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Effectiveness of Powered Mobility Devices in Community Mobility-Related Participation: A Prospective Study Among People With Mobility Restrictions

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Abstract

Objective: To investigate the effectiveness of powered mobility device (i.e. powered wheelchair and scooter) interventions over a one year period in the Nordic context.

Design: Prospective design.

Setting: The study involved community-living participants from Denmark, Finland and Norway.

Participants: In all, 180 participants with different self-reported impairments participated in the study. The mean age was 68.7 (95%CI=39.9-97.5) years and 47.8% of the participants were men.

Methods: The participants were interviewed twice about mobility and mobility-related participation, face-to-face in their homes. The first interview took place shortly before the participants had received their powered mobility device and the second about one year later (mean 386.9 days SD=52.78).

Main Outcome measures: Changes in frequency, ease/difficulty, and number of mobility-related participation aspects in daily life were investigated in the total sample and in sub-groups by means of the NOMO 1.0 instrument, applying structured interview format.

Results: In the total sample the frequency of shopping groceries ($p<.001$, effect size=0.29, 95%CI=0.08-0.50), going for a walk/ride ($p<.001$, effect size=0.62, 95%CI=0.41-83) increased, while the number of participation aspects performed ($p<0.001$) increased only slightly. Going to a restaurant/café/pub, shopping groceries, other shopping, posting letters, going to the bank, the chemist's, going for a walk/ride, and visiting family/friends became easier ($p<.001$to $p=.001$); effect sizes varied between 0.50 (95%CI=0.29-0.71) and 0.85 (95%CI=0.63-1.07). Men, scooter users, and users with poor self-reported health seem to benefit the most from the intervention.

Conclusions: Powered mobility device interventions mainly contribute to mobility-related participation by making participation easier for people with mobility restrictions and by increasing the frequency of participation aspects such as shopping groceries and going for a walk/ride. The effects varied regarding the sub-groups. The present study further strengthens the current evidence that powered mobility devices increase mobility-related participation in daily life among certain subgroups of adults with mobility restrictions.

Keywords

Assistive devices, electric scooters, electric wheelchairs, outcome, rehabilitation.

Introduction

Assistive devices, including electric motor driven wheelchairs are provided in order to compensate for loss in physical functioning and to promote participation, which is an essential part of rehabilitation. Scooters are designed for persons with limited walking ability, while powered wheelchairs, with some exceptions, are typically provided to persons with more severe impairments (problems in body function or structure such as organs, limbs and their components [1]) [2]. Both types of equipment hereafter will be denoted as powered mobility devices. This study investigated the effectiveness of powered mobility devices in daily life among adults with mobility restrictions in the Nordic context (Denmark, Finland and Norway).

The cost of powered mobility varies between different countries. For example in Norway in 2013, 6.10 Euros per inhabitant were spent on powered mobility devices [3]. Since many resources are being spent on these devices there is a need to know the outcomes of these interventions. Moreover, as public and private funding agencies begin to demand evidence of effectiveness to support the provision of them, knowledge about their effectiveness is required [4, 5]. In this study, effectiveness is understood as the degree of impact an assistive device has on the user's ability to function in daily life [6], and activity and participation can be considered as effectiveness dimensions [6, 7]. Activity is defined as the execution of a task or action by an individual, and activity limitations are difficulties in executing such activities. Participation is understood as involvement in life situations, while problems an individual may experience in involvement in such situations are denoted participation restrictions [1, 8].

There is a lack of research on effectiveness, especially regarding constructs of participation [9] such as mobility-related participation [10], which for example can be investigated in terms of frequency and ease/difficulty of mobility during participation in daily life [11].

During the latest decade, some studies have reported on the effectiveness of powered mobility devices. Two systematic reviews concluded that the devices impact positively on mobility, activity and participation [12, 13]. The devices were most frequently used for shopping, going to malls or large discount stores and visiting friends [14, 15], or had a positive effect on activity and participation within social and civic life among users [16]. Increased frequency of going for a walk, and that shopping, walking and visiting friends/family became easier were also reported [17]. Similar results were shown by others [18, 19]. Due to relatively small samples sizes, sub-group analyses were not feasible. Therefore, larger studies with prospective designs and well-defined user groups are required to provide evidence of the long term effects of powered mobility devices [17-20]. Studies are needed to investigate where the devices are being used, how frequently they are used, and who benefit the most from using the powered mobility devices [5, 18].

Based on previous research and focusing on adults with mobility restrictions, the objective of this study was to investigate the effectiveness of powered mobility device interventions in terms of mobility-related participation after one year use, in the Nordic context. We hypothesized that powered mobility device interventions are effective regarding

1) increased frequency in specific aspects of mobility-related participation
2) perceptions of easier mobility during mobility-related participation
3) increased number of mobility-related participation aspects performed

in daily life in a one year period. Further, we hypothesized that positive effects differ according to age, gender, living situation, national context, type of powered mobility device, and self-reported health.

Materials and methods

The study was part of a larger Nordic project on powered mobility device outcomes with a prospective (before-after) design, involving participants from Denmark, Finland and Norway. In these countries the legislation entitles persons having physical impairments to receive a mobility device, mostly free of charge, given they can use it safely, and the device is evaluated by rehabilitation therapists as appropriate and necessary in order to participate in daily life [8].

Sample

Based on experiences from earlier studies the aim was to recruit a sample of 55 participants per country [21]. The inclusion criteria were persons who (a) were about to receive a powered mobility device for the first time, where the decision to provide the device had been made on basis of eligibility criteria, but the device had not been delivered, (b) were 18 years of age or older, (c) had sufficient cognitive capacity for participation in interviews (based on the case managers' prior and present knowledge about the participants), and (d) were living in non-institutionalized settings, including adapted dwellings. Persons who had been exposed to recent injuries or accidents or had progressing diseases like amyotrophic lateral sclerosis were excluded. For details of the recruitment, see Figure 1. Before the participants received their powered mobility devices, assessments, selection of model, driving tests, adaptation of the devices (if needed) and necessary housing adaptations were completed [22].

Insert Figure 1 about here.

Procedures

Eligible participants were invited to take part in the study by local occupational or physical therapists acting as case managers (in Denmark and Finland) or study interviewers (in Norway). Participants were recruited consecutively as their application for a powered mobility device was accepted, and those who agreed to participate in the study received written information as well as a letter of consent which they signed and returned before the study started. The participants were recruited from the municipality of Odense in Denmark (May 2009 - December 2011), from ten of 20 assistive technology centres in Finland (February – December 2011) and eight of 19 counties in Norway (May 2009 - February 2012).

In Denmark and Finland the interviewers were not the same persons as those who recruited the participants. In Denmark six, in Finland 15, and in Norway 12 experienced occupational therapists or physical therapists completed the interviews. The interviewers attended a one day training course before baseline and follow-up, led by the national coordinators (the last author in Denmark, the third author in Finland, the first author in Norway). Guidelines for data collection were distributed to all the interviewers. The case managers or interviewers coordinated the interviews and assured the quality of the data collection in Finland and Norway, while in Denmark this was done by the local study coordinator. In addition, the national coordinators did proof readings and ensured that the data entry into the statistical software was correct.

Each informant was interviewed face-to-face at home visits by the same interviewer. However, in Finland some of the interviews were accomplished at an assistive technology centre. The baseline interview took place shortly before the participants received their powered mobility devices and the follow-up interview about one year later (mean 386.9 days 95%CI=283.4-490.4). Each interview lasted between 45 and 60 minutes – the variation being due to the participants' different need of time before giving a response to the items. In order to reduce researcher bias [23], none of the interviewers collected data from their own clients.

Ethical considerations

All principles of ethical guidelines for human research were followed. All the participants gave informed written consent and were guaranteed anonymity and confidentiality. According to current national legislation, a formal ethical approval was not necessary in Denmark, but permission to store personal data was granted by the Danish Data Protection Agency. In Finland the larger project was approved by the Ethical Council of the Hospital District of Helsinki and Uusimaa (Record no: 417/13/03/00/09). As the study was part of the routine follow-up activities of the Norwegian Labour and Welfare Service a formal ethical approval was not necessary, but the Norwegian Data Inspectorate was informed (Registration number 40030).

Instrument for data collection

The data was collected before (baseline) and after (follow-up) provision of powered mobility devices by means of the Nordic mobility-related participation outcome evaluation of assistive device intervention (NOMO 1.0) focusing on mobility-related participation [10]. The structured NOMO 1.0 interview format is to be used by means of a face-to-face interview. It was developed based on the International Classification of Functioning, Disability and Health ICF [1], and has been tested for content validity and test-retest reliability with satisfactory results (substantial to almost perfect) [21]. The instrument and a manual are available in four Nordic languages. The NOMO 1.0 consists of a descriptive part A (background variables) and an outcome part B consisting of 24 items representing four dimensions: need for assistance (four items; because data on these are not considered as part of mobility-related participation, they are not presented in this study), frequency and ease/difficulty of mobility-related participation (20 items), and number of participation aspects performed. The items of the frequency dimension are rated on an eight-point ordinal scale ranging from “daily” to “never”, while those of the ease/difficulty dimension are rated on a five-point ordinal scale ranging from “very easy” to “very difficult”. In addition, a “does not know” response option is available. Also, “does not wish to answer” and “reason unknown” response options are available to the items of both dimensions.

The NOMO 1.0 consists of a baseline and a follow-up version with an identical part B [21]. The NOMO 1.0 does not provide a total score. For details of the NOMO 1.0, see Table 1. In addition to the NOMO 1.0 items, at follow-up a question was asked about changes in health condition and social events between the two interviews.

Insert Table 1 about here.

Data analysis

Ninety-four participants had experienced changes related to their health, medication and/or family relations (divorce, new partner, marriage, bereavements) between baseline and follow-up. However, we did not consider these changes to influence on the effectiveness of the powered mobility devices. Consequently, they were included in the study. There were national differences in relation to, for example, age and type of powered mobility device, but since such differences reflect clinical reality, the national samples were analysed together (see Table 2).

The numbers of "does not wish to answer" and "does not know" responses were acceptable [24] (varied between 0-4 for the items at baseline and between 0-2 at follow-up). As these response options were not part of the NOMO 1.0 ordinal scales they were excluded from the analyses. In order to prepare the data prior to analysis, to describe the changes in the number of mobility-related participation aspects performed during the study period, the number at baseline and follow-up was computed for each informant.

Descriptive statistics were used to characterise the national samples, the total sample and participants lost to follow-up. One-way Anova or the t-test was used to analyse national differences and differences between the total sample and participants lost to follow-up regarding age, number of self-reported impairments (both normally distributed), and self-reported health. The Mann-Whitney U-test or Kruskal-Wallis' test were used for ordinal data to investigate differences between the national samples, between the total sample and those lost to follow-up.

Descriptives were calculated for frequency and ease/difficulty of mobility-related participation at baseline and follow-up, including the number of participants who reported that they were engaged in various aspects of participation. Changes in ease/difficulty over time were divided into three groups: participation became easier, unchanged, or more difficult.

The sign test was used to analyse differences in frequency and ease/difficulty in participation between baseline and follow-up. For items with significant differences, a further sign test was used to analyse differences concerning the following sub-groups: age groups (<61 years, 61-79 years, >79 years), gender, living alone or not, national context, type of powered mobility device, and self-reported health. For items with significant differences, the effect size was calculated as the mean change of scores, divided by the standard deviation (SD) of the baseline scores. An effect size of 0.20 is generally considered as small, 0.50 as moderate, and an effect size of 0.80 is considered as large [24]. Finally, for the number of aspects (normally distributed) performed, means and 95%CI were calculated for the total sample, and the t-test was used to analyse differences between sub-groups at baseline and follow up. The effect size was also calculated. The 95%CI for the effect size was based on Hedges and Olkin's (1985)[25] formula for calculating the variance for the theoretical sampling distribution of the effect size.

The SPSS, edition 19, was used for all statistical analyses. The level of statistical significance was set to $p \leq .05$, but due to the high numbers of statistical tests performed, Bonferroni corrections were applied [26] for the frequency and ease/difficulty items ($p \leq .0025$).

Results

Of 248 participants, 54 were lost to follow-up because they did not want to participate (n=10), were too ill (n=9), were hospitalized (n=4), were deceased (n=10), other reasons (n=8) or no reason were given (n=13). In order to diminish bias due to changing physical environments, participants who had moved to a different house/flat during the study period were also excluded (n=14), leaving 180 participants for the study.

The mean age of the sample (N=180) was 68.7 (95% CI=39.9-97.5) years. The great majority (n=149) of the participants had been provided a powered mobility device for outdoor use, and most (n=148) used a scooter. The participants using a powered wheelchair were younger than those using a scooter, with mean age of 63.1 and 69.9, respectively (p=.017). At baseline, the mean number of self-reported impairments was 4.2, with more impairments among powered wheelchair participants compared to those using a scooter, with mean number of 5.0 and 4.1, respectively (p=.027). Participants younger than 61 years had more impairments (mean=5.0) compared to the age group 61-79 years (mean=4.0) and those older than 79 years (mean=3.9) (p=.008), though there was no difference in self-reported health. Further, relatively more participants of the youngest age group (n=34) lived with another person compared to those aged 61-79 years (n=35) and those older than 79 years (n=20, p=.003). Except from poorer self-rated health and more powered wheelchair users, those lost to follow-up did not differ from the sample followed. Demographic and health data are presented in Table 2.

Insert Table 2 about here.

At follow-up compared to baseline, the frequency of mobility-related participation increased for the total sample in terms of *shopping groceries* (p<.001; effect size=0.29, 95% CI=0.08-

0.50) and *going for a walk/ride* (p<.001; effect size=0.62, 95% CI=0.41-0.83). The frequency of both aspects increased for participants aged 61-79 years, men, the Danish sample, and those using scooters (p=<.001). There were no changes in frequency for the remaining 18 aspects. For details, see Table 3 and Table 4.

Insert Table 3 and Table 4 about here.

Concerning perception of ease/difficulty in mobility during mobility-related participation, eight aspects became easier to perform over the one year study period: mobility when *visiting restaurants/cafes/pubs*, *shopping groceries*, *other shopping*, *posting letters*, *going to the bank, the chemist's, going for a walk/ride*, and *visiting family/friends* (p=<.001 to p=.001). The aspects were easier to perform for about half of the participants (varied between 44.9-73.7% of the participants), and the effect size varied from moderate (other shopping=0.50, 95%CI=0.29-0.71) to large (going for a walk/ride=0.85, 95%CI=0.63-1.07). No activities became more difficult. *Shopping groceries, going for a walk/ride,* and *visiting family/friends* became easier for most of the sub-groups. For details, see Table 3 and Table 4.

At follow-up and compared to baseline, the change in number of mobility-related participation aspects performed varied between -6 and +10. The mean increase was 0.64, that is, from 10.11 (95% CI=1.90-18.32) participation aspects at baseline to 10.75 (95% CI=3.25-18.25) at follow-up (p<.001), but the effect size was small (0.15, 95%CI=-0.05-0.35). Participants aged 61-79 years, Danish participants and those with poor self-reported health increased their number of participation aspects at follow-up compared with baseline. For further details, see Table 4.

Discussion

Supporting our hypothesis the results show that powered mobility device interventions do make mobility easier, and also that such interventions may increase the frequency and number of mobility-related participation aspects performed by powered mobility device users, although not to the same extent. In spite of the fact that previous research has shown that assistive devices give easier access to the community [15], only minor increases of participation frequency and the number of mobility-related aspects were found. In fact, the mean increase of less than one participation aspect performed rather indicates maintenance of participation aspects in daily life rather than a real increase. Furthermore, our findings showing variations concerning sub-groups support our hypotheses. That is, based on positive changes for more participation aspects, men, scooter users and users with poor self-reported health seem to benefit most from the powered mobility device interventions (see Table 4).

Some of the results support previous research on powered mobility devices, for example increased frequency of *shopping groceries* [14] and *going for a walk/ride*, and that mobility became easier for some participation aspects [17, 27]. The powered mobility devices increase mobility-related participation in daily life among adults with impairments [10, 14, 16-20]. It may therefore be concluded that the devices seem to be effective and relevant for the users in a rehabilitation perspective.

The fact that the frequency of *shopping groceries* and *going for a walk/ride* increased supports findings by Löfqvist et al. [17], and Hoenig et al. [14], who reported similar results after powered mobility device interventions. One potential limitation as to why the frequency of participation did not increase for more aspects in the present study may be that people provided with the equipment did not rely on the device in daily mobility. Another reason may be that adults have defined roles in daily life and usually continue to do what they previously have been doing. Research by Auger et al. (2010) and Hoenig et al. (2007) has concluded that the powered mobility device use has a relatively small impact on life-space mobility because frequency changes happen mostly at home or near neighborhood [11, 19]. Our findings seem to support the latter. Moreover, as existing research literature has concluded that *shopping groceries* and *going for a walk/ride* are the only aspects that usually increase in frequency after powered mobility device provision, an increase in more participation aspects may not be expected [14, 15, 17, 20] . On the other hand, unlike the findings of Löfqvist et al. [17], we found a small but significant increase in the number of participation aspects performed after the provision of powered mobility devices. However, the changes varied considerably among the participants, and the effect size was small (0.15). In contrast, an increase of up to ten aspects performed for some of the participants was less than the increase of 16 new aspects as reported by Pettersson et al. (2006) [16]. This difference may be due to the fact that they used an entirely different outcome assessment instrument allowing spontaneous identification of aspects, which the NOMO 1.0 does not offer.

The results of the present study indicate that men benefit more from powered mobility device use than women, which supports previous research (see Table 4) [10, 19]. Post hoc analysis at both baseline and follow-up showed a tendency for women to perform all the participation aspects more frequently than men, even though the differences were not significant for all the aspects ($p<.05$ for 14 of 20 aspects at baseline and 11 of 20 aspects at follow-up). Concerning *going for a walk/ride* there were no gender differences neither at baseline nor follow-up. Both men and women increased the frequency of this aspect, indicating that both genders benefited equally much from the powered mobility device use in this respect. However, at baseline women were *shopping groceries* significantly more frequently than men ($p=.002$), while at follow-up there were no significant gender differences, indicating that the powered mobility device use had a greater impact in terms of increased frequency on men compared to women when shopping groceries. Post hoc analysis at baseline and follow-up of the items of the ease/difficulty scale showed no significant gender differences. Still, compared to the women there was a tendency that mobility became easier for men between baseline and follow-up, resulting in significant differences in more participation aspects compared to women. For example, at baseline 32.5% of the men rated that *going to the bank* was “very easy” or “easy”, while at follow-up 61.7% gave the same responses. The corresponding figures for women were 29.5% at baseline and 48.3% at follow-up. Similar figures were found for the *going to the chemist’s* and *other shopping* items. However, in order to obtain reliable knowledge about powered mobility devices and gender differences, further studies are needed.

The finding that the impact of the powered mobility devices seems to be larger for people aged 61-79 years than for the other age groups (see Table 4) may be explained by the fact that a larger percentage of these participants lived alone compared to those in the youngest age group. Thus, they presumably had less people to assist them in aspects such as buying groceries, other shopping, going to the chemist’s, etc. Concerning participants younger than 61 years, more powered wheelchair users and more health problems compared to others may have made them more dependent on the person(s) they lived together with. Therefore, the powered mobility device use may have had relatively little impact on the youngest age group’s participation aspects. Furthermore, the oldest age group did not seem to benefit from the powered mobility device intervention to a great extent. Previous research has shown that very old users are less active using their powered mobility devices than younger users [10]. In fact, Brandt et al (2004) showed that the probability that age-group 77-92 years would use their powered wheelchair frequently was 3-4 times less than the younger age-groups, which may be explained by the fact that very old people often loose their capability and interest in performing different aspects in daily life [28].

A noteworthy strength of the present study is the prospective design, the 1-year follow-up, and that the sample was diverse and large enough to allow for valid sub-group analyses, although a larger sample of participants would allow for an even more powerful sub-group analysis. Normally, a large sample size will identify a small change as significant and increase the possibility for a type 1 error, i.e. rejecting the null hypothesis when it is wrong to do so. However, except for the frequency of shopping groceries and number of participation aspects, the effect sizes were moderate to large for the other aspects with positive changes at follow-up compared to baseline. While the present study shows that there are positive effects of being provided a powered mobility device, depending on life-style and prevalence of related health problems such as obesity, in some countries there is a debate about whether using such devices might have adverse effects. However, in the Nordic context this is not relevant as more or less all such equipment is provided after a thorough assessment effectuated by skilled rehabilitation professionals, and mostly publicly financed. Thus, in cases where the professional assessment shows that a powered mobility device is not appropriate for one or another reason, alternative of complementary interventions are suggested.

Unlike the study by Hoenig et al (2007) [14] and Auger et al (2010) [17] with similar results, our study was a before and after comparison and not a randomized controlled trial, which may be considered as a study limitation [29]. However, a controlled design would require providing assistive devices to some users and not to others, and since the legislation in the Nordic countries entitles persons with disabilities to assistive devices mostly free of charge [8], such research is not possible for legal and ethical reasons [30]. Furthermore, according to

Djulbegovic and Hozo (2002) [30] randomized controlled studies should be undertaken only if there is substantial uncertainty about which intervention would benefit a person the most. With few exceptions we found moderate to large positive changes after powered mobility device provision. Since the results from previous research is pointing in the same direction, there can be no substantial doubt of the effectiveness of powered mobility devices regarding mobility-related participation in daily life [31].

Compared to those who participated in the study, the fairly high number of participants not possible to follow (n=68, 27%) may be considered as a study limitation. In fact, 54 (22%) did not participate in the second interview because they did not want to, were too ill, hospitalized, deceased or other reasons, while 14 participants were excluded from the study due to having moved to a different environment. On the other hand, except from rating their health as poorer and using powered wheelchairs to a greater extent those lost to follow-up did not differ from the sample followed (see Table 2).

A possible limitation of the study may be the one year period between baseline and follow-up because of increased risk for negative incidences during the period that may have influenced on the results. A previous study (southern Sweden) showed that a 4-month follow-up interval gave the same results as a one year follow-up [17]. However, considering the seasonal weather variations in the northern parts of the Nordic countries, we considered it important to collect data at both baseline and follow-up during the summer/autumn. To avoid snow/ice conditions at the time of one of the interviews, a one year follow-up period was chosen. On the other hand, more than one-year follow-up period may be considered a strength of the present study as Gitlin et al. [32] defined the initial six months after powered mobility device provision corresponding to an initial use period, while the stage beyond the first year delineates expert use. We consider that expert use is necessary for a valid evaluation of the effectiveness of powered mobility device interventions.

The lack of data on housing type and information about outdoor environmental barriers such as high curbs, uneven pavements, hills etc, may be considered a study limitation. Environmental barriers may have caused accessibility problems, possibly contributing to the explanation of the variation in number of participation aspects performed [10]. Edvards et al. (2010) [15] concluded that less than two thirds of the participants agreed that they could access most locations when using their powered mobility device, indicating the presence of barriers to some participants. On the other hand, Evans et al (2007) [18] reported that reasons for infrequent use did not relate to environmental barriers. Brandt et al (2004) [10] concluded that apart from visiting family and friends, physical barriers did not play a pronounced role in performing other participation aspects. One explanation may be that the users have adapted their behavior by using routes without physical barriers or by going to accessible places rather than to places they would like to go [33]. In contrast to public facilities such as shops, banks etc., there are no alternatives concerning the specific homes of family and friends. In our study, as users who had moved to a different house/flat between baseline and follow-up were excluded from the analyses, the environment was considered to be a stable factor during the one year study period. Still, future studies should account for environmental factors.

The number of interviewers may also be a study limitation because interviewers with different levels of experiences from using standardized instruments could have influenced the variance error. On the other hand, the interviewers in this study were all trained to perform the interviews, and there was no information indicating that the interviews were performed in a sub-optimal way of differently in the three countries. For scientific purposes it is preferred to have a small number of trained interviewers in order to maximize reliability, the fact that the present study had many interviewers simply reflect the complex clinical reality. That is, since the NOMO 1.0 will be used by numerous interviewers and not only in ideal research circumstances by trained researchers, the number of interviewers may be considered a strength [34].

In future research there is a need to compare study results intentionally requiring use of the same outcome assessment instruments. However, there is a lack of consensus regarding which instrument to use. Instruments such as the Functional Mobility Assessment (FMA) [35] and the Assistive Technology Outcome Measure (ATOM) [36] are for instance being used in some regions, but they are not available in Nordic languages or psychometrically tested in Nordic contexts, and likewise the NOMO 1.0 has not been translated into English or been psychometrically tested in other cultural contexts.

Even though the NOMO 1.0 proved to be instrumental in the present study, further psychometric testing is part of the ongoing larger project. The NOMO 1.0 was constructed about ten years ago, and some of the items may not be as relevant today. For example, in today's highly computerized society people probably do not visit the bank or post letters as often as before. Consequently, further validity studies of the instrument are required.

Conclusions

Powered mobility devices contribute to mobility-related participation by making participation aspects easier for people with mobility restrictions

Powered mobility devices increase the frequency of shopping groceries and going for a walk/ride

Men, scooter users, and users with poor self-reported health seem to benefit the most from the use of powered mobility devices

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Conflict of interest

The authors declare no conflict of interest.

Table 1. *Part A and B of the NOMO 1.0**

	Part A		
	Demographics		
	Types of mobility devices used		
	Means of transportation		
	Functional limitations / self-reported health		
	Living arrangements and housing		
	Important events after baseline interview (asked at follow-up)		
	(the above items are suggestions, not mandatory)		
	Part B		
Item no	How much assistance do you need from other people when:	Need for assistance, four point ordinal scale**	
B1	You move about indoors at home?	1 2 3 4	
B2	You move in and out of your home?	1 2 3 4	
B3	You move about indoors in other houses and buildings than your home?	1 2 3 4	
B4	You move about outdoors?	1 2 3 4	
Item no	How often do you:	Frequency of mobility-related participation, eight point ordinal scale*** and "does not know"	Ease/difficulty in mobility when performing activity 1-20, five point ordinal scale**** and "does not know"
B5	Do kitchen work	1 2 3 4 5 6 7 8	1 2 3 4 5
B6	Do laundry	1 2 3 4 5 6 7 8	1 2 3 4 5
B7	Do cleaning	1 2 3 4 5 6 7 8	1 2 3 4 5
B8	Take care of children	1 2 3 4 5 6 7 8	1 2 3 4 5
B9	Go to a restaurant/cafe/pub	1 2 3 4 5 6 7 8	1 2 3 4 5
B10	Go to the hairdresser's	1 2 3 4 5 6 7 8	1 2 3 4 5
B11	Shop groceries	1 2 3 4 5 6 7 8	1 2 3 4 5
B12	Do other shopping	1 2 3 4 5 6 7 8	1 2 3 4 5
B13	Post letters	1 2 3 4 5 6 7 8	1 2 3 4 5
B14	Go to a bank	1 2 3 4 5 6 7 8	1 2 3 4 5
B15	Go to the chemist's	1 2 3 4 5 6 7 8	1 2 3 4 5
B16	Go to the library	1 2 3 4 5 6 7 8	1 2 3 4 5
B17	Do social activities/church	1 2 3 4 5 6 7 8	1 2 3 4 5
B18	Do culture/sport activities	1 2 3 4 5 6 7 8	1 2 3 4 5
B19	Do hobbies/physical activities	1 2 3 4 5 6 7 8	1 2 3 4 5
B20	Deliver/collect children	1 2 3 4 5 6 7 8	1 2 3 4 5
B21	Go for a walk/ride	1 2 3 4 5 6 7 8	1 2 3 4 5
B22	Visite family/friends	1 2 3 4 5 6 7 8	1 2 3 4 5
B23	work/study	1 2 3 4 5 6 7 8	1 2 3 4 5
B24	Do garden work	1 2 3 4 5 6 7 8	1 2 3 4 5

*This version consists of part A and B items of the NOMO 1.0 is for presentation purposes only and has not been translated into English according to scientific recommendations.

**Four point ordinal rating scale: 1=no help; 2=a little help; 3=some help; 4=much help. In addition, there were "do not wish to answer" and "reason unknown" response options. Need for assistance was not part of this study.

***Eight point ordinal rating scale: 1=daily; 2=several times a week; 3=about once a week; 4=several times a month; 5=about once a month; 6=several times a year; 7=about once a year; 8=never. In addition, there are "do not wish to answer" and "reason unknown" response options.

****Five point ordinal rating scale: 1=very easy; 2=Easy; 3=Neither easy nor difficult; 4=difficult; 5=very difficult. In addition, there were "do not wish to answer" and "reason unknown" response options. In addition, there are "do not wish to answer" and "reason unknown" response options.

Table 2. *Characteristics of the national samples and the total sample of powered wheelchair and scooter users (N=180), as well as characteristics of the informants not possible to follow (n=68)*

	Danish sample*, n=46	Finnish sample*, n=50	Norwegian sample*, n=84	Difference between the national samples, p-value	Total sample at follow-up, N=180	Informants not possible to follow, n=68**	Differences between the total sample and informants not possible to follow, p-value
Mean age in years (95% CI)	70.5 (45.2-95.8)	55.6 (32.5-80.7)	75.5 (52.8-98.2)	<.001	68.7 (39.9-97.5)	65.1 (32.4-97.8)	.088
Men, n (%)	23 (50.0)	16 (32.0)	47 (56.0)	.026	86 (47.8)	30 (45.5)	.834
Place of living, n (%)				.001			.239
city	23 (51.1)	20 (40.0)	28 (33.7)		71 (39.9)	33 (50.0)	
suburb	20 (44.4)	14 (28.0)	44 (53.0)		78 (43.8)	22 (33.3)	
rural area	2 (4.4)	16 (32.0)	11 (13.3)		29 (16.3)	11 (16.7)	
Living in ordinary housing	45 (97.8)	49 (98.0)	72 (85.7)	.010	166 (92.2)	58 (87.9)	.284
Living alone, n (%)	33 (71.7)	16 (32.0)	42 (50.0)	.004	91 (50.6)	35 (53.0)	.685
Powered wheelchair, joystick, n (%)	1 (2.2)	13 (26.0)	18 (21.4)	.005	32 (17.8)	27 (41.5)	<.001
Powered wheelchair, scooter type, n (%)	45 (97.8)	37 (74.0)	66 (78.6)		148 (82.2)	38 (58.5)	
Other mobility assistive devices (manual wheelchairs, wheeled walkers, crutches, canes), n (%)	44 (95.7)	47 (94.0)	65 (77.4)	.003	156 (86.7)	59 (89.4)	.776
Self-reported impairments, n (%)							
Reduced vision	11 (23.9)	8 (16.0)	20 (23.8)	.519	39 (21.7)	16 (24.2)	.722
Reduced hearing/deafness	6 (13.0)	3 (6.0)	24 (28.6)	.003	33 (18.3)	11 (16.7)	.703
Reduced balance and/or vertigo	17 (37.8)	33 (66.0)	40 (47.6)	.072	90 (50.3)	29 (43.9)	.324
Reduced endurance	29 (63.0)	29 (58.0)	34 (40.5)	.033	92 (51.1)	29 (43.9)	.388
Reduced function in arms	29 (63.0)	32 (64.0)	38 (46.3)	.034	99 (55.6)	35 (53.8)	.938
Reduced function in back and/or legs	43 (93.5)	48 (96.0)	67 (79.8)	.045	158 (87.8)	55 (83.3)	.360
Problems with coordination of movements	13 (28.3)	22 (44.9)	13 (15.7)	<.001	48 (27.0)	17 (26.2)	.616
Problems with movements of head/neck	6 (13.0)	6 (12.0)	17 (20.5)	.075	29 (16.2)	7 (10.8)	.509
Memory problems	7 (15.2)	10 (20.0)	18 (21.4)	.769	35 (19.4)	8 (12.1)	.180
Tiredness	25 (54.3)	26 (52.0)	34 (40.5)	.319	85 (47.2)	36 (54.5)	.491
Number of self-reported impairments, mean (95% CI)	4.3 (1.0-7.6)	4.7 (1.0-8.4)	4.0 (0.0-8.5)	.168	4.2 (0.3-8.1)	4.0 (0.3-7.7)	.501
Self-reported health, median (IQR)***	4 (3-4)	4 (3-4)	4 (3-4)	.555	4 (3-4)	4 (4-5)	.002

* Recruitment of informants; Denmark: municipality of Odense; Finland: from assistive technology centres in Kuopio, Tampere, Turku, Helsinki, Oulu, Hämeenlinna, Satakunta, Lahti, Seinäjoki, and South Carelia; Norway: from the counties of Østfold, Oslo, Hedmark, Oppland, Telemark, Vest-Agder, Rogaland, and Nord-Trøndelag.

** Informants who particpated at baseline, but not at follow-up.

*** Self-reported health rated on a 5-point scale: 1=excellent; 2=very good; 3=Good; 4=poor; 5=very poor.

Table 3. *The frequency of mobility-related participation and ease/difficulty of mobility before (baseline, T1) and after (follow-up, T2) provision of a powered wheelchair or scooter in the total sample, N=180*

	Frequency of mobility-related participation[a]						Ease/difficulty in mobility-related participation[b]						
Item	n	T1 median (IQR)	T2 median (IQR)	Changes between T1 and T2, p-value[cd]	Informants who performed activities at T1, n	Informants who performed activities at T2, n	n	T1 median (IQR)	T2 median (IQR)	Changes between T1 and T2, p-value[cd]	Easier at T2, n	Unchanged at T2, n	More difficult at T2, n
Kitchen work	180	1 (1-3)	1 (1-3)	.766	150	147	138	3 (2-4	3 (2-3)	.321	40	65	33
Laundry	180	4 (3-8)	4 (3-8)	.603	111	110	100	3 (2-4)	3 (2-4)	.204	29	46	25
Cleaning	180	6 (3-8)	6 (3-8)	.230	99	95	77	3 (2-4)	3 (3-4)	.499	17	40	20
Take care of children	180	8 (8-8)	8 (8-8)	.243	39	33	25	3 (2-4)	3 (2-4)	.287	9	11	5
Restaurant/cafe/pub	180	6 (5-8)	6 (5-8)	.043	119	126	109	3 (3-4)	3 (2-3)	**<.001**	53	35	21
Hairdresser's	180	6 (6-8)	6 (6-8)	1.000	132	130	120	3 (2-4)	3 (2-3)	.012	44	47	29
Shopping groceries	180	3 (2-8)	3 (2-5)	**<.001**	135	151	131	3 (3-4)	2 (2-3)	**<.001**	70	42	19
Other shopping	179	6 (5-7)	6 (5-7)	.615	137	151	128	4 (3-4)	3 (2-4)	**<.001**	62	44	22
Post	179	7 (6-8)	7 (6-8)	.911	92	95	76	3 (2-4)	2 (2-3)	**<.001**	36	30	10
Bank	180	7 (5-8)	7 (5-8)	.525	104	106	84	4 (2-4)	2 (2-3)	**<.001**	44	29	11
Chemist's	180	6 (5-8)	6 (5-8)	.450	108	113	99	3 (2-4)	3 (2-3)	**.001**	43	37	19
Library	180	8 (8-8)	8 (8-8)	.860	41	39	32	3 (2-4)	2 (2-4)	.091	16	10	6
Social activities/church	180	8 (4-8)	7 (4-8)	.906	86	92	68	3 (2-4)	2 (2-3)	.059	22	32	14
Culture/sport	180	8 (6-8)	8 (6-8)	.149	72	79	55	3 (3-4)	3 (2-3)	.004	25	21	9
Hobbies/physical activities	180	8 (3-8)	8 (3-8)	1.000	59	63	44	3 (2-4)	3 (2-3)	.019	18	19	7
Deliver/collect children	179	8 (8-8)	8 (8-8)	.065	12	10	8	4 (3-4)	3 (2-4)	.157	4	3	1
Going for a walk/ride	180	6 (2-8)	2 (1-4)	**<.001**	105	160	96	3 (3-4)	2 (2-3)	**<.001**	54	27	15
Visiting familiy/friends	180	5 (3-6)	5 (3-6)	.290	157	163	147	3 (3-4)	3 (2-4)	**<.001**	66	67	14
Work/study	180	8 (8-8)	8 (8-8)	1.000	13	14	8	3 (2-4)	3 (2-4)	1.000	2	5	1
Garden	180	8 (6-8)	8 (6-8)	.784	58	52	41	4 (3-4)	4 (3-4)	.690	14	16	11

[a]Response alternatives: 1=daily; 2=several times a week; 3=about once a week; 4=several times a month; 5=about once a month; 6=several times a year; 7=about once a year; 8=never.

[b]Response alternatives: 1=very easy; 2=easy; 3=neither easy or difficult; 4=difficult; 5=very difficult.

[c]The sign test.

[d]For frequency and ease/difficulty in mobility-related participation p≤0.0025 was considered significant.

Table 4. *The significant effects in a 1-year perspective of powered mobility device interventions in terms of increased frequency, easier mobility and increased number of participation aspects performed, N=180**

	n	Increased frequency of		Easier mobility when								Increase in number of
Items		Shopping groceries	Going for a walk/ ride	Going to restaurant/ cafe/pub	Shopping groceries	Doing other shopping	Posting letters	Going to the bank	Going to the chemist's	Going for a walk/ride	Visiting family/ friends	Partici-pation aspects
Groups												
Age-group <61 years	48		x									
Age-group 61-79 years	83	x	x		x			x		x	x	x
Age-group >79 years	49					x					x	
Men	86	x	x		x	x		x	x	x	x	
Women	94		x		x					x	x	
Living alone	91	x			x					x	x	
Living with others	89		x			x					x	
Danish sample	46	x	x							x	x	x
Finnish sample	50			x								
Norwegian sample	84		x		x			x		x	x	
Powered wheelchair	32		x	x	x					x		
Scooter	148	x	x		x	x	x	x		x	x	
Good self-reported health	72	x			x					x		
Poor self-reported health	107		x	x	x	x	x	x		x	x	x

* Bonferroni corrections were applied for all analyses (p<.0025), except for the changes in number of participation aspects (p<.05).

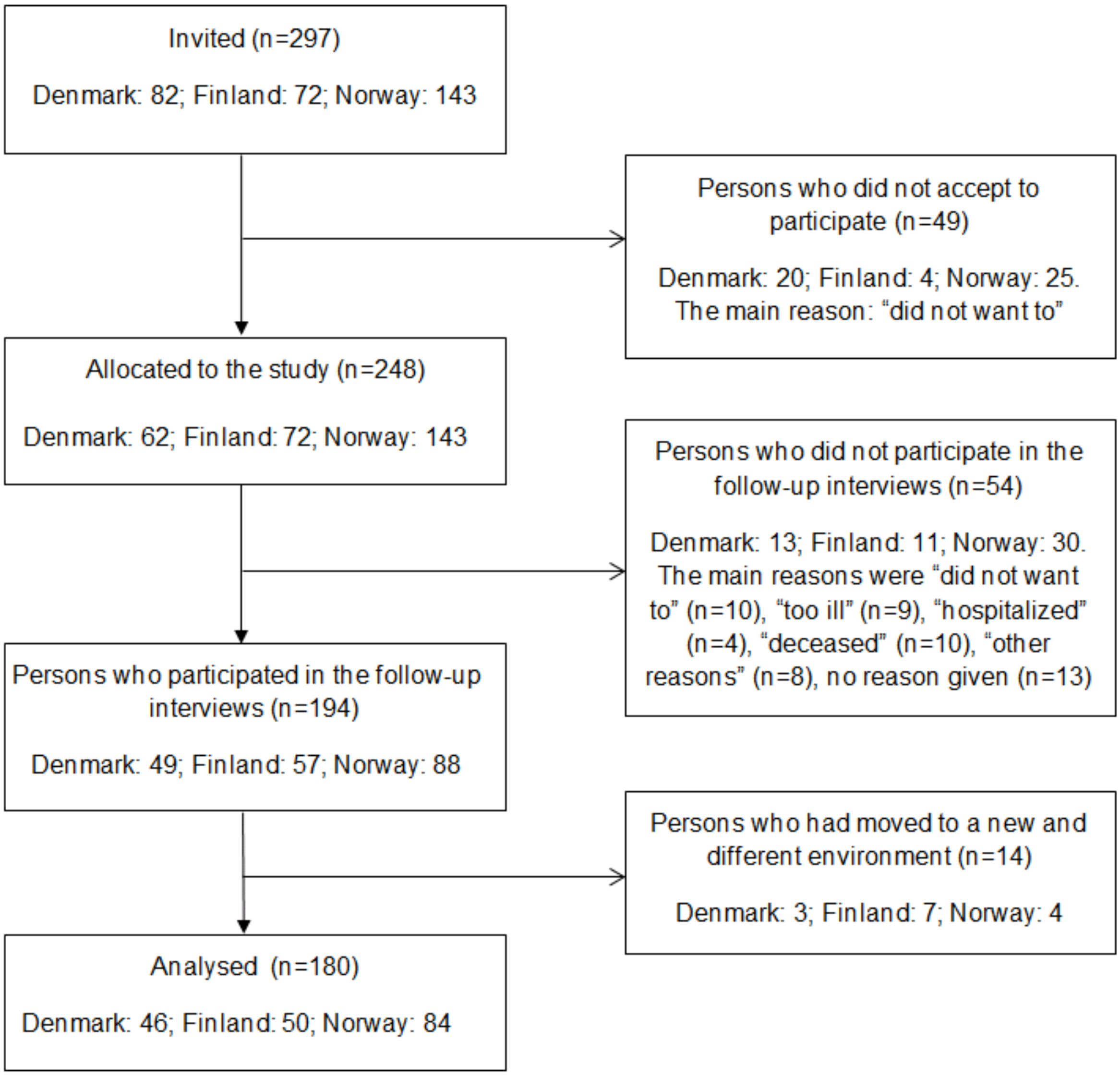

Figure 1. Informants from Denmark, Finland and Norway in the study.

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