594 Transitioning participants into their training program following enrolment was relatively quick,
595 but the average delay was slightly above the targeted value of <10 days. After enrolment, the
596 study statistician was contacted by email to initiate the randomization procedure and respond
597 with the group allocation; this typically required 1-3 days to process. Booking the initial training
598 session could only be initiated once this was complete and required coordination of schedules
599 between the trainee and trainer, as well as the training space. Given these variables, the
600 processing time was not unreasonable, but a subsequent study would implement a more
601 expeditious procedure for group allocation and prepare 'availability' schedules to offer
602 participants. The trainers found the time provided to be sufficient and the intervention protocol
603 clear, with only a few minor deviations required. These minor adjustments to process were
604 logical and prudent decisions made, which speaks to the need for the study trainers to have
605 sufficient experience and clinical reasoning skills. The modifications made to the treatment
606 protocol were relatively minor, suggesting that the current protocol could be employed in a
607 subsequent trial. Based on the experiences of this feasibility trial, it would be prudent to append a
608 "Frequently Asked Questions" section to the protocol including guidance on potential
609 circumstances where minor deviations might be warranted.
610
611 With respect to treatment issues, the feasibility study was conducted without major injury or
612 adverse events occurring during data collection, in-person training, or home training activities.
613 Several situations arose where two participants did experience health issues; these were not
614 incurred due to study-related activities but clearly could impact participation and performance in

615   training and data collection. This is particularly relevant given the target population of middle-
616   aged and older adults whose mobility is compromised due to a health condition, as they are
617   especially vulnerable to concomitant injuries and development of co-morbidities. A large-scale
618   RCT study with the EPIC Wheels program will incorporate strategies to deal with such situations
619   should they arise (e.g. guidelines for suspending or extending training/data collection based upon
620   emergent health events).
621
622   While the intent of this study was to establish feasibility, there is evidence to suggest that the
623   recommended treatment dose was sufficient to generate improvement beyond the MDC
624   threshold, and that increasing dosage (i.e. training time) may have additional benefit. The video-
625   based training material in the EPIC Wheels program is approximately 250 minutes in length, of
626   which 150 minutes is instructional content. All but one participant met the minimum training
627   requirement of 300 minutes; however, only four achieved the preferred training goal of 600
628   minutes over the study period. Based on these findings, we will recommend participants have
629   flexibility to incorporate tablet-based activities and practice independent of the tablet program,
630   but encourage increasing total practice beyond the minimum standard.
631
632   The perception of program benefit for EPIC Wheels participants was strong. All but one
633   participant agreed or strongly agreed with every statement on the post-treatment evaluation form,
634   and the agreement rate of nearly 97% was well above the target feasibility parameter. All EPIC
635   Wheels participants felt that wheelchair skill training was important and six of the seven strongly
636   agreed that the method of training was appropriate and had succeeded in improving their skill
637   level. Only one participant provided a non-agreement response; as a very experienced user, they
638   disagreed that the method of training and types of skills taught were appropriate for them, but
639   still agreed the program had improved their skill level. In summary, EPIC Wheels participants
640   perceived the program to be relevant, appropriate and beneficial.
641
642   Based upon the analysis of the feasibility indicators, a full-scale RCT evaluating the clinical
643   impact of the EPIC Wheels intervention is recommended, provided the recommendations for
644   recruitment are implemented. Establishing a collaborative partnership with health care
645   authorities is essential to facilitate on-site champions and implement an active, opt-out
646   recruitment strategy. In addition, expanding and customizing the intervention content would
647   allow access to a larger potential pool of participants. Sufficient financial resources will be
648   required to cover participant transportation costs and WiFi access when necessary. Use of the
649   HUI measure will also allow integration of cost-effectiveness outcomes in a subsequent study.
650
651   **Limitations**
652   The indicators used to measure feasibility were established prior to undertaking the study and
653   were based on recommendations from multiple sources within the research literature. However,
654   no standardized format or tool is currently validated for use in medical rehabilitation and

655   consequently the feasibility evaluation was based upon the selection of recommended indicators
656   and assigned target criteria for success. The recruitment challenges and resulting small sample
657   size provided less data upon which to evaluate the feasibility criteria, and limit generalizability
658   of the results, as the study sample may not be representative of the larger population of middle-
659   aged and older adult MWC users. A larger sample might have uncovered additional issues in the
660   data collection and intervention protocols, safety risks, and equipment issues. In particular,
661   individuals who employ a hemiplegic or foot propulsion strategy were excluded; given that 25-
662   75% of individuals who experience a stroke use a wheelchair (Charbonneau, Kirby, &
663   Thompson, 2013), this is a sizeable population that should be included. The collection of tablet
664   usage and adherence data for the control group participants would have been useful and could
665   potentially have also been compared to the adherence indicator, as was the case with the EPIC
666   Wheels group. Several outcomes had some missing data where the study Tester or Trainer
667   information was not documented. Greater diligence and oversight strategies should be employed
668   in future to ensure a comprehensive and complete data set for all procedures.
669
670   **Conclusions**
671
672   This study confirmed the vast majority of feasibility indicators were met or exceeded, with
673   recruitment presenting the greatest challenge. Adherence was generally strong and participants
674   were willing to invest time and effort to achieve the training expectations. Participants' perceived
675   benefit of the intervention was high, even among those with more extensive experience using a
676   MWC. The affirmative findings and recommendations for minor adaptation suggest that a large-
677   scale RCT design is viable, provided a more comprehensive and active recruitment strategy is
678   employed.
679
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681

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683   in developing the EPIC Wheels software and delivery platform.
684

685   **References**
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Figure 1

Randomized control trial study design

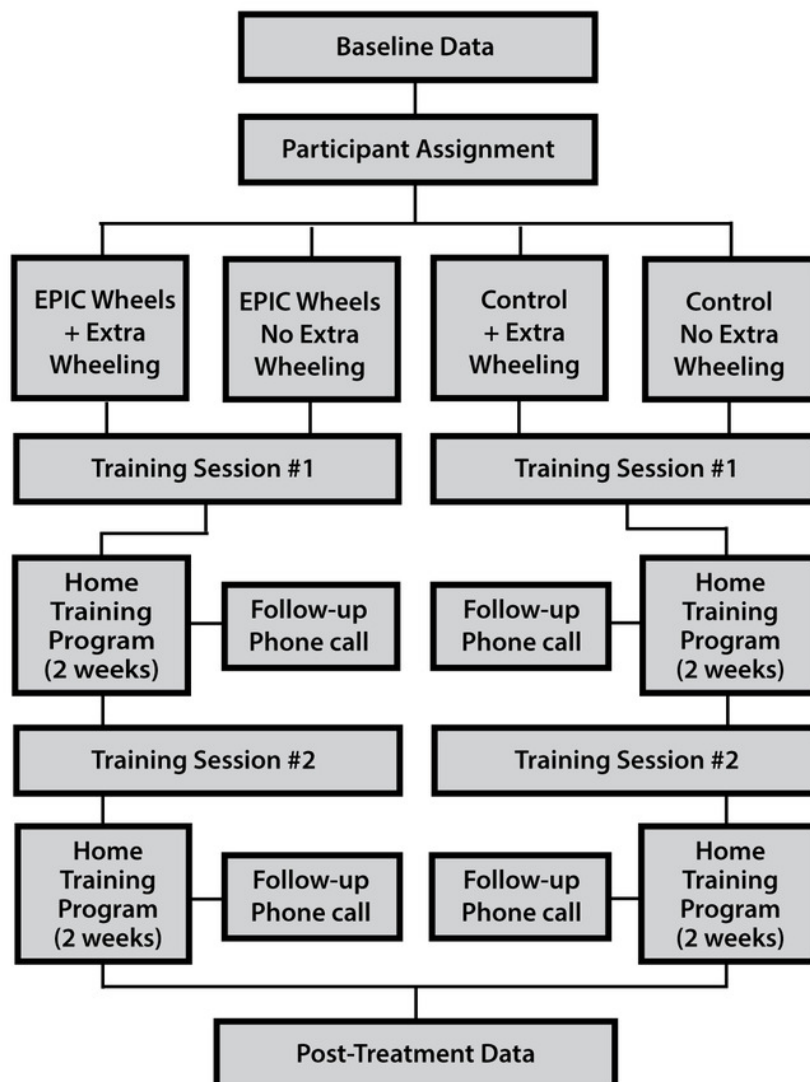
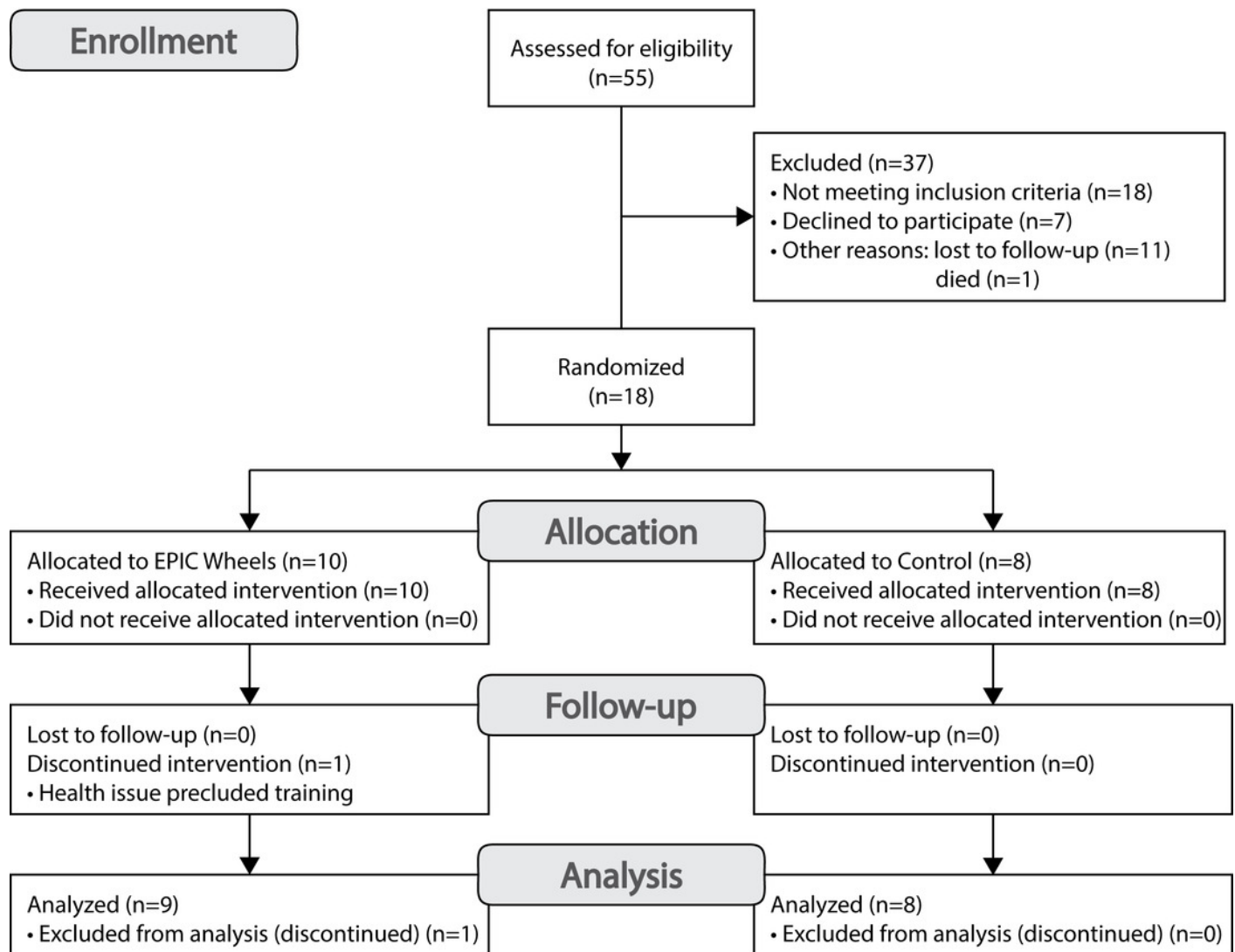



Figure 2

CONSORT flow diagram for participant recruitment

Clinical Outcome Measures

* Primary clinical outcome measure

1 **Table 1   Clinical Outcome Measures**

Clinical Construct	Outcome Measure
Skill Capacity*	Wheelchair Skills Test - Capacity (WST-C)
Safety	Wheelchair Skills Test - Safety (WST-S)
	Wheeling While Talking (WWT) test
Self-efficacy	Wheelchair Use Confidence Scale (WheelCon)
Participation in Occupation	Wheelchair Outcome Measure (WhOM): Indoor and Outdoor subscales
Mobility	Life-Space Assessment (LSA)
Health Related Quality of Life	Health Utilities Index (HUI)

3 * Primary clinical outcome measure

Feasibility indicators, proposed criteria and outcomes

1 **Table 2**   **Feasibility indicators, proposed criteria and outcomes**

Feasibility Component	Indicator	Criteria	Outcome
Process			
Recruitment rate	# of subjects recruited	3 subjects/month/site: Total of 44 over 8 months	Revise
Consent rate	% of subjects consenting	< 10% subject refusal	Revise
Retention rate	% of subjects with DC2	Complete data collection for > 80%	Achieved
Treatment adherence (EPIC Group)	Attend both training sessions	> 85% of subjects	Achieved
	Meet minimum practice time guidelines	> 85% of subjects	Achieved
(Control Group)	Both training sessions conducted	> 85% of subjects	Achieved
Resources			
Data collection: Subject & Tester burden	DC1 duration	> 85% of subjects complete in ≤ 2 h	Revise
	DC2 duration	> 85% of subjects complete in ≤ 1.5 h	Revise
Collection of HUI data	Administration	Mean HUI administration is < 10 minutes	Achieved
	HUI pre/post score	Statistically significant change pre-post	Achieved
Trainer burden	Time spent with subject in training intervention	Mean time ≤ 2 hours for Session 1 and ≤ 1 hour for Session 2	Achieved

Management			
Participant processing time	Time from data collection to treatment	Mean time is $\leq$ 10 days at each site	Revise
Tablet reliability	Downtime due to technical or mechanical issues	> 90% of subjects are not without a tablet for > 2 days	Achieved
Equipment loss/damage	Tablet is lost/unusable	< 2 tablets lost over study	Achieved
Treatment administration issues	Post-treatment Evaluation Form (Study Trainer)	Any issues identified modifiable without substantial changes to the protocol	Achieved
Treatment			
Safety (Data Collection & Training)	Adverse events during assessment or training	No major injuries or adverse events reported	Achieved
Safety (Home program)	Adverse events during home training	No major injuries or adverse events reported	Achieved
Dose level response	Training expectations effect a change score	Minimum practice time guidelines sufficient for a treatment effect	Achieved
Perceived benefit	Post-treatment Participant Questionnaire	> 85% of responses will be "strongly agree/agree"	Achieved

3   Note: DC1 = baseline data collection; DC2 = post-treatment data collection; HUI = Health Utilities Index

EPIC Wheels home training guidelines and participant results (n = 7)

† Intensity of treatment was defined as the duration of training time in a single day

1   **Table 3   EPIC Wheels home training guidelines and participant results (n = 7*)**

Parameter	Instruction to participant	Minimum	Mean ± SD (Range)
Frequency:			
Total days of training	20-28 days	20 days	15.0 ± 5.9 days (8.0 – 26.0)
Days/week training	5-7 days/week	5 days	3.8 ± 1.5 days (2.0 – 6.5)
Intensity:†			
Training duration/day	15-30 minutes	15 minutes	45.1 ± 19.9 (10.9 – 72.2)
Dosage:			
Minutes of training/week	75 – 150	75 minutes	183.6 ± 171.0 (26.2 – 360.8)
Total minutes training	300 - 600	300 minutes	734.0 ± 459.5 (104.6 – 1443.0)

2   * Home training data was only available for 7 participants

3   † Intensity of treatment was defined as the duration of training time in a single day

EPIC Wheels home program training data for EPIC Wheels participant

Values in **bold font** did not meet the weekly minimum goal of 75 minutes or total training period goal of 300 minutes [a] Minutes spent on tablet-related training (i.e. watching demo videos, training games & timed training activities) [b] Total minutes of tablet-related training + self-reported non-tablet training time [c] Total minutes of self-reported non-tablet training time [d] Grand total of tablet and non-tablet training time

1 **Table 4**   **EPIC Wheels home program training data for EPIC Wheels participant**

Participant	Week 1		Week 2		Week 3		Week 4		Total		
	Tablet[a]	All[b]	Tablet	All	Tablet	All	Tablet	All	Tablet	Other[c]	Grand[d]
Site 1 P4	46.7	182.0	54.0	319.0	64.5	300.0	57.4	402.0	222.6	980.0	1202.6
Site 1 P5	218.9	279.0	318.7	374.0	232.6	263.0	148.2	248.0	918.4	245.0	1163.4
Site 1 P7	228.2	228.2	399.4	399.4	84.2	84.2	0.0	**0.0**	711.8	0.0	711.8
Site 2 P2	141.0	152.0	85.0	85.0	630.0	665.0	526.0	541.0	1382.0	61.0	1443.0
Site 2 P3	214.5	265.0	60.5	**60.5**	50.8	90.8	86.0	171.0	411.8	175.0	586.8
Site 2 P6	126.3	126.3	1.1	**1.1**	13.3	**53.3**	5.6	**5.6**	146.3	40.0	**186.3**
Site 2 P7	133.9	148.9	69.9	**69.9**	124.5	154.5	8.0	108.0	336.3	145.0	481.3
Site 2 P10	495.1	550.1	61.2	121.2	0	**10.0**	0	**45.0**	556.3	170.0	726.3
Site 2 P11	63.9	**63.9**	20	**20**	1.5	**1.5**	19.2	**19.2**	104.6	0	**104.6**
Mean ± SD	185.4 ± 133.1	221.7 ± 140.9	118.9 ± 140.0	161.1 ± 157.5	133.5 ± 200.0	180.3 ± 209.5	94.5 ± 169.4	171.1 ± 416.0	532.2 ± 443.1	201.8 ± 304.1	734.0 ± 459.5

3 Values in **bold font** did not meet the weekly minimum goal of 75 minutes or total training period goal of 300 minutes

4 [a] Minutes spent on tablet-related training (i.e. watching demo videos, training games & timed training activities)

5 [b] Total minutes of tablet-related training + self-reported non-tablet training time

6 [c] Total minutes of self-reported non-tablet training time

7 [d] Grand total of tablet and non-tablet training time

EPIC Wheels group post-treatment questionnaire results (n = 9)

1 **Table 5 EPIC Wheels group post-treatment questionnaire results (n = 9)**

Item	Strongly Disagree	Disagree	Agree	Strongly Agree
Receiving wheelchair skills training is valuable or important for me				9
The method of training I received was reasonable and appropriate for me		1	1	7
The kinds of wheelchair skills taught were reasonable and appropriate for me		1	3	5
The trainer working with me was reasonable and appropriate for me				9
The expectations for participating in training and practice sessions were manageable and practical			4	4
The essential components of the training program were provided as described at the study outset			2	7
I was able to perform or improve skills taught in the training program			2	7
I did not experience an injury or undue physical or mental stress				9
The training program was successful in improving my wheelchair skills			1	8
Response total		2.5%	16.3%	81.3%