Development and content validation of the Wheelchair Use Confidence Scale: A mixed-methods study

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Abstract

Background—Confidence in one's ability to perform a given task can be a stronger predictor of performance than skill itself. There are currently no measures to assess confidence with manual wheelchair use. The objective of this study was to develop and assess the content validity of the Wheelchair Use Confidence Scale (WheelCon-M).

Method—A two-phase mixed-methods design was used. Semi-structured interviews were conducted to generate items, followed by a Delphi survey for item selection. Persons who use a wheelchair, health care professionals, and researchers participated in both phases of the study.

Results—An 84-item WheelCon-M was developed based on the qualitative data. After the Delphi survey, a final 62-item WheelCon-M was composed of the following six areas (number of items per area): Negotiating the Physical Environment (33 items), Activities Performed Using a Manual Wheelchair (11 items), Knowledge and Problem Solving (six items), Advocacy (four items), Managing Social Situations (five items), and Managing Emotions (three items).

Conclusion—This paper reports the development and content validation of the WheelCon-M. As a scale to measure confidence with wheelchair use was not available prior to this work, clinicians now have a method of identifying individuals who have low confidence with wheelchair use.

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Introduction

A goal of the rehabilitation of persons who use a manual wheelchair is to promote independence with wheelchair use in order to enable participation in chosen daily activities. Low self-efficacy has recently been recognized as an invisible barrier to manual wheelchair use [1]. Defined as belief in one's ability to perform a given task, self-efficacy is the core of Bandura's Social Cognitive Theory [2]. It influences both choice of activities and motivational level, and also contributes to the attainment of knowledge and refinement of new abilities [2]. Although wheelchair use may seem straightforward, it can be quite complex, such as in situations where physical (e.g. curbs) or social (e.g. stigma) environmental barriers must be managed. The terms self-efficacy and confidence are often used interchangeably and will also be used interchangeably in this paper.

Self-efficacy is task specific and its measurement requires a domain-specific assessment tool [2]. Self-efficacy assessments have been developed for various aspects of mobility, such as the Ambulatory Self-Confidence Questionnaire [3] and the Activities-specific Balance Confidence Scale [4]. However, a validated tool to measure self-efficacy with manual wheelchair use does not exist. There is only one study in the literature that has assessed confidence with wheelchair use [5]. A study specific measure was used which asks about confidence in using one's wheelchair: at home, out of doors, in public places such as the grocery store or mall, and in unfamiliar places. The measure used was developed specifically for the study. It was not developed using stakeholders (e.g., persons who use a wheelchair or health care professionals) or according to Bandura's guidelines for developing self-efficacy scales [6]. Furthermore, it was not assessed in terms of its reliability or validity. As the only measure developed and available to date, this literature review confirmed the need for the development of an assessment to measure confidence with wheelchair use.

This study reports the development and content validation of a new self-efficacy measure, the Wheelchair Use Confidence Scale (WheelCon-M). Our intention was that this scale would be suitable for use with adults who use a manual wheelchair with any physical diagnosis across the continuum of care from initial rehabilitation to community reintegration.

Method

The WheelCon-M was developed using a two-phase mixed-methods, sequential qualitative-quantitative design [7]. Item generation was conducted using semi-structured interviews. Item selection was accomplished using a Delphi survey. The two phases will be described in sequence below. All procedures were approved by the University of British Columbia and Capital Health research ethics boards. Informed consent was obtained from all participants.

Item Generation

Recruitment—Purposive sampling was used to identify a group of experts that consisted of persons who use a manual wheelchair, health care professionals and researchers from eastern and western Canada. In order to be eligible for participation, persons who use a wheelchair were also required to have: been 19 years of age or older, lived in the community, used a manual wheelchair as their primary means of mobility, and had at least six months of experience using a manual wheelchair. They were recruited through a number of sources, including a research lab volunteer database, clinicians, and various organizations such as the Canadian Paraplegic Association that could recommend individuals who could speak about confidence with wheelchair use. Health care professionals and researchers were eligible to participate if they: were an occupational therapist, physical therapist, physiatrist, or researcher in the area of wheeled mobility and had at least three years of experience in working with clients who use wheeled mobility (clinically or in a research capacity). Participants from these groups were targeted on the basis of their reputation, as determined by factors such as clinical expertise, research activities, and publication record in the area of wheelchair use. An inability to speak and write in English was the only exclusion criteria for all groups.

Procedure—Use of in-depth qualitative interviews to generate items for the WheelCon-M presented a contemporary user-centered approach intended to illicit a broad spectrum of content so that important and novel items were less likely to be overlooked. The interviews, focused on determining situations where confidence is challenged with wheelchair use, were based on a semi-structured interview guide. A trained occupational therapist/researcher conducted all of the interviews either face to face or by telephone and interviews continued to the point of theoretical saturation [8]. All interviews were digitally recorded and transcribed verbatim.

Data Analysis—The interview transcripts were analyzed using a constant comparison approach [9] whereby data collection and data analysis occurred simultaneously. This process allowed emerging themes regarding confidence with wheelchair use in earlier interviews to be further explored and substantiated by participants in later interviews. The qualitative data analysis program NVivo8 was used to code the data and identify major themes.

WheelCon-M Development—A draft WheelCon-M was constructed based on both Bandura's guidelines for the construction of self-efficacy scales [6] and the interviews with experts. The guidelines informed the development of the scale in terms of the instructions, the response scale, and format. More specifically, the instructions are formatted to ask the respondents about their level of confidence 'as of now', the response scale used the 100-point scale ranging in 10-unit intervals, the items were phrased in terms of 'can do' rather than 'will do', and the items were organized according to gradations of challenge. The interviews (as well as the authors' knowledge of the area) served as a conceptual analysis of the domain of wheelchair use and the information gathered during the interviews informed the generation of the items. Essentially all reported confidence challenging situations related

to wheelchair use were included in the draft WheelCon-M to ensure the development of a comprehensive scale.

Item Selection

A three Round Delphi survey was used to generate consensus on the content of the draft WheelCon-M among a panel of experts. As the draft scale was completed during the interview phase, it was deemed that three rounds would suffice to reach adequate consensus and would minimize participant burden. Consensus was operationally defined as 70% [10].

The Expert Panel—The expert panel for the Delphi survey consisted of all interview phase participants, plus 14 additional persons who use a wheelchair and researcher experts recruited using the same strategies and inclusion/exclusion criteria. Persons who use a wheelchair were added to expand upon their views, while additional researchers were added to contribute a stronger measurement perspective to the item selection process. A total of 43 experts agreed to participate in the Delphi survey. We believe this group of individuals is a representative sample of experts in the area of wheeled mobility and/or confidence.

Delphi Questionnaire Development and Distribution—Two versions of the questionnaire were developed: a paper copy distributed via mail and an online version distributed using Survey Monkey. Only the format of the questionnaires differed, the content was the same. A small pilot study was conducted for both versions (n=5 for each) and minor modifications were made based on the feedback received. Questionnaires were distributed to the expert panel using the method of their choice. Experts were asked to complete the questionnaire within seven days. Reminders were sent two days before the upcoming deadline, by email for those participants completing the online version and by phone for those completing the paper version. Non-responders were sent reminders the day after the deadline and again a few days later. Those respondents who did not complete the survey after the reminders were dropped from the study.

Round One—The Round one questionnaire contained: (1) written instructions explaining how to evaluate the scale; (2) a brief overview of the rationale for developing the WheelCon-M; (3) a copy of the WheelCon-M itself for the experts to complete prior to giving feedback; (4) evaluation forms for rating the WheelCon-M instructions, response scale and items; and (5) space for rewording suggestions or general comments in all of the evaluation sections and space for suggestions for items missed at the end of the questionnaire. Experts rated clarity of instructions using 'yes'/'no' response options. For the 0 ('not confident') –100 ('completely confident') response scale, experts rated the number of response options and anchor descriptors using a four point system ('strongly disagree' to 'strongly agree'). Experts also rated the WheelCon-M items in terms of: (a) their relevancy to measuring confidence with wheelchair use ('not relevant', 'somewhat relevant', 'quite relevant' and 'very relevant'), (b) the ability of the items to discriminate between individuals with high and low confidence ('not well', 'somewhat well', 'quite well', 'very well'), and (c) whether or not the items were clearly worded ('yes' or 'no').

Round Two and Round Three—The Round two and three questionnaires contained: (1) instructions; (2) a reminder of the rationale for developing the WheelCon-M; (3) a flow-chart to show the process for retaining or removing items in the subsequent round; (4) items to be re-rated from the previous round; (5) new items based on comments from Round one to be rated (Round two only); and (6) an opportunity at the end of the questionnaire for further comments. For the items to be re-rated, the expert panelists were provided with the group summary responses as well as their own responses from the previous round. The same processes for distribution and reminders from Round one were used in Rounds two and three.

Analysis—Responses were combined and cumulative percentage scores calculated for all quantitative questions, including instructions, response scale and items. All comments and suggestions were read and carefully considered. An algorithm was used to analyze the items in the order of relevancy, discriminatory ability and wording. Figure 1 outlines this process. For items that did not achieve consensus after the three rounds of questionnaires, the responses from the persons who use a wheelchair group were used to determine which items would be retained in the WheelCon-M. This decision was based on recommendations for the development and validation of self-efficacy instruments [11].

Results

Item Generation

Experts—All 29 experts contacted agreed to participate in the interviews. The demographic data for the expert panel are presented in Table 1. The persons who use a wheelchair were, on average, middle aged (48.7±18.7) with 13.4±11.9 years of experience using a manual wheelchair. The health care professionals were experienced with many years of practice (14.3±8.1) and mainly occupational therapists. The single researcher was also an occupational therapist.

Interviews—An 84-item draft WheelCon-M was developed based on data from 29 interviews. The interviews continued until no new ideas emerged. The content was organized according to themes into six areas (number of items per area): Negotiating the Physical Environment (39), Activities Performed Using a Manual Wheelchair (26), Knowledge and Problem Solving (six), Advocacy (four), Managing Social Situations (six), and Managing Emotions (three). This 84-item draft WheelCon-M was used to construct the first questionnaire of the Delphi survey.

Item Selection

Experts—All 43 experts contacted agreed to participate in the Delphi survey. The demographic data for the expert panel are presented in Table 1. The persons who use a wheelchair group (13 individuals from the interview phase plus nine new experts) was on average middle aged (52±16.9 years) with 18.3±14.9 years of experience using a manual wheelchair. The health care professional group was composed of the same individuals as in the interview phase. The researcher group members (one individual from the interview phase

plus five new experts) were experienced in their fields and mainly occupational therapists. The number of experts responding to each round of the Delphi is shown in Table 2.

Delphi Rounds—The response rates for Rounds one, two and three were 95.3%, 82.9% and 94.1% respectively. Three of the expert panelists in Round one and two in Rounds two and three (all persons who use a wheelchair) requested and were provided with assistance to complete the questionnaire. Specifically, one panelist required physical assistance in writing the answers and two panelists required guidance in working through the process of determining if the items could discriminate between low and high confidence. Table 3 provides details regarding the number of experts who completed the paper version versus the online version of the Delphi survey, the time to complete the survey, response rates per category of participant, and reasons for drop out.

WheelCon-M Instructions and Response Scale—Eighty-three percent of the expert panel responded that the instructions were clear. Although consensus was reached, suggestions to improve the instructions were also provided in the comments section. Simple changes were implemented to improve the readability and clarity of the instructions based on recommendations from the expert panelists. For example, one panelist suggested adding an extra example in the instructions to demonstrate that self-efficacy can be incremental. In line with this suggestion, the instruction now reads 'For example, an answer to the question "How confident are you that you can lift a 5 lb. box?" might be 82%, whereas "How confident are you that you can lift a 10 lb box?" might be 48%'. Some recommendations were disregarded because they conflicted with Bandura's guidelines. For example, one panelist's recommendation to change 'as of now' in the instructions was disregarded based on Bandura's principle that people should judge their capabilities as of now, not their potential capabilities or their future capabilities [6].

For the response scale, 80.5% of the expert panel agreed/strongly agreed that the 0–100 scale provided a good number of response options and 85.4% of the panel agreed/strongly agreed that the descriptors for the response scale were appropriate. However, comments were also provided in this section, including a recommendation to use a smaller scale, such as 0–10 or 0–20. This suggestion was disregarded as we felt that a 0–100 response scale may improve the sensitivity of the measure [12]. Since the instructions and response scale questions all achieved over a 70% consensus, it was not necessary to include them in Round two for re-rating.

WheelCon-M Items—In Round one, the first draft WheelCon-M contained 84 items to be rated in terms of their relevancy, discriminatory ability, and wording. This generated a total of 252 separate questions to be answered about the items. In Round two, there were 29 items from Round one requiring re-rating of relevancy and/or discriminatory ability. Three new items were added to Round two based on suggestions. The 29 items to be re-rated from Round one, plus the three new items generated a total of 43 questions for Round two. In Round three, 17 items had to be re-rated from Round two generating 21 questions. Table 4 shows the number of items per round removed, retained, and re-rated based on 70% consensus.

Table 5 shows the WheelCon-M items that were removed per round and the reason for their removal. In Round one, seven items from the Negotiating the Physical Environment area, six items from the Activities Performed in the Wheelchair area, and one item from the Social Situations area were deemed not relevant and therefore removed. Interestingly, all items removed from the Activities and Social Situations areas were also deemed not able to discriminate between high and low confidence. In Round two, no items were removed. In Round three, one item was removed from the Physical Environment area due its inability to discriminate between high and low confidence.

Fourteen items did not reach consensus after three Delphi rounds: four in the Negotiating the Physical Environment area, nine in the Activities Performed in the Wheelchair area, and one in the Managing Social Situations area. Based on the responses of the persons who use a wheelchair group, one item was retained from Negotiating the Physical Environment area, one in the Activities area, and one in the Managing Social Situations area. Finally, a decision was made to return two items to the WheelCon-M because they were the counter to items that remained on the scale. For example, the item 'over a drainage grate and then up a curb cut' was removed from the WheelCon-M based on a 70% response that it was not relevant, while, 'over a drainage grate and then down a curb cut' did not achieve a 70% consensus as not relevant. To counter the remaining item, the removed item was returned to the WheelCon-M.

The Final Version of the WheelCon-M—After reviewing the literature, conducting 29 interviews, and implementing a three round Delphi survey with 43 experts, the WheelCon-M was developed and the content validated. Ultimately, the resultant 62-item WheelCon-M was composed of the following areas (number of items per area): Negotiating the Physical Environment (33 items), Activities Performed Using a Manual Wheelchair (11 items), Knowledge and Problem Solving (six items), Advocacy (four items), Managing Social Situations (five items), and Managing Emotions (three items). A copy of the WheelCon-M is available from the authors.

Discussion

The development and content validation of the 62-item WheelCon-M was reported in this paper. The mixed methods, sequential qualitative-quantitative design enabled exploration into this new area of research maximizing involvement of key stakeholders. Use of persons who use a wheelchair, health care professionals and researchers resulted in the development of both expected and unexpected WheelCon-M content areas, each evaluating a different aspect of confidence with wheelchair use. The WheelCon-M instructions, response scale and format were developed according to Bandura's guidelines for developing self-efficacy scales [6]. The content of the items in each area was validated using a Delphi survey.

The Negotiating the Physical Environment area was expected and represents over half of the items (33) in the scale. The number of items representing physical environment is consistent with the extensive literature in this area. There are many studies that explore the physical environment related to wheelchair use [13,14] and a number of instruments that have been developed to assess wheelchair skill in overcoming environmental barriers [15–17]. The

difference, of course, between instruments that assess function or skill and this new scale, is that the WheelCon-M is designed to ask about belief in one's ability to overcome aspects of the physical environment. Many of the items in the WheelCon-M address aspects of the physical environment that are either the same as, or similar to, those addressed in instruments that objectively measure wheelchair function or skill, such as wheeling over potholes and climbing curbs [15,16,17]. The overlap between WheelCon-M items and items in objective measurements of wheelchair use lends support to the credibility of these physical environment items.

Many of the items that were removed from the Negotiating the Physical Environment area of the WheelCon-M during the Delphi survey represent items that may have resulted in a ceiling or floor effect. For instance, some items asked about aspects of the environment that are generally not very challenging to confidence, such as 'As of now, how confident are you moving your wheelchair… through open doorways, along a paved sidewalk, and through a store with lots of space between the aisles'. Other items that were removed asked about aspects of the environment that are generally very challenging to confidence and that many people avoid, rather than attempt, in their daily lives, such as 'As of now, how confident are you moving your wheelchair up/down three to five steps?'.

Some items in the Negotiating the Physical Environment area address two issues in the same question. An example of such an item is 'As of now, how confident are you moving your wheelchair down a steep slope and then stopping?'. It is generally recommended that such items be avoided because the aspect of the question to which the individual is responding may be unclear [18]. However, during the interview phase of this study, many of the participants commented on high levels of confidence to complete certain skills or overcome specific aspects of the physical environment separately, but low levels of confidence when certain skills or aspects of the environment occurred in sequence. Therefore, we felt it was important to include such questions in the WheelCon-M.

The Activities Performed Using a Manual Wheelchair area was also expected to have items that overlap with items in instruments that measure wheelchair skill or function [15,16,17,19,20]. Some items in this area were removed because they were deemed not relevant, perhaps because they were not common practice for many persons who use a wheelchair, such as 'As of now, how confident are you moving from your wheelchair to a chair in a restaurant?'. Other items were removed mainly because the experts felt the items were not able to distinguish between high and low confidence such as, 'As of now, how confident are you reaching an item off of a high shelf while using your wheelchair?'. Interestingly, these types of items are often found on instruments that measure wheelchair skill [15,16,20].

The remainder of the areas were unexpected as these domains are generally not assessed related to wheelchair use. The Knowledge and Problem Solving area (six items) focuses on knowledge of: assistance required, capabilities of one's wheelchair, and wheelchair maintenance, as well as problem solving in new environments or stressful situations. The implications of low confidence in these areas can be far reaching for persons who use a wheelchair. For instance, if one does not have confidence in their ability to problem-solve in

new situations or in their knowledge of their wheelchair, they may be less likely to venture out into the community or to become involved in new activities.

The four items in the Advocacy area ask about confidence related to advocating for changes to one's wheelchair, home, school or work, and community environments. Despite efforts that have been made to implement universal design and ensure wheelchair accessibility, physical barriers continue to exist. Therefore, confidence in one's ability to advocate for his or her needs is especially important. Whether advocating for funding for a ramp, a new wheelchair cushion, or fixing a cracked sidewalk, all of these changes can make a difference in the confidence of a person to use his or her wheelchair.

The Managing Social Situations area is a novel domain in the body of wheelchair literature. Most questions in this five item area involve the confidence of persons who use a wheelchair in how they perceive that they 'look' performing tasks or activities. In other areas of study [21,22], this phenomenon is called self-presentational efficacy which, by definition, refers to an individual's belief that he or she can successfully portray a specific impression to others [23]. Creating a particular impression can be central to anyone, but may be particularly important to some individuals who use a manual wheelchair.

The Managing Emotions area has three items that ask about confidence in managing emotions while moving one's wheelchair in new environments, when trying new skills, and in stressful situations. Managing emotions can play an important role in the development of new wheelchair skills and the generalization of these skills into new environments and in new activities. For example, if a person who uses a wheelchair is unable to manage the anxiety related to learning to climb a curb, it is unlikely they will consistently perform this skill which may, in turn, limit their independent community wheelchair use.

This study has its limitations. First, although some may consider a sample of 43 to be small, Delphi panel sample sizes vary considerably in the literature and choice of the 'best' participants is considered more important than the number of participants [10]. Second, use of a panel of experts may be seen as restricting. Although the experts were identified based on their knowledge and experience with wheelchair use and provided a broad range of perspectives, each participant was only able to draw on their own experiences and therefore may not have had the knowledge to appropriately answer all of the Delphi survey questions. Regardless of individual experiences though, consensus was reached for retaining or removing 70 out of 84 items across all three participant groups. The degree of consensus achieved indicates that the influence of the group as a whole was able to cancel out inappropriate responses, thereby demonstrating the effectiveness of the Delphi process. Third, ending the Delphi survey after three rounds, before consensus was reached for all items, may be seen as a limitation. However, despite not reaching consensus for 14 out of the 84 items across all three groups of experts, use of the responses of persons who use a wheelchair to make the final decision was appropriate as they are, after all, the true experts of wheelchair use.

This work also has several strengths. First, the mixed methods design facilitated the use of three groups of experts to generate and select items for the WheelCon-M. As the

development of the four unexpected areas in the WheelCon-M can attest, the qualitative component of this study was especially important in identifying important areas of measurement related to confidence with wheelchair use. Second, the interviews continued to the point of saturation and so it is likely that all areas important to measuring confidence with wheelchair use were identified. Third, the high response rate for each round of the Delphi survey is also a strength. The response rates for each round were over the suggested 70% response rate required to maintain the rigor of the Delphi process [10].

This study describes important work on the development and validation of the WheelCon-M. The interviews enabled an advance in our knowledge of confidence with wheelchair use by generating both the expected and unexpected areas of the WheelCon-M. The inclusion of persons who use a wheelchair, health care professionals, and researchers in the Delphi expert panel was used to balance insight from practical, clinical, and measurement perspectives. The Delphi survey refined and validated the content validity of the draft WheelCon-M. Development of such scales is, however, an ongoing process with varying sources of evidence regarding measurement properties and so there is still much work to be done [24]. Recommendations for continued validation of the WheelCon-M include examining the response processes of the individuals who complete the WheelCon-M, as well as its internal structure, relations to other variables, and intended and unintended consequences.

Conclusion

The development and content validation of the WheelCon-M was reported in this paper. As a scale to measure confidence with wheelchair use was not available prior to this work, clinicians now have a method to measure this invisible barrier to wheelchair use. We believe that a subjective measure of belief in one's ability to use his or her wheelchair will be a useful addition to objective observer-based scales of wheelchair use. It will enable clinicians to make informed decisions when prescribing and training clients to use a manual wheelchair and also provide researchers with an important and relevant area of study in future research.

Acknowledgments

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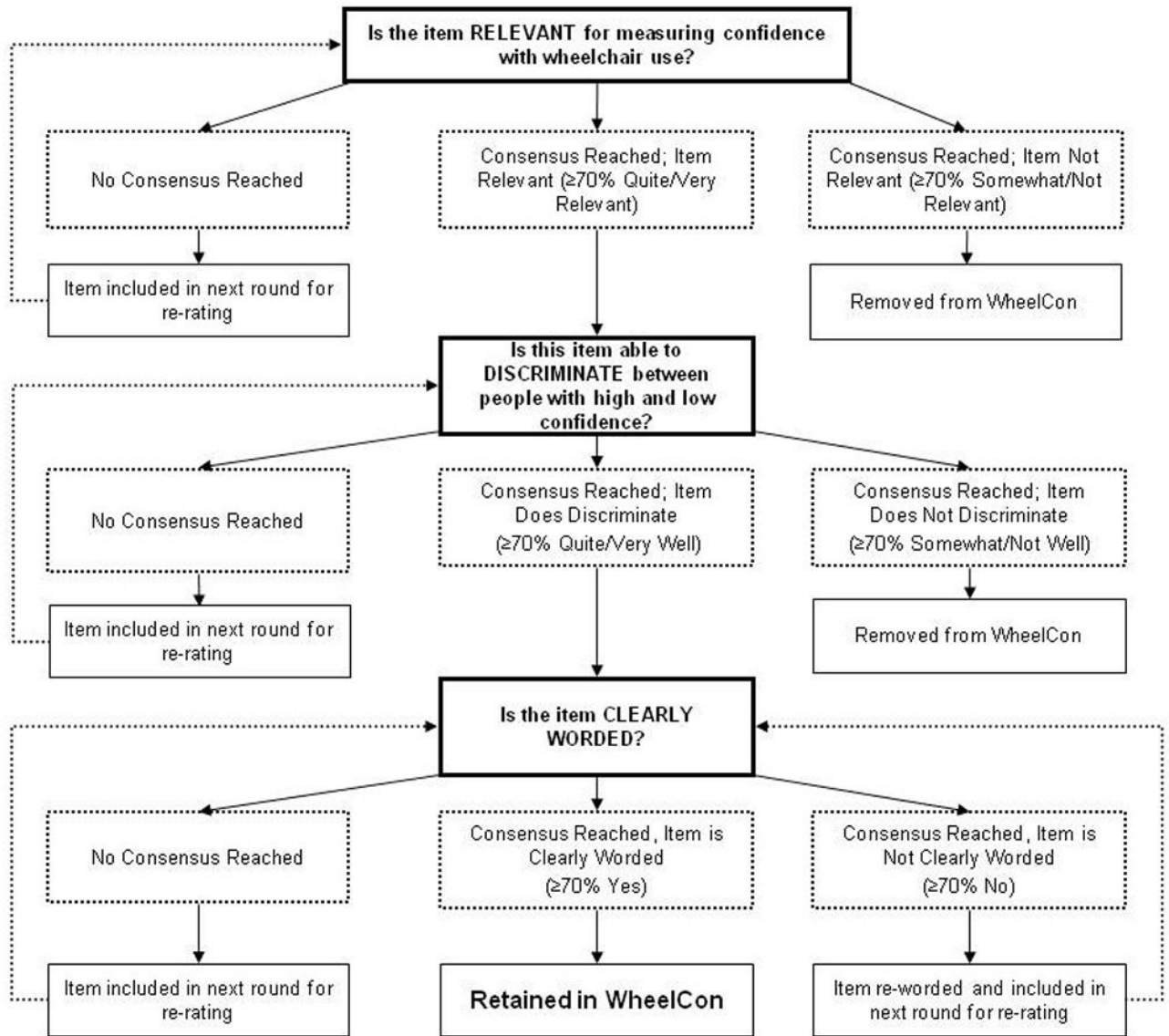
Figure 1.
WheelCon-M item analysis process using the Delphi survey

Table 1

Demographics for experts in the Item Generationphase (interviews) and Item Selection phase (Delphi)

	Persons who use a wheelchair		Professionals Interview / Delphi (n=15)	Researchers	
	Interview (n=13)	Delphi (n=22)		Interview (n=1)	Delphi (n=6)
Age (mean, (SD))	48.7 (18.7)	52.0 (16.9)	40.2 (8.5)	36	38.7 (7.0)
Female (%)	46.2	36.4	86.7	100.0	100.0
Years in Wheelchair (mean, (SD))	13.4 (11.9)	18.3 (14.9)	-	-	-
Years Practicing (mean, (SD))			14.3 (8.1)	11	13.5 (8.3)
Bachelors education (%)	53.8	50.0	93.3	100.0	100.0
Diagnosis (%)					
SCI	30.7	50.0			
Spina Bifida	15.4	13.6			
Amputation	15.4	9.2			
MS	15.4	9.2			
CVA	7.7	4.5			
Osteoporosis	7.7	4.5			
Arthrogryposis	7.7	4.5			
Polio	0.0	4.5			
Profession (%)					
Activity Worker			6.7	0.0	0.0
Occupational Therapist			60.0	100.0	66.7
Occupational Therapy Assistant			6.7	0.0	0.0
Physiotherapist			20.0	0.0	0.0
Physician			6.7	0.0	0.0
Researcher			0.0	0.0	33.3

Note: Interview refers to the in-depth qualitative interviews completed during the Item Generation phase of the study, while Delphi refers to the Delphi survey completed during the Item Selection phase of the study.

Table 2

Experts involved in the Delphi process

	Persons who use a wheelchair	Professionals	Researchers	Total
Invited to Participate	22	15	6	43
Agreed to Participate	22	15	6	43
Round 1 returns				
Without reminder	18	12	5	35
After 1 reminder	2	2	0	4
After 2 reminders	1	0	1	2
Completed round 1	21	14	6	41
Round 2 returns				
Without reminder	16	5	4	25
After 1 reminder	2	6	1	9
Completed round 2	18	11	5	34
Round 3 returns				
Without reminder	15	6	2	23
After 1 reminder	3	3	3	9
Completed round 3	18	9	5	32

Table 3

Delphi responses and time to complete per round

	Round 1				Round 2				Round 3			
	WC	HCP	Res.	Total	WC	HCP	Res.	Total	WC	HCP	Res.	Total
Paper Version (n)	7	1		8	6	1		7	6	1		7
Online Version (n)	14	13	6	33	12	10	5	27	12	8	5	25
Time to complete (%)												
<10 min									22.2	44.4	40.0	31.3
10–19 min					44.4	81.8	60.0	58.8	44.4	44.4	60.0	46.9
20–29 min					44.4	18.2	20.0	32.4	27.8	11.1		18.8
30–39 min	19.0	21.4		17.1								
40–49 min	14.3	28.6	16.7	17.1	5.6		20.0	5.9	5.6			3.1
50–59 min	14.3	28.6	16.7	19.5								
>60 min	52.4	21.4	83.3	46.3	5.6			2.9				
Response Rate (%)	95.5	93.3	100.0	95.3	85.7	78.6	83.3	82.9	100.0	81.8	100.0	94.1
Reasons for dropout (n)	Unknown (1)	Too busy (1)			Husband sick (1), Hospitalized (1), Unknown (1)	Completed late (1), Too busy (2), Unknown (2)	Too busy (1)			Unknown (2)		

WC=persons who use a wheelchair; HCP=health care professional; Res=researcher

Table 4

Items retained, removed, and re-rated after each round of the Delphi

Delphi Round	No of Items to be Rated			No of Items Retained (>70% quite/very)	No of Items Removed		
	Relevant Only?	Able to Discriminate Only?	Relevant and Able to Discriminate?		Not Relevant	Not able to Distinguish	No Consensus
1	0	0	84	41	14	0	29
2	1	23	5 (+3 new)	14	0	0	17
3	1	12	4	1	1	1	14
Post Delphi	2	11	1	3	2	9	0

Note: All items reached consensus for being clearly worded in their first round.

Table 5

Items removed from the WheelCon-M during and post Delphi rounds

Delphi Rounds	Reason for Removal	
	Not Relevant	Not Able to Discriminate
Round 1		
Physical Environment area (As of now, how confident are you moving your wheelchair…)		
▪ through puddles?	✓	✓
▪ through slush?	✓	
▪ along a cobblestone walkway?	✓	
▪ over a drainage grate and then up a curb cut?	✓	
▪ through snow and then up a curb cut?	✓	
▪ up 3 to 5 steps?	✓	
▪ down 3 to 5 steps?	✓	
Activities area (As of now, how confident are you…)		
▪ moving from your wheelchair to a chair in a restaurant?	✓	✓
▪ moving from your wheelchair to a seat in a movie theatre?	✓	✓
▪ folding your manual wheelchair?	✓	✓
▪ unfolding your manual wheelchair?	✓	✓
▪ putting your wheelchair in your vehicle?	✓	✓
▪ securing your wheelchair on public transportation?	✓	✓
Social Situations area (As of now, how confident are you that you can…)		
▪ make a good impression in front of friends or colleagues when doing more challenging wheelchair activities, such as wheeling across gravel or moving from your wheelchair to another seat like in a movie theatre?	✓	✓
Round 2		
No questions were removed		
Round 3		
Physical Environment area (As of now, how confident are you moving your wheelchair…)		
▪ through open doorways?		✓
Post Delphi Rounds		

Delphi Rounds	Reason for Removal	
	Not Relevant	Not Able to Discriminate
Physical Environment area (As of now, how confident are you moving your wheelchair…)		
▪ around tight corners?		✓
▪ along a paved sidewalk?		✓
▪ through a store with lots of space between the aisles?		✓
Activities area (As of now, how confident are you…)		
▪ doing laundry while using your wheelchair?	✓	
▪ getting dressed while using your wheelchair?		✓
▪ participating in wheelchair sports, such as wheelchair basketball?	✓	
▪ positioning your wheelchair at a dining table?		✓
▪ reaching an item off of a high shelf while using your wheelchair?		✓
▪ picking a magazine up off of the floor while using your wheelchair?		✓
▪ doing toileting activities while using your wheelchair?		✓
▪ cleaning your home while using your wheelchair?		✓