Clinicians' and researchers' perspectives on manual wheelchair data loggers

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Abstract

Recent studies have employed data loggers to record a wide range of, sometimes differing, objective outcomes associated with the use of manual wheelchairs. To identify which outcomes are broadly perceived to be the most important to measure when objectively documenting manual wheelchair use, a cross-sectional survey was conducted with groups of researchers and clinicians in the field of wheeled mobility. We also surveyed the challenges these groups experienced when using data loggers. The survey was informed by a previous scoping review of the scientific and gray literature. Seventy-four people, with various academic and professional backgrounds, completed the survey: 57 researchers (77.0%) and 17 clinicians (23.0%). Regarding the importance they attributed to commonly measured outcomes, the most highly rated outcome identified by both groups was “distance traveled.” There were significant differences between the groups’ perspectives in rating and ranking the importance of “pressure-relief activities”, “seat pressure” and “acceleration.” In terms of challenges or barriers associated with the use of data

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loggers for monitoring manual wheelchair use, it appears that researchers and clinicians have relatively similar needs and preferences. However, only clinicians reported that the time they wanted to, or could, allocate to review recorded information was a potential hardship. Our hope is that these results will help further development and increase the functionality and applicability of data loggers for manual wheelchairs in research and clinical contexts.

Keywords

Manual wheelchair; Data logging; Survey

Wheelchairs are prescribed to facilitate independent mobility and promote social participation of individuals with mobility limitations. More than 65 million people use wheelchairs worldwide,¹ and there are nearly 198,000 manual wheelchair users in Canada.² To better understand the use and impact of manual wheelchairs, it is important to accurately document the characteristics and activity levels of wheelchair users in the community. Recent studies have increasingly employed electronic monitoring technologies (i.e. data loggers) to record objective driving outcomes and physiological characteristics of manual wheelchair users.³ However, the technologies used offer marked differences in their properties, especially regarding the measured outcomes.³ These disparities lead to discrepancies in the literature that may be confusing to clinicians and researchers alike. For instance, several systems can measure the same outcome, but because of their specific technical properties (e.g. frequency of data acquisition), the results obtained by each of them may be somewhat different and may, therefore, lead to different interpretations. To understand how these tools have been used to quantify and objectively assess manual wheelchair use thus far, a scoping review of the scientific and gray literature was completed.³ This review identified 119 papers that presented a wide variety of data logging systems and sensing technologies, measuring a wide range of outcomes. We briefly summarize the results below. Given the continuing improvements to relevant technologies, and as suggested in part by Hoenig *et al.* (2007),⁴ research and clinical contexts would benefit by understanding which outcomes are important to measure and how best to accomplish this.

As a first step to address this gap in the literature, we developed an online survey to query researchers and clinicians about which outcomes are considered most important when objectively documenting manual wheelchair use. We also wanted to explore the differences, if any, in the perspectives of these two groups. Finally, we documented some of the challenges researchers and clinicians may experience when using data loggers with manual wheelchairs.

METHODS

A cross-sectional survey was conducted with researchers and clinicians in the field of wheeled mobility. A survey is a “system for collecting information from or about people to describe, compare, or explain their knowledge, attitudes, and behavior”,⁵ and allows one to explore specific aspects of a situation.⁶ In this study, participants were included if they were a minimum of 18 years of age, fluent in English, had access to the internet, and were working and/or publishing in the field of wheelchair mobility. Researchers and clinicians

were recruited through: 1) emailing personal networks of the researchers, 2) emailing the main/corresponding authors of the 119 papers retained for our scoping review,³ 3) posting to listserves/online forums of organizations and special interest groups related to wheeled mobility (i.e. Rehabilitation Engineering and Assistive Technology Society of North America (AT-FORUM, Wheeled Mobility and Seating Special Interest Group), Miami Project, clinical faculties (e.g. occupational and physical therapy departments at the University of <<removed for blinding>>)), 4) online postings on relevant webpages (i.e. CanWheel (www.canwheel.ca), Rehabilitation Research Program (<http://www.rehabresearchprogram.com/>), International Collaboration on Repair Discoveries (<http://icord.org/>)), and 5) snowball sampling. The recruitment text included links and short descriptions of the online survey. After two weeks, a follow-up email was sent to individuals. Website forum postings were reposted weekly to ensure that they stayed in a visible location on the forum.

The first page of the survey included a section explaining the survey (e.g. objectives), potential risks and benefits of completing it, expectations and time required of the participants, and qualifications of the researchers. It also included a definition of a data logger to avoid different interpretations among the participants. The survey was pilot tested and then modified based on the feedback of five members of <<removed for blinding>>, a <<removed for blinding>> research team of over 20 members who are senior and junior level researchers, clinicians, and clinicians-researchers in wheeled mobility (see <<removed for blinding>>). The survey was created using Fluid Survey software (<http://www.fluidsurveys.com>, Ottawa, ON, CA).^a The study was approved by the Behavioural Research Ethics Board at the University of <<removed for blinding>>.

Demographic and Descriptive Characteristics

Demographic information collected from the respondents (see Appendix) included highest level of education, primary and secondary languages spoken, age, gender, and geographic location. Participants were asked if they identified as researchers or clinicians and answered a set of questions specific to their principal occupation (i.e. researcher or clinician). Information regarding researchers' primary work site, academic/professional background, research interests, and years of research experience (generally and specifically with a focus on manual wheelchair mobility) was collected. Clinicians provided details regarding their primary work site, years of clinical practice, and information regarding their clientele's age and primary diagnosis. They were also asked how many years of experience they had in clinical practice involving manual wheelchairs, number of clients they prescribed manual wheelchairs to in the last six months, and what types of manual wheelchairs they prescribed. Participants were asked questions related to their use of data logger technologies in the assessment of manual wheelchair use.

Mobility and Physiological Outcomes Measured

The survey was informed by a scoping review of the scientific and gray literature.³ Five databases were searched from January 1979 to June 2015: Medline, Compendex, CINAHL,

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EMBASE and Google Scholar. The review retained 119 papers that included a range of data logging devices, sensing technologies, and measured outcomes. In particular, the frequency with which studies measured each outcome was calculated. For the survey, only outcomes representing at least 2% of all the reported outcomes were included, that is to say those that were most frequently reported in the 119 retained papers.³ Based on the results of this scoping review, we divided these outcomes into two categories: mobility outcomes and physiological outcomes. The eight mobility outcomes surveyed were distance traveled in the wheelchair, mobility events, speed/velocity, acceleration, driving time, angular velocity, forces/torque/power, and pressure-relief activities. The four physiological outcomes were heart rate, respiration, seat pressure, and body temperature. Table 1 shows the definitions of each of these 12 outcomes (these definitions were also provided to participants). Participants were asked to rate the importance of these mobility and physiological related outcomes in their research and/or clinical practice on a scale from 0 (=not important at all) to 10 (=extremely important). Participants were asked to then rank all of these outcomes in order of importance from 1 (=the most important outcome) to 12 (=the least important outcome). Finally, they were invited to add any outcomes they felt were important, and that had not already been listed, and to rate/rank them (see Appendix).

Potential Challenges/Barriers in the Use of Data Logging Technologies

The final survey questions focused on potential challenges/barriers in collecting outcomes related to manual wheelchair use with data logging technologies. The barriers included: battery life (how long the technology should work without being recharged), installation time (how long installation should reasonably take), calibration time (how long calibration should reasonably take), data extraction (what is a reasonable amount of effort to exert in extracting the data), scan of information (how much time is reasonable to set aside in order to review summary data from the data logger), cost (how much the technology should reasonably cost), and weight of the system (how much a system should reasonably weigh). A brief definition of each of these challenges/barriers was provided to the participants (see Appendix). See Appendix for response options for each challenge/barrier identified. Participants were also asked to include any potential challenges/barriers that were not identified in the survey (see Appendix).

Analysis

The data were analyzed using descriptive statistics (percentages, means $\pm$ SD) to characterize the samples and calculate the frequency with which each response option was chosen by the participants (for the outcomes and challenges/barriers sections). For the responses concerning the outcomes measured by the data loggers, statistical differences between clinicians and researchers were analyzed using the rank-sum Wilcoxon test. The Bonferroni correction was applied, so the significant level was set to $p < 0.004$ ($0.05/12$ variables). Thematic analysis⁷ was used to analyze open-ended questions. More precisely, narratives were grouped into categories and codes were created. For example, when participants were asked if there were any other outcomes that they thought were important to capture that had not been mentioned in the survey, many different responses were obtained. Similar answers were grouped into themes where appropriate (e.g. stroke consistency, number of strokes, and kinematics of the shoulder were grouped together in the “characteristics of strokes” theme).

This process was realized by one coauthor, and another coauthor reviewed the work done. Any discrepancies were resolved via discussions, and any necessary adjustments were made. Survey responses were exported into Microsoft Excel 2010 (Microsoft Corporation, Redmond, WA).^b SPSS 13 (SPSS Inc., Chicago, IL)^c was used to calculate the statistical differences between the two groups.

RESULTS

Demographic and Descriptive Characteristics

Seventy-four people, with various academic and professional backgrounds, answered the survey: 57 researchers (77.0%) and 17 clinicians (23.0%). Researchers had 16.2 ± 9.7 mean years of research experience and 6.9 ± 6.6 mean years of research experience with a primary focus on manual wheelchair mobility. Clinicians had 17.9 ± 9.2 mean years of clinical experience and 15.7 ± 8.1 mean years of clinical practice involving manual wheelchair prescription. On average, in the six months preceding the survey, the clinicians prescribed a manual wheelchair to more than 17.9 ± 15.4 clients. Tables 2 and 3 present demographic and descriptive information in more detail.

Mobility and Physiological Outcomes Measured

When participants were asked to rate the importance of the 12 outcomes (on a scale from 0 to 10, where 10=extremely important), “distance traveled”, “mobility events” and “speed/velocity” were identified by researchers as most important (means of 7.5 ± 2.4 , 7.2 ± 2.4 and 7.0 ± 2.1 , respectively), while “pressure-relief activities”, “seat pressure” and “distance traveled” were identified by clinicians (means of 8.9 ± 1.4 , 7.9 ± 2.6 and 7.9 ± 1.7 , respectively) (Table 4). Statistically significant differences between the two groups were found for “pressure-relief activities” ($p < 0.001$), “seat pressure” ($p = 0.001$) and “acceleration” ($p = 0.003$) (Table 4).

When ranking the outcomes (from 1 to 12, where 1=the most important outcome), researchers and clinicians identified “distance traveled” as the most important outcome (means of 3.7 ± 3.0 and 3.2 ± 2.7 , respectively) and “body temperature” as the least important (means of 9.7 ± 2.9 and 10.4 ± 3.0 , respectively) (Table 5). Statistically significant differences between groups were also found for “pressure-relief activities” ($p < 0.001$), “seat pressure” ($p = 0.001$) and “acceleration” ($p = 0.001$) (Table 5).

Twenty-six participants (18 researchers and 8 clinicians) identified additional outcomes they felt were important to capture that were not listed in the survey. The following outcomes were mentioned by more than one individual: characteristics of strokes (e.g. kinematics of the shoulders, strokes consistency, etc.) ($n = 5$ researchers), location (indoors/outdoors) ($n = 3$ researchers), blood pressure ($n = 3$ researchers), measures of the environment (e.g. degree of slope) ($n = 1$ researcher and 2 clinicians), wheelchair skills (e.g. ability to get over physical obstacles) ($n = 2$ researchers), pain ($n = 2$ clinicians), and perceived exertion ($n = 1$ researcher and 1 clinician).

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^cSPSS Inc, 233 S Wacker Dr, 11th Fl, Chicago, IL 60606, USA.

Potential Challenges/Barriers in the Use of Data Logging Technologies

Participants were questioned about different options to overcome specific challenges or barriers encountered when using data loggers in their research or clinical practice. A notable descriptive difference between groups was that clinicians reported that the time they wanted to, or could, allocate to review recorded information was lower than that of researchers. Refer to Figure 1 for all preferred options of researchers and clinicians.

Some participants (n=20: 14 researchers and 6 clinicians) identified other potential challenges or barriers they felt were important to consider. The following were mentioned by more than one individual: the robustness and resistance of the system to weather exposure (n=4 researchers), the accuracy and reliability of the system (n=3 researchers and 1 clinician), the necessity for the system to fit different wheelchair models/cushions (n=2 researchers and 1 clinician), the necessity of extra time for therapists' intervention (n=1 researcher and 2 clinicians), and privacy and interaction with their current computer system (n=2 clinicians).

DISCUSSION

Researchers and clinicians had substantial experience, including in the field of manual wheelchair mobility, although they had varied academic and professional backgrounds. Regarding the importance they attributed to most measured outcomes in the scientific and gray literature, the most important outcome identified by both groups was “distance traveled”. Interestingly, in our earlier scoping review conducted on existing data logging work performed with manual wheelchairs,³ “distance traveled” was the most reported outcome in the 119 retained papers. More specifically, when we calculated the frequency with which studies measured each outcome, it represented 10.9% of all the outcomes measured. Since some of the participants surveyed were authors of these papers, in which “distance traveled” was frequently measured, it is likely that it was chosen by those respondents as being an important outcome. “Distance traveled” may have been that much measured because available technology is relatively simple and inexpensive. Moreover, mobility (including the “distance traveled”) is considered as a prerequisite for community participation and realization of meaningful activities (e.g. visit family and friends, shopping, etc.). For instance, Tolerico *et al.* (2007) found that users who are employed cover more distance than their peers who are unemployed.⁸ Also, the benefits of physical activity (e.g. propelling a manual wheelchair) on physical and psychological health status are well established.^{9,10}

Conversely, significant differences between clinicians' and researchers' perspectives were observed for “pressure-relief activities” ($p<0.001$) and “seat pressure” ($p=0.001$). These outcomes are very important for clinicians, with mean scores of 8.9 and 7.9, respectively, and much less so for researchers, with mean scores of 4.7 and 5.3, respectively. This disparity is also reflected in the rank attributed to these two outcomes: 3.5 and 4.8 for clinicians, respectively, and 7.5 and 8.3 for researchers, respectively. In the recent scoping review, “pressure-relief activities” and “seat pressure” represented only 1.8% and 4.4% of the total measured outcomes.³ These data highlight a significant discrepancy between the work performed in this research field and clinical interests or priorities. To improve the

utility and versatility of data loggers, there is a need to further consider clinicians' concerns, perhaps by integrating additional sensors that measure such outcomes, or improving existing systems that measure seat pressure. Another discrepancy between researchers' and clinicians' perspectives was the importance (rating and ranking) attributed to "acceleration", which has more importance for researchers. This is supported by the scoping review. This outcome represented 8.1% of the total measured outcomes.³

In terms of challenges or barriers associated with the use of data loggers with manual wheelchairs, clinicians and researchers have identified similar needs. The main difference between their perspectives is in the time they want, or can, allocate to review information collected. While clinicians want rapid access to this information (i.e. in less than 5 minutes), researchers identified no time limit. This disparity may reflect the differences in their reality (e.g. organizational boundaries, resources available) and the aims pursued by these two groups while using data loggers. Finally, the reimbursement of costs and the policy strategies that would be necessary for the introduction of data loggers in clinical practice has not been addressed in this study. Even with consumer devices for specific users (e.g. Fitbit), these are non-negligible aspects which could be further explored to ensure a successful adoption of such technology in clinical practice.

Study Limitations

Despite the considerable sample size, there was a substantial difference between the number of researchers and clinicians who completed the survey, but we were pleased to have participants from different backgrounds and contexts. However, the background of each participant certainly influenced his/her perception of the important outcomes to measure and the challenges faced when using a data logger. This may have been more problematic for the participants who were both a clinician and a researcher, whereby the answers may have presumably been skewed towards which perspective they were considering at the time. Similarly, a clinician-researcher and an engineer-researcher, who both identified as researchers, answered from very different perspectives. In this study, we did not explore the reasons behind the highlighted disparities in perspectives. Future research using interviews or focus groups may be more appropriate to document this aspect. Despite the fact that this survey was pilot tested and modified according to the feedback received, question comprehension remains a limitation intrinsic to self-report surveys. Participants may have misinterpreted some of the definitions provided for the outcomes and challenges/barriers. Regarding the challenges or barriers associated with the use of data loggers, the differences observed between the two groups were only descriptive. The number of participants for each response option was frequently insufficient for the performance of statistical analyses. It would have been necessary to make groupings of response options, which would not have been significant or appropriate in the context. Finally, although they constitute an important source of information, people with disabilities were not included in this study. Indeed, we think they could offer a unique perspective, which could be the subject of a separate study.

CONCLUSIONS

Data loggers are increasingly used to provide innovative and quantitative documentation of wheelchair users' activities by recording a variety of outcome measures. Existing outcome measurements might have been overly influenced by available technologies. Thus, we sought to identify what is most interesting to researchers and clinicians. These data can inform work with data loggers in the future, which will, hopefully, suffer less from technological limitations. As a first step in compiling this information, we developed an online survey study. The results demonstrate that although researchers and clinicians agree on the importance of some outcomes, such as "distance traveled", they disagree on others. The greatest group differences were found regarding pressure-relief activities and seat pressure. Clinicians attributed significantly more importance to these outcomes than researchers did. In terms of challenges or barriers associated with the use of data loggers for monitoring manual wheelchair use, it appears that researchers and clinicians have relatively similar needs/preferences, except for the time they want to, or can, allocate to review the information collected. The clinicians report that very limited time is available while the researchers do not. Our hope is that these results will help further development and increase the functionality and applicability of data loggers for manual wheelchairs in research and clinical contexts, as these systems have the potential to provide information on community participation and encourage compliance with clinical recommendations. As stated elsewhere, the development of a flexible, valid, and user-friendly system for the objective assessment of manual wheelchair use remains a challenge.³ A flexible data logging device that can measure an assortment of outcomes and integrate different commercial sensors, which makes it easier to measure specific variables, is potentially very promising for a variety of uses. In the future, technological developments and decreasing costs of data loggers and sensing technologies may make it possible to easily measure many significant outcomes.

Supplementary Material

Refer to Web version on PubMed Central for supplementary material.

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Figure 1.
Perspectives of researchers and clinicians to overcome challenges and barriers encountered

Table 1

Definitions of the proposed outcomes

Outcomes	Definitions
<i>Mobility outcomes</i>	
Distance traveled	Includes measures such as distance traveled in the wheelchair and maximum distance of continuous movement.
Mobility events	Includes measures such as counts of continuous segments of movement of the wheelchair, movement bouts or activity counts, duration of dynamic activities as a percentage of a 24-hour period.
Speed/Velocity	Rate at which the wheelchair moves or changes its position, continuously or averaged.
Acceleration	Rate of change of velocity or speed of the wheelchair.
Driving time	Includes such measures as time spent moving the wheelchair (i.e. pushing or wheeling), time spent operating a wheelchair, percent of time in the wheelchair spent wheeling and maximum time of continuous movement.
Angular velocity	Rate of angular displacement of the wheelchair or of the user (e.g. of the trunk).
Forces/Torque/Power	Includes measures of propulsion forces, torque, or power, total drag forces and contact forces over the hand's surface.
Pressure-relief activities	Includes measures such as frequency and duration of pressure relieving maneuvers (e.g. frequency of daily transfers, frequency of push-up).
<i>Physiological outcomes</i>	
Heart rate	Includes various measures of heart rate, peak heart rate, heart rate reserve, physical strain, etc. May be measured continuously or averaged. May be measured while propelling, while resting, or at all times.
Respiration	Includes such measures as respiratory rate, oxygen saturation, oxygen consumption (VO_2) and carbon dioxide production (VCO_2).
Seat pressure	Includes such measures as weight distribution and pressure maps of sitting postures. May be measured continuously or averaged. May be measured while propelling, while resting, or at all times.
Body temperature	Includes measures such as skin, aural, body surface, core temperature or heat storage.

Table 2

Demographic characteristics of the sample

Characteristics	Researchers (n=57)		Clinicians (n=17)	
	n	%	n	%
Gender				
Male	37	64.9	5	29.4
Female	19	33.3	12	70.6
No answer	1	1.8		
Age (years)				
18–24	1	1.7	0	0.0
25–34	14	24.6	4	23.5
35–44	17	29.8	6	35.3
45–54	16	28.1	4	23.5
55–64	4	7.0	3	17.7
65 and above	3	5.3	0	0.0
Prefer not to answer	2	3.5	0	0.0
Highest level of education				
Post-secondary college diploma/certificate	0	0.0	1	5.9
University undergraduate degree	2	3.5	2	11.8
Master degree	7	12.3	6	35.3
PhD degree	27	47.4	3	17.6
Post-doctoral work	20	35.1	0	0.0
Other	1	1.7	5	29.4
Country of residence				
United States of America	20	35.1	13	76.5
Canada	13	22.8	2	11.7
Netherlands	5	8.8	1	5.9
Australia	3	5.3	1	5.9
United Kingdom	3	5.3		
Spain	3	5.3		
Taiwan	3	5.3		
Brazil	2	3.4		
Other: Europe	3	5.3		
Other: Central America	2	3.4		

Table 3

Descriptive characteristics of the sample

Descriptive characteristics	n	%
Researchers' characteristics (n=57)		
Primary site of work		
University	37	64.9
Research center affiliated with a rehabilitation facility	8	14.1
Research center affiliated with a hospital	6	10.5
Other	6	10.5
Academic/professional background (qualitative answers)		
Engineering and computer science	22	38.6
Rehabilitation and rehabilitation science	19	33.3
Human movement science	18	31.6
Assistive technology, prosthetics, and orthotics	4	7.0
Gerontology	2	3.5
Other	8	14.0
Research interests/themes (check all that apply)		
Outcome and quantitative measurement	35	61.4
Wheeled mobility technologies	26	45.6
Wheelchair seating components and interventions	18	31.6
Assistive robotics and mechatronics	14	24.6
Seat pressure measurement	10	17.5
Wheeled mobility in developing countries	6	10.5
Postural support in wheelchairs	5	8.8
Wheelchair transportation issues	4	7.0
Other	17	29.8
Peer-reviewed publications which made use of a data logger		
Yes	36	63.2
No	21	36.8
Clinicians' characteristics (n=17)		
Primary site of work		
Rehabilitation centre	7	41.1
Hospital	5	29.4
Community-based practice	1	5.9
Long-term care facility	1	5.9
University	1	5.9
Other	2	11.8
Clinical practice area		
Occupation therapist	6	35.3
Physical therapist	6	35.3
Physician	1	5.9

Descriptive characteristics	n	%
Other	4	23.5
Use of data loggers in clinical practice		
Yes	1	5.9
No	16	94.1
Peer-reviewed publications which made use of a data logger		
Yes	2	11.8
No	15	88.2

Table 4

Importance* of retained mobility and physiological outcomes

Outcomes	Mean importance for researchers (SD)	Mean importance for clinicians (SD)	Mean importance, all participants (SD)	P value [rank-sum Wilcoxon test]
<i>Mobility outcomes</i>				
Distance traveled	7.5 (2.4); n=55	7.9 (1.7); n=17	7.6 (2.3); n=72	0.695
Mobility events	7.2 (2.4); n=54	6.4 (2.5); n=17	7.0 (2.4); n=71	0.231
Speed/Velocity	7.0 (2.1); n=55	6.7 (1.9); n=17	7.0 (2.1); n=72	0.564
Driving time	7.0 (2.4); n=55	5.8 (2.4); n=17	6.7 (2.4); n=72	0.080
Force/Torque/ Power	6.5 (3.0); n=54	6.2 (2.5); n=17	6.4 (2.8); n=71	0.605
Pressure-relief activities	4.7 (3.4); n=54	8.9 (1.4); n=17	5.7 (3.5); n=71	0.000
Acceleration	5.6 (2.8); n=55	3.5 (1.6); n=17	5.1 (2.7); n=72	0.003
Angular velocity	4.7 (2.8); n=54	3.6 (2.3); n=17	4.4 (2.7); n=71	0.143
<i>Physiological outcomes</i>				
Heart rate	6.6 (3.4); n=56	5.6 (2.2); n=17	6.4 (3.2); n=73	0.064
Seat pressure	5.3 (3.1); n=56	7.9 (2.6); n=17	5.9 (3.2); n=73	0.001
Respiration	5.3 (3.2); n=55	5.6 (2.3); n=17	5.4 (3.0); n=72	0.749
Body temperature	4.6 (2.9); n=55	4.6 (2.5); n=17	4.6 (2.8); n=72	0.947

* Importance: 0=not important at all, 10=extremely important

Table 5Rank^{*} attributed to the retained mobility and physiological outcomes

Outcomes	Mean rank for researchers (SD)	Mean rank for clinicians (SD)	Mean rank, all participants (SD)	P value [rank-sum Wilcoxon test]
Distance traveled	3.7 (3.0); n=51	3.2 (2.7); n=16	3.6 (2.9); n=67	0.469
Mobility events	4.5 (2.5); n=52	4.9 (2.4); n=17	4.6 (2.5); n=69	0.545
Driving time	4.4 (2.5); n=51	5.9 (2.9); n=17	4.8 (2.7); n=68	0.052
Speed/Velocity	4.8 (2.6); n=52	5.4 (3.5); n=16	4.9 (2.8); n=68	0.810
Force/Torque/ Power	5.9 (3.4); n=53	6.3 (2.9); n=16	6.0 (3.3); n=69	0.694
Heart rate	6.2 (3.4); n=51	6.7 (2.5); n=17	6.3 (3.2); n=68	0.722
Pressure-relief activities	7.5 (3.2); n=53	3.5 (2.3); n=17	6.5 (3.5); n=70	0.000
Acceleration	6.3 (3.2); n=53	9.2 (2.1); n=16	7.0 (3.2); n=69	0.001
Seat pressure	8.3 (3.4); n=52	4.8 (3.0); n=17	7.5 (3.6); n=69	0.001
Angular velocity	7.5 (2.6); n=50	8.9 (2.5); n=16	7.9 (2.7); n=66	0.049
Respiration	8.5 (2.8); n=50	7.8 (3.0); n=17	8.3 (2.8); n=67	0.289
Body temperature	9.7 (2.9); n=52	10.4 (3.0); n=17	9.9 (2.9); n=69	0.129

* Rank: 1=the most important outcome, 12=the least important outcome