

## Wheelchair Skills Assessment and Training of : From Research Evidence to Clinical Practice

AGE-WELL & APPTA Policy Rounds  
February 28, 2024  
R. Lee Kirby, MD, FRCPC  
Division of Physical Medicine and Rehabilitation  
Department of Medicine  
Dalhousie University and Nova Scotia Health




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## Setting the Stage

- Acknowledgements:
  - Wheelchair Research Team, funding bodies
- Conflict of interest: None
- Target audience: AGE-WELL & APPTA professionals
- Resources: website, handout
- Questions: chat, oral or [kirby@dal.ca](mailto:kirby@dal.ca)

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## Session Objectives

Participants will be able to describe:

1. The WHO wheelchair-service-delivery process
2. The components of the Wheelchair Skills Program (WSP)
3. The extent of research evidence in support of the WSP assessment and training protocols
4. The relevance of the WSP to clinical rehabilitation practice

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Participants will be able to describe:

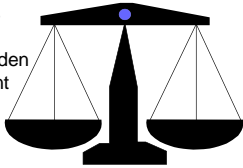
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## Wheelchairs

**BENEFITS**

- Mobility
- Caregiver burden
- LTC placement
- Participation



**PROBLEMS**

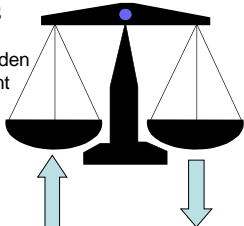
- Improper fit
- Repair
- Overuse injuries
- Acute injuries

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## Wheelchairs

**BENEFITS**

- Mobility
- Caregiver burden
- LTC placement
- Participation



↑  
Better accessibility  
Better wheelchair design  
Better wheelchair service delivery  
↓

**PROBLEMS**

- Improper fit
- Repair
- Overuse injuries
- Acute injuries

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## Wheelchairs

**BENEFITS**

- Mobility
- Caregiver burden
- LTC placement
- Participation

**PROBLEMS**

- Improper fit
- Repair
- Overuse injuries
- Acute injuries

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## World Health Organization

WHO Guidelines 2008

2008: [www.who.int/disabilities/publications/technology/wheelchairguidelines/en/index.html](http://www.who.int/disabilities/publications/technology/wheelchairguidelines/en/index.html)

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WHO Guidelines June 5, 2023

<https://www.who.int/publications/i/item/9789240074521>

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### Figure 4. Four wheelchair service steps

1 Select	2 Fit	3 Train	4 Follow up
The wheelchair user's specific needs and preferences are defined through an individual assessment, to select the most appropriate wheelchair(s) for them.	The wheelchair, wheelchair cushion, postural support devices and any other accessories are prepared and fitted for the wheelchair user.	The wheelchair user, along with those who will assist them, takes part in task-specific training in how to use and care for their wheelchair.	Follow up is offered to all users, for as long as they require a wheelchair, with the frequency based on their individual needs.

WHO Guidelines 2023

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[www.wheelchairskillsprogram.ca](http://www.wheelchairskillsprogram.ca)

1996

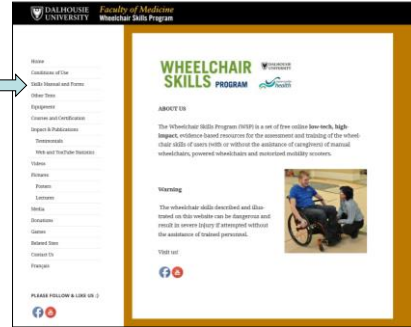
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## What's Different About the WSP?

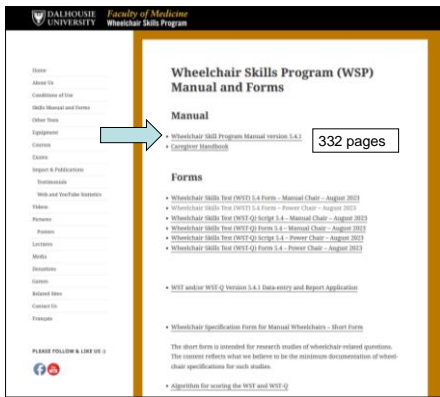
- Evidence-based
- Both assessment and training
- Both wheelchair users and caregivers
- Manual wheelchairs, power and scooters
- The process and sequencing used
- Updated often (August 2023)
- It's FREE! ("open source")

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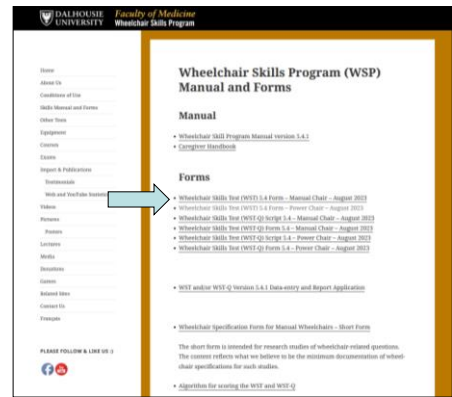
[www.wheelchairskillsprogram.ca](http://www.wheelchairskillsprogram.ca)



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Wheelchair Skills Test (WST) Version 5.4 Form  
Manual Wheelchairs  
Name of wheelchair user: \_\_\_\_\_  
Caregiver assisting (if any): \_\_\_\_\_ Date: \_\_\_\_\_

#	Individual Skill	Capacity (0-3)*	Comments
1	Rolls forward		
2	Rolls backward		
3	Turns in place		
4	Turns while moving forward		
5	Turns while moving backward		
6	Maneuvers sideways		
7	Pushes objects		
8	Operates body positioning options		
9	Stalls wheels		
10	Performs level transfers		
11	Rolls and unfolds wheelchair		
12	Performs ground transfers		
13	Goes through hinged door		
14	Ascends slight incline		
15	Descends slight incline		
16	Ascends steep incline		
17	Descends steep incline		
18	Rolls on soft surface		
19	Goes over obstacle		
20	Ascends low curb		
21	Descends low curb		
22	Ascends high curb		
23	Descends high curb		
24	Performs stationary wheelchair		
25	Turns in place in wheelchair position		
26	Rolls forward and backward in wheelchair position		
27	Descends high curb in wheelchair position		
28	Descends steep incline in wheelchair position		
29	Ascends steep incline		
30	Descends steep incline		
* See criteria on next page		Total score**	%
** See formula on next page			

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General Scale for Scoring Skill Capacity*		
Advanced pass	3	The subject carries out the skill in a highly proficient or advanced manner.
Pass	2	The subject carries out the skill independently and safely, but with room for improvement.
Partial pass	1	The subject safely completes most of the evaluation criteria or can direct the actions of another person.
Fail	0	The subject does not complete most of the evaluation criteria, is unsafe or unwilling.
No part	NP	The wheelchair does not have the parts to allow this skill.
Testing Error	TE	The tester cannot assess the skill for some reason.

\* More details, including criteria specific to individual skills can be found in the WSP Manual.

**Formula for calculating total percentage score:**  
 Total WST Capacity Score = sum of individual skill scores / (number of possible skills - number of NP scores - number of TE scores) x 3 X 100%

General comments including any suggestions for remediation:

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## WST Comments – Diagnosis



Worley et al. Am J Phys Med Rehabil 2006;85:931-4

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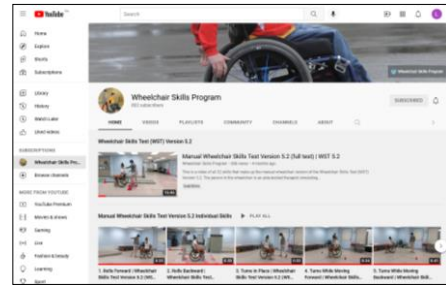
## WST Comments – Wheelchair



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## WSP YouTube Channel



[https://www.youtube.com/channel/UCxInALbMRBcE\\_JDD548CQ-w](https://www.youtube.com/channel/UCxInALbMRBcE_JDD548CQ-w)

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Wheelchair Skills Test Questionnaire (WST-Q) Version 5.4 Form					
Manual Wheelchair					
Name of wheelchair user: _____					
Number completing questionnaire (if not user): _____					
Tester: _____					
#	Individual Skill	Performance (0-3C)	Confidence (0-3C)	Frequency (0-3C)	Training Goal (Y/N)
1	Rolls forward				
2	Rolls backward				
3	Turns in place				
4	Turns while moving forward				
5	Turns while moving backward				
6	Maneuvers sideways				
7	Reaches objects				
8	Operates foot/positioning options				
9	Shifts weight				
10	Performs level transfers				
11	Pushes and pulls/inch wheelchair				
12	Performs ground transfers				
13	Goes through hinged doors				
14	Ascends slight incline				
15	Descends slight incline				
16	Ascends steep incline				
17	Descends steep incline				
18	Rolls on soft surface				
19	Cuts over obstacles				
20	Ascends low curb				
21	Descends low curb				
22	Ascends high curb				
23	Descends high curb				
24	Performs emergency stop				
25	Turns in place in wheelchair position				
26	Rolls forward and backward in wheelchair position				
27	Descends high curb in wheelchair position				
28	Descends steep incline in wheelchair position				
29	Ascends stairs				
30	Descends stairs				
Total scores**		%	%	%	%

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### Total % Calculated Scores

**WST:**


- Capacity Score = # skills passed/total x 100%

**WST-Q:**

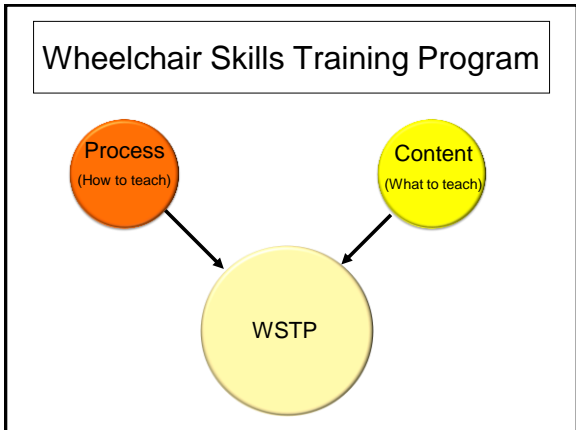
- Performance Score = # skills passed/total x 100%
- Confidence Score = total/total possible x 100%
- Frequency Score = # skills passed/total x 100%

25

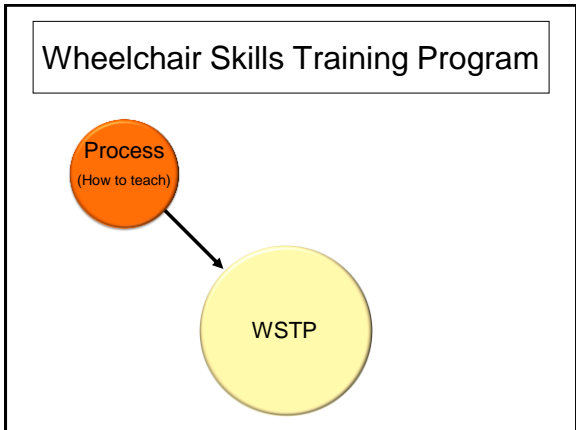
### WST Comments – Training



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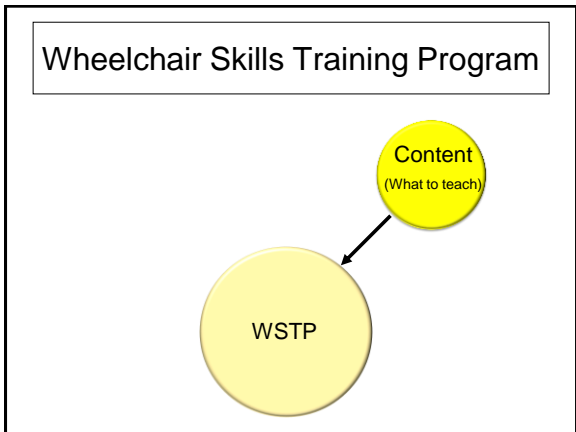


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### WSTP Process



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[www.wheelchairskillsprogram.ca](http://www.wheelchairskillsprogram.ca)

**ABOUT US**

The Wheelchair Skills Program (WSP) is a set of ten colour bar tests, high-impact, evidence-based measures for the assessment and training of the wheel chair skills of users both in and out of the classroom (clinical/rehabilitation, powered wheelchairs and manual/active users).

**Warning**

The wheelchair skills described and illustrated on this website can be dangerous and result in severe injury if attempted without the assistance of trained personnel.

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### Publications & Impact

PubMed Searches & RSS Feeds

View Selected Articles in PubMed About Wheelchair Skills Testing

Subscribe to an RSS Feed for this Search

120

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## Example of WST Paper

DISABILITY AND REHABILITATION: ASSISTIVE TECHNOLOGY, 2017  
<https://doi.org/10.1080/14639231.2017.1382644>

Taylor & Francis  
Taylor & Francis Group

**ORIGINAL RESEARCH**

### Measurement properties of the Wheelchair Skills Test for scooters among experienced users

W. Ben Mortenson<sup>AB,1</sup>, Laura Hurd Clarke<sup>BC</sup>, Charlie H. Goldsmith<sup>BC</sup>, Sharon Jang<sup>BC</sup> and R. Lee Kirby<sup>1</sup>

<sup>1</sup>Department of Occupational Science and Occupational Therapy, University of British Columbia, Vancouver, BC, Canada; <sup>2</sup>International Collaboration on Repair Discoveries (ICORD), UBC Faculty of Medicine and Vancouver Coastal Health (VCH) Research Institute, Vancouver, BC, Canada; <sup>3</sup>Rehabilitation Research Program, VCH Research Institute, Vancouver, BC, Canada; <sup>4</sup>School of Kinesiology, University of British Columbia, Vancouver, BC, Canada; <sup>5</sup>Faculty of Health Sciences, Simon Fraser University, Burnaby, BC, Canada; <sup>6</sup>Division of Physical Medicine and Rehabilitation, Department of Medicine, Dalhousie University, Halifax, NS, Canada

**ABSTRACT**

**Purpose:** To investigate the score distribution, reliability, and validity of the objective Wheelchair Skills Test (WST) for scooter users.

**Method:** A study using a test-retest design was conducted with 20 people who had mobility limitations that prevented them from ambulating more than one city block without a mobility aid, and who had owned a scooter for ≥2 months. Objective scooter skills, confidence, and physical accessibility were measured at both time points, while anxiety, depression, visual attention and task switching, functional independence, and visual acuity were measured only at baseline.

**Results:** The mean total WST scores at Time 1 and Time 2 were 86.3% and 87.5%. The WST ICC was 0.89. The WST had a SEM of a 2.0 and a Cronbach's alpha of 0.74. The total WST scores were significantly correlated with total subjective WST-Q scores ( $r=0.847$ ,  $p<0.013$ ), scooter confidence ( $r=0.466$ ,  $p=0.038$ ), and were affected by gender ( $p=0.005$ ).

**Conclusion:** The WST for scooters has good test-retest reliability and generally varies as anticipated with other measures. Although further study is needed, the WST for scooters appears to have promise for use in research and clinical practice.

**ARTICLE HISTORY**

Received 17 June 2016  
 Revised 4 January 2017  
 Accepted 4 January 2017

**KEYWORDS**

mobility scooter; reliability; validity; mobility limitation

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### Publications & Impact

PubMed Searches & RSS Feeds

View Selected Articles in PubMed About Wheelchair Skills Training Programs

Subscribe to an RSS Feed for this Search

79

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## Example of Training Tip Paper

Taylor & Francis

ORIGINAL RESEARCH

### Effect of travel direction and wheelchair position on the ease of a caregiver getting an occupied wheelchair across a soft surface: a randomized crossover trial

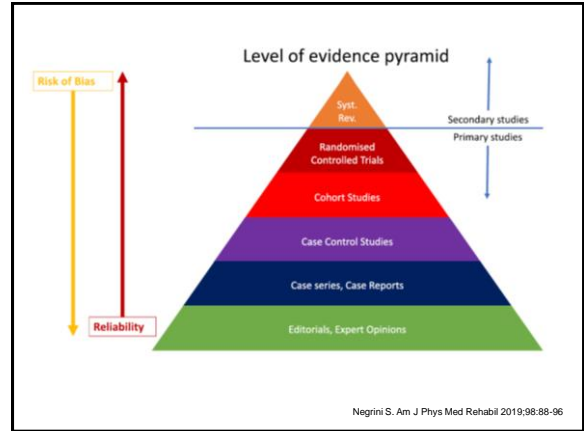
B. Lee Kirby<sup>a</sup>, Kim Parker<sup>a</sup>, Eric Poor<sup>a</sup>, Char Smith<sup>a</sup>, Dee Omond<sup>a</sup>, Michel Ladoocan<sup>a</sup>, Victoria Suzanne Haworth<sup>a</sup>, Christopher J. Thurgood<sup>a</sup> and Nageer Sandilal<sup>a</sup>

<sup>a</sup>Division of Physical Medicine and Rehabilitation, Department of Medicine, Dalhousie University, Halifax, NS, Canada; <sup>b</sup>Assistive Technology Program, Nova Scotia Health, Halifax, NS, Canada; <sup>c</sup>Faculty of Medicine, Dalhousie University, Halifax, NS, Canada; <sup>d</sup>Department of Occupational Therapy, Nova Scotia Health, Halifax, NS, Canada; <sup>e</sup>Technology, School of Health and Human Performance, Dalhousie University, Halifax, NS, Canada; <sup>f</sup>Research Methods Unit, Nova Scotia Health, Halifax, NS, Canada

**ABSTRACT**  
**Objective:** To test the hypothesis that, in comparison with pushing an occupied upright manual wheelchair forward, pulling backward on the push-handles improves the objective and subjective ease with which a caregiver can get the wheelchair across a soft surface (e.g. grass, mud, sand, gravel) and the ease with which a caregiver can get the wheelchair across a soft surface improves if the wheelchair is tilted back to the neutral position.  
**Methods:** We used a randomized crossover trial with within-participant comparisons to study 22 identified paths of standard caregivers and wheelchair occupants. The caregivers performed an occupied manual wheelchair (m-wc) across a soft surface (22 cm x 22 m) from north to south (condition 1), upright-forward, upright-backward, wheelchair-forward and wheelchair-backward in random order. The main outcome measure was time by the primary C.O. and the main secondary measure was the ease of performance (1-point Likert scale).  
**Results:** The upright-backward condition was the fastest ( $p < 0.05$ ) and had the highest ease-of-performance scores. In the forward direction, there was no statistically significant difference in the time required between the upright and tilted positions, but the wheelchair position was considered easier.  
**Conclusions:** Although further study is needed, our findings suggest that caregivers should pull rather than push occupied manual wheelchairs across soft surfaces. In the forward direction, caregivers may find the relative position easier than the upright condition. These techniques have the potential to both improve the effectiveness of and reduce fatigue to caregivers.

Clinical Trial Registration Number: NCT 03958119

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Taylor & Francis

REVIEW

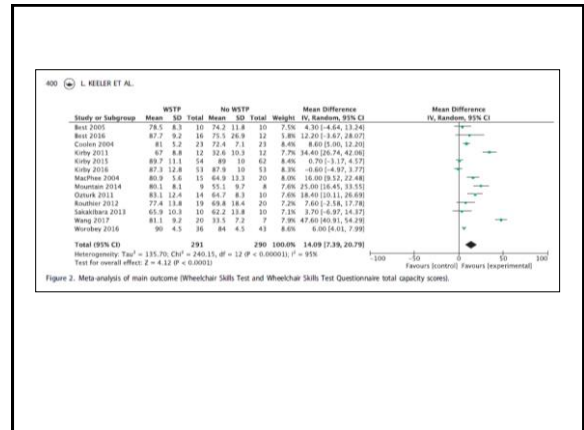
### Effectiveness of the Wheelchair Skills Training Program: a systematic review and meta-analysis<sup>a</sup>

Laura Keeler<sup>a</sup>, R. Lee Kirby<sup>b</sup>, Kim Parker<sup>c</sup>, Katie D. McLean<sup>d</sup> and Jill A. Hayden<sup>e</sup>

<sup>a</sup>Department of Community Health and Epidemiology, Dalhousie University, Halifax, NS, Canada; <sup>b</sup>Division of Physical Medicine and Rehabilitation, Department of Medicine, Dalhousie University, Halifax, NS, Canada; <sup>c</sup>Assistive Technology Program, Nova Scotia Health Authority, Halifax, NS, Canada; <sup>d</sup>Library Services, Nova Scotia Health Authority, Halifax, NS, Canada

**ABSTRACT**  
**Objective:** To conduct a systematic review synthesizing the evidence for the effectiveness of the Wheelchair Skills Training Program (WSTP).  
**Data Sources:** We searched PubMed, the Cochrane Library, CINAHL, and Embase databases, as well as grey literature, up to 10 October 2017.  
**Study Selection:** Randomized controlled trials (RCTs) assessing the effectiveness of the WSTP.  
**Data Extractions:** Two independent reviewers screened articles and extracted data. Methodological quality was assessed using Cochrane's Risk of Bias Tool.  
**Data Synthesis:** Meta-analysis (including subgroup analysis) were conducted for the Wheelchair Skills Test (WST) and WST Questionnaire (WST-Q) total capacity scores. We qualitatively assessed heterogeneity, WST-Q subtotal and individual-skill capacity scores and other identified outcomes. The quality of evidence was determined using the Grades of Recommendation, Assessment, Development and Evaluation (GRADE) approach. Thirteen articles (581 participants) were included for analysis. The level of evidence was of mod-

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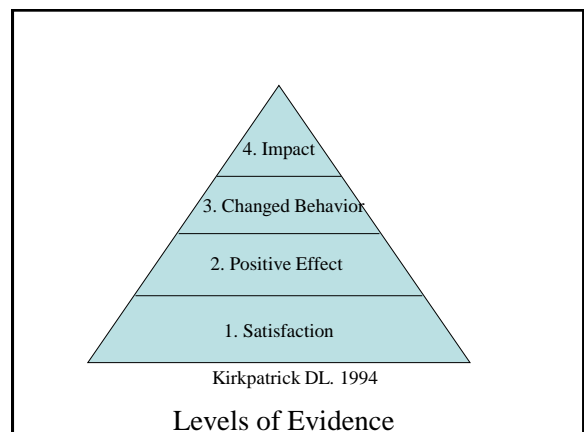
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### 3. Train: Training must be provided for wheelchair users and those who assist them to enable maximum use including:

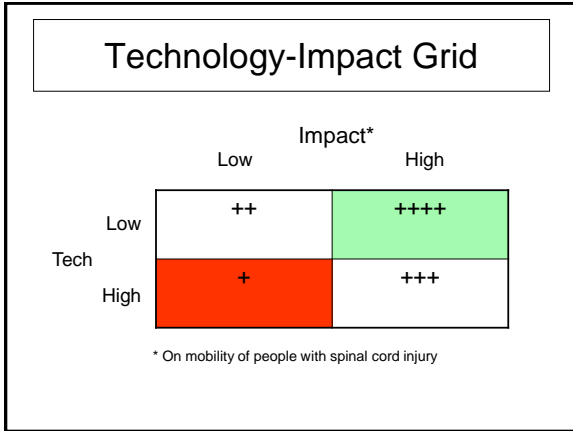
- **Skills to use a wheelchair** Strong recommendation, moderate certainty evidence
- **Use of wheelchair components** Strong recommendation, moderate certainty evidence
- **Guiding others with whom they interact** Strong recommendation, very low certainty evidence
- **Wheelchair maintenance and repairs** Conditional recommendation, very low certainty evidence

WHO Guidelines 2023

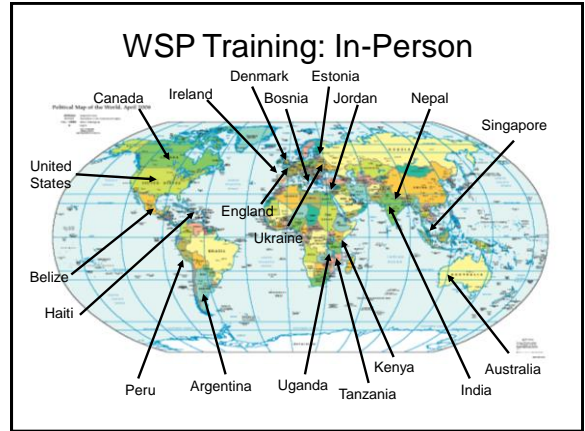
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- ### Metrics
- WSP website:
    - 181,249 users (2007 – June 5, 2023)
    - 200 countries
  - WSP YouTube channel: (2018 – February 27, 2024)
    - Views: 328,845
    - Hours viewed: 6,800
    - Subscribers: 1,700

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**ACRM** Archives of Physical Medicine and Rehabilitation

Journal Homepage: [www.archives.physio.org](http://www.archives.physio.org)  
Archives of Physical Medicine and Rehabilitation 2019;100:1648-54

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ORIGINAL RESEARCH

**Relationships Between Wheelchair Services Received and Wheelchair User Outcomes in Less-Resourced Settings: A Cross-Sectional Survey in Kenya and the Philippines**

R. Lee Kirby, MD,<sup>a,b</sup> Steve P. Doucette, MS,<sup>b,c</sup>

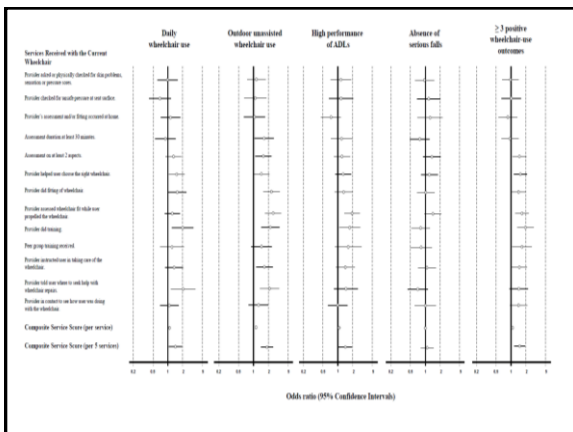
From the <sup>a</sup>Division of Physical Medicine and Rehabilitation, Department of Medicine, Dalhousie University, Halifax, Nova Scotia; <sup>b</sup>Department of Community Health and Epidemiology, Dalhousie University, Halifax, Nova Scotia; and <sup>c</sup>Research Methods Unit, Nova Scotia Health Authority, Halifax, Nova Scotia, Canada.

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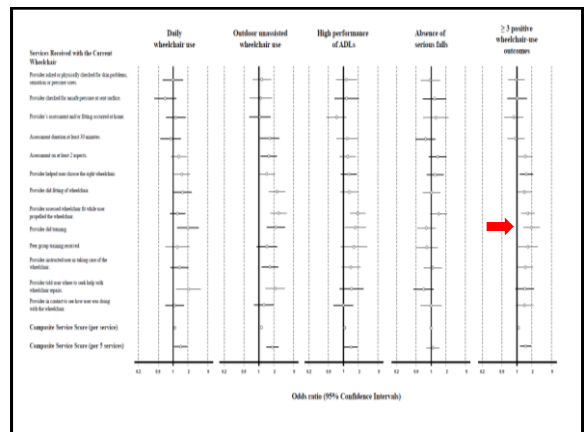
N = 852

Arch Phys Med Rehabil 2019;100:1648-54

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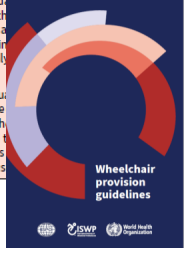
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**Box 9. Wheelchair skills programme**

As part of a research series, Dalhousie University and the Nova Scotia Rehabilitation and Arthritis Centre in Canada developed a Wheelchair skills test to assess the capacity of wheelchair users to safely perform the skills they need in their everyday lives. The test was developed to assess wheelchair users who could not perform the wheelchair skills training programme. The test was developed using the best available learning principles and wheelchair skill techniques. A growing body of research, including two systematic reviews (125,126) and meta-analyses, has shown the safety and effectiveness of such training.

The programme has since expanded its scope to include manual wheelchairs and motorized mobility scooters, and to include users. By January 2023, the programme website ([www.wheelchair.org](http://www.wheelchair.org)) was used by over 173 000 unique users from 200 countries and the programme's YouTube channel ([youtube.com/channel/UCxlnALbMRBce\\_JD548CQ-w](https://www.youtube.com/channel/UCxlnALbMRBce_JD548CQ-w)) has the importance of such information for many wheelchair users.



WHO Guidelines 2023, p 36

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## Evolution of the Wheelchair Skills Program



<https://pixabay.com/photos/evolution-development-future-age-4107273/>

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“The perfect is the enemy of the good.”

Voltaire, 1694-1778  
Dictionnaire Philosophique, 1764

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DISABILITY AND REHABILITATION: ASSISTIVE TECHNOLOGY  
<https://doi.org/10.1080/17483107.2021.1995665>

Taylor & Francis  
Taylor & Francis Group

ORIGINAL RESEARCH

**Practices and views of wheelchair service providers regarding wheelchair-skills training for clients and their caregivers: a global online survey**

Ronald Lee Kirby<sup>a</sup>, Cher Smith<sup>b</sup>, Kim Parker<sup>c</sup>, Christopher John Theriault<sup>d</sup> and Navjot Sandhla<sup>e</sup>

<sup>a</sup>Division of Physical Medicine and Rehabilitation, Dalhousie University, Halifax, Canada; <sup>b</sup>Department of Occupational Therapy, Nova Scotia Health Authority, Halifax, Canada; <sup>c</sup>Assistive Technology Program, Nova Scotia Health Authority, Halifax, Canada; <sup>d</sup>Research Methods Unit, Nova Scotia Health Authority, Halifax, Canada

**ABSTRACT**  
**Purpose:** To determine the extent to which wheelchair service providers conduct wheelchair-skills training, the nature of training, and the providers' perceptions on training.  
**Materials and methods:** Anonymous global online survey consisting of 29 questions administered via the REDCap electronic data-capture tool to English-speaking wheelchair service providers.  
**Results:** We received 309 responses from wheelchair service providers in 35 countries. Of the respondents who responded to the question "...do you typically provide wheelchair-skills training...?" 227 (81.6%) reported 'yes, always' or 'yes, usually' for clients and 213 (81.9%) for caregivers. The median duration of training sessions for clients and caregivers was 45 and 30min; the median number of sessions was 2 for both. Regarding the importance of training, 251 (94.4%) answered 'very important' for clients and 201 (78.3%) for caregivers. For clients and caregivers, 162 (68.4%) and 191 (74.3%) of respondents considered themselves adequately prepared for the trainer role. A variety of barriers and facilitators to training were identified.  
**Conclusions:** Most wheelchair service providers report that they provide wheelchair-skills training for clients and their caregivers, most consider such training to be important and most consider themselves adequately prepared for the training role. However, the amount of training is generally minimal. Further efforts are needed to address the identified barriers to training.

**ARTICLE HISTORY**  
Received 9 July 2021  
Revised 30 September 2021  
Accepted 16 September 2021

**KEYWORDS**  
rehabilitation; wheelchair; motor skills; training; surveys and questionnaires

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**Figure 2: The two "Death Valleys" of the clinical translational continuum**

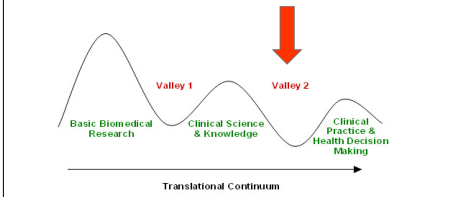


Figure from Steven Reis, University of Pittsburgh and Harold Pincus, Columbia University.

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