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Wheelchair Skills Training: A scoping review

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Abstract

This study aimed to identify the types of available evidence and analyze knowledge gaps on wheelchair skills training among PWDs in literature. This study employed a scoping review method and was guided by Arksey and O'Malley's using five steps framework. A total of 15 peer-reviewed articles met the inclusion criteria. The results support the effectiveness of wheelchair skills training through personal feedbacks from participants, observation and the use of standardized outcome measures, including self-perceived assessment. This study highlights the importance and benefit of wheelchair skills training to wheelchair users, caregivers and health personnel.

Keywords: Skill Training; Disability; Wheelchair; Scoping Review

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1.0 Introduction

World Health Organization (2012) defines a wheelchair as a device that provides wheeled mobility and seating support for a person who has difficulty in walking or moving around. Wheelchair serves as a primary means of mobility for persons with physical disabilities. A fit wheelchair is a wheelchair that meets the users' needs and environmental conditions. Wheelchairs have been shown to improve the lives of people with disabilities by enabling independent mobility, employment, and equal participation in community life (Sumner, O'Connell, & Macalpine, 2017). Wheelchairs have been proved to increase wheelchair users' participation in community and employment (Sumner et al., 2017).

Despite the proven positive impact on the life of wheelchair users, they also experienced secondary injuries as a result from long term used of a wheelchair, such as a shoulder injury (Leving, et al 2018; Morgan et al, 2017; Boninger et al 2005), pressure sores (Desai et al, 2018; Toro, et al, 2016), scoliosis (Walsh, 2009), muscular injuries (Lemay, Routhier, Noreau, Phang & Ginis, 2012), fatigue and pain in hip the joint (Desai et al., 2018), postural deformities as well as injuries as a results of falling (Forslund et al, 2017; Best, Routhier, & Miller, 2015; Rice, Ousley and Sosnoff, 2015; Xiang, Chany & Smith, 2006).

Morgan et al., (2015) state that wheelchair skills may reduce wheelchair users' injuries and help them maneuver independently. Previous studies have stated that wheelchair skills are one of the factors affecting social and community participation in wheelchair users (Smith, 2014). Wheelchair skills training has been shown to prevent future health and participation restrictions (Morgan et al., 2015), improves wheelchair users' self-efficacy (Best et al., 2015) and increase confidence among inexperienced wheelchair users (Sakakibara et al., 2013).

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Wheelchair skills training is used by trainers and health personnels to help wheelchair users to improve their skills in using wheelchair and improve wheelchair handling skills for caregivers. To assist wheelchair users and caregivers, the wheelchair research team at the Dalhousie University and the Nova Scotia Rehabilitation Centre has introduced a Wheelchair Skills Program (WSP). The WSP is a set of skills that wheelchair users and caregivers need to perform regularly and had been widely used to train wheelchair users and caregivers (Kirby et al, 2019). However, formal wheelchair skills training is still relatively uncommon in Malaysia. Therefore, this scoping review was aimed to examine the types of available evidence and knowledge gaps on wheelchair skills training among PWDs in literature.

2.0 Research Method

This research will be using scoping review using Arksey and O'Malley methodological framework. Scoping review is used to describe existing literature and other sources of information and usually include such study findings from different study design and methods (Sucharew & Macaluso, 2019). The methodological framework of scoping review by Arksey and O'Malley (2005) introduces five steps to guide researchers; identifying the research question, identifying relevant studies, study selection, charting the data, and collating, summarizing, and reporting results. Arksey and O'Malley's (2005) five steps are outlined as follows;

i) Identifying the Research Question

The research question of this study is to examine the types of available evidence and knowledge gaps on wheelchair skills training among PWDs in literature.

ii) Identifying Relevant Studies

The following databases were searched: EBSCOhost, ProQuest, ScienceDirect, Web of Science and google scholar. Keywords used are wheelchair skills, wheelchair training, wheelchair skills training, wheelchair skills program, wheelchair skill test, wheelchair skill test questionnaire and wheelchair program.

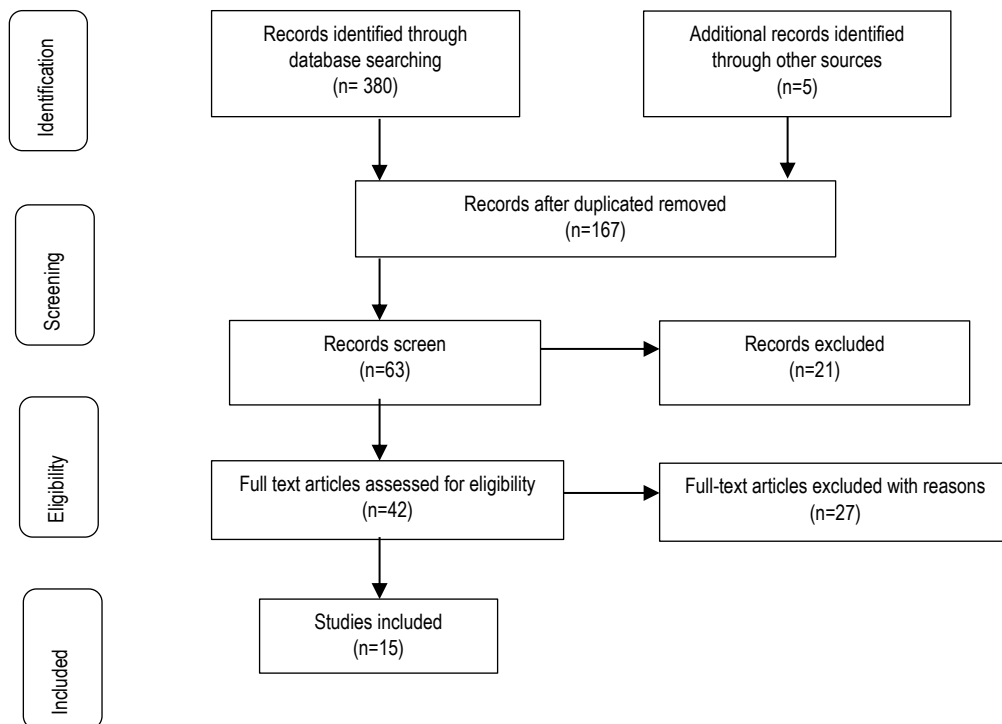


Fig 1 Flow Diagram for Scoping Review

iii) Study Selection

Studies were selected using the inclusion and exclusion criteria. The inclusion criteria are the journals must be published from 2000 to 2020, written in English and are peer reviewed. The journals were not included if the journals were published before 2000, not written in English and are books or from chapters.

iv) Data Charting

Three reviewers screened the articles to extract relevant studies based on the inclusion and exclusion criteria. A table was created to chart the relevant data and to critically appraise the papers. The categories are the citation, objectives of research, study design, sample size, intervention or module, outcome measures and findings. The information is recorded in table 1.1.

v) Collating, Summarizing, And Reporting Results.

The results and findings of the scoping review was discussed under themes that highlight the efficacy of wheelchair skills training.

Table 1.1: The summarization of journal in wheelchair skills training

Author	Aim	Study Design	Sample size	Intervention/ Module	Outcomes measure	Findings
Coolen, Kirby, MacPhee, Dupuis, Smith, Best, MacKenzie & MacLeod (2004)	<ul style="list-style-type: none"> To test the hypothesis that a brief formalized period of wheelchair skills training, added to the standard curriculum, cause significantly greater overall improvements in wheelchair skills than a standard undergraduate occupational therapy (OT) curriculum alone. 	<ul style="list-style-type: none"> Randomized controlled trial. 	<ul style="list-style-type: none"> 82 students in a university undergraduate OT program. 	<ul style="list-style-type: none"> Using WSTP module For intervention group, students are allocated to the Wheelchair Skills Training Program (WSTP) group, were trained (on a single occasion each, in groups of 1-3 at a time) on the 50 skills that make up the WSTP. Students in control group only receive standard university curriculum. 	<ul style="list-style-type: none"> Wheelchair Skills Test (WST), Version 2.4. 	<ul style="list-style-type: none"> The WSTP is an effective way to improve the wheelchair-skills performance of OT students. WSTP group score higher in mean percentage of WST.
MacPhee, Kirby, Coolen, Smith, MacLeod & Dupuis (2004)	<ul style="list-style-type: none"> To test the hypothesis that a brief, formalized period of additional wheelchair skills training is safe and results in significantly greater improvements in wheelchair skills performance than a standard rehabilitation program. 	<ul style="list-style-type: none"> Randomized controlled trial. 	<ul style="list-style-type: none"> 35 wheelchair users admitted for initial rehabilitation. 	<ul style="list-style-type: none"> Using WSP Module. Subjects randomly allocated to the treatment group participated in the Wheelchair Skills Training Program (WSTP), averaging 4.5-1.5 training sessions, each 30 minutes long. 	<ul style="list-style-type: none"> Wheelchair Skills Test (WST), version 2.4. 	<ul style="list-style-type: none"> The WSTP is safe and practical and has a clinically significant effect on the independent wheeled mobility of new wheelchair users. WSTP groups shows higher improvements.
Best, Kirby, Smith, MacLeod (2005)	<ul style="list-style-type: none"> To test the hypotheses that wheelchair skills training of community-based manual wheelchair users is efficacious, safe, and practical. 	<ul style="list-style-type: none"> A randomized controlled trial. 	<ul style="list-style-type: none"> 20 community-based manual wheelchair users. 	<ul style="list-style-type: none"> Using Wheelchair Skills Training Program (WSTP). Participants allocated to WSTP or control group. In WSTP group, participants receive a mean of 45 hours of training. 	<ul style="list-style-type: none"> Wheelchair Skills Test (WST, version 3.1) 	<ul style="list-style-type: none"> Wheelchair skills training of community-based manual wheelchair users is efficacious, safe, and practical. WSTP group have significantly higher scores in post-test.
Kirby, Smith, Billard, Irving, Pitts & White (2010)	<ul style="list-style-type: none"> To examine the hypotheses that training a parent in wheelchair-user and caregiver wheelchair skills would improve the child's wheelchair skills 	<ul style="list-style-type: none"> Case study 	<ul style="list-style-type: none"> An 11-year-old girl with spina bifida and her mother. 	<ul style="list-style-type: none"> WSTP The mother received 4 training sessions averaging 42.5 minutes per session over a period of three weeks. 	<ul style="list-style-type: none"> Wheelchair Skills Test (WST 4.1) 	<ul style="list-style-type: none"> The WST score of the child and mother shows improvements. WST scores for mother is higher after training than the child.
Routhier, Kirby, Demers, Depa & Thompson (2012)	<ul style="list-style-type: none"> To test the hypotheses that wheelchair users who received the French-Canadian version of the Wheelchair Skills Training (WSTP) would significantly improves their wheelchair-skills capacity and that these improvements would be retained at three months 	<ul style="list-style-type: none"> Multicenter, single-blind, randomized controlled trial. 	<ul style="list-style-type: none"> 39 manual wheelchair users. 	<ul style="list-style-type: none"> Participants in WSTP group received standard care with a mean of 5 hours and 36 minutes training sessions. 	<ul style="list-style-type: none"> The French-Canadian version of WST 	<ul style="list-style-type: none"> WSTP training improves wheelchair skills immediately after training especially at community-skills level. The WSTP group scores

Author	Aim	Study Design	Sample size	Intervention/ Module	Outcomes measure	Findings
						higher on post-test.
Sawatzky, Rushton, Denison, McDonald (2012)	<ul style="list-style-type: none"> To determine the effectiveness of a two-day modified Wheelchair Skills Programme 3.2 for children. 	<ul style="list-style-type: none"> Single group design. 	<ul style="list-style-type: none"> Children (ages 6–19 years) with SCI or spina bifida. 	<ul style="list-style-type: none"> The WSTP consisted of 9 hours training over two days. It involved the testing of the wheelchair skills (WST) as well as training wheelchair skills like the WSTP 	<ul style="list-style-type: none"> Wheelchair Skills Test. 	<ul style="list-style-type: none"> A two-day wheelchair skills programme can potentially improve skill level in children with spinal cord injuries or spina bifida.
Sakakibara, Miller, Souza, Nikolova & Best (2013)	<ul style="list-style-type: none"> To examine the effects of wheelchair skills training on confidence in older adults who are inexperienced with using a wheelchair 	<ul style="list-style-type: none"> Single blind randomized controlled trial 	<ul style="list-style-type: none"> 20 community-living older adults 	<ul style="list-style-type: none"> The intervention group received two 1-hour training sessions that followed the Wheelchair Skills Training Program (WSTP) protocol. The control group received a single socialization contact. 	<ul style="list-style-type: none"> Wheelchair Use Confidence Scale-Manual (WheelCon-M) 	<ul style="list-style-type: none"> WSTP improve confidence in using a manual wheelchair among inexperienced older adults. The confidence scores after post intervention is higher.
Morgan, Engsborg, Gray (2014)	<ul style="list-style-type: none"> Identify similarities and differences between the perspectives of health care professionals and manual wheelchair users and use the ICF to organize themes related to rehabilitation and learning how to use a manual wheelchair user. 	<ul style="list-style-type: none"> Descriptive (Focus Group to collect qualitative data) 	<ul style="list-style-type: none"> 13 healthcare professionals 14 SCI 	<ul style="list-style-type: none"> Focus group conducted with health care professionals and wheelchair users to identify wheelchair themes. 	<ul style="list-style-type: none"> International Classification of Functioning, Disability, and Health (ICF) 	<ul style="list-style-type: none"> Identifying essential components for training the proper propulsion mechanics and wheelchair skills in new-manual wheelchair users is an essential step in preventing future health and participation restrictions.
Mountain, Kirby Smith Eskes & Thompson (2014)	<ul style="list-style-type: none"> To test the hypotheses that people with stroke using powered wheelchairs who receive formal wheelchair skills training improve their wheelchair skills. 	<ul style="list-style-type: none"> Randomized controlled trail. 	<ul style="list-style-type: none"> 17 stroke patients 	<ul style="list-style-type: none"> Training based on Wheelchair Skills Training Program. In intervention group, participants received Wheelchair Skills Training up to 5 30-minutes one on one training sessions. 	<ul style="list-style-type: none"> Wheelchair Skills Test (WST). 	<ul style="list-style-type: none"> The change of WST score in intervention group was notable. Wheelchair skills improve after wheelchair skills training.
Hashim, Jee, Lee, Hanapi, Lee, Fauzi, Engkasan, Hasnan (2016)	<ul style="list-style-type: none"> Determine the effect of an advanced wheelchair skills training on wheelchair mobility function in persons with Spinal Cord Injury (SCI). 	<ul style="list-style-type: none"> A pre and post intervention study 	<ul style="list-style-type: none"> 19 persons with traumatic or non-traumatic SCI 	<ul style="list-style-type: none"> Advance Wheelchair Training Workshop (AWTW). Training protocol was adapted from Wheelchair Skills Manual Programme. Consisted of 12 varying wheelchair skills including propulsion, performing 	<ul style="list-style-type: none"> Wheelchair Mobility Test (WMT). 	<ul style="list-style-type: none"> Skills in ascending stairs showed most improvement followed by descending stairs. Improvements in back wheel balance, overcoming small threshold and low platform

Author	Aim	Study Design	Sample size	Intervention/ Module	Outcomes measure	Findings
Kirby, Miller, Routhier, Demers, Mihailidis, Polgar, Rushton, Titus, Smith, McAllister (2015)	<ul style="list-style-type: none"> To test the hypothesis that powered wheelchair users who receive the Wheelchair Skills Training Program (WSTP) improve their wheelchair skills in comparison with a control group that receives standard care. 	<ul style="list-style-type: none"> Randomized controlled trial. 	<ul style="list-style-type: none"> 116 powered wheelchair users. 	<ul style="list-style-type: none"> wheelie, negotiating platform, threshold, or grater, and managing fall, ramp, and stairs. Wheelchair Skills Training Program (WSTP). Five 30 minutes WSTP training sessions for participants in WSTP group. 	<ul style="list-style-type: none"> Wheelchair Skills Test Questionnaire (WST-Q). Goal Attainment Score (GAS) Satisfaction Questionnaire Injury Rate Wheelchair Use Confidence Scale for Power Wheelchair Users (WheelCon) Life Space Assessment. 	<ul style="list-style-type: none"> Participants in WSTP group demonstrate modest transient post-training improvements in WST-Q scores, performance scores and they have substantial improvements on individualized goals.
Kirby, Mitchell, Sabharwal, McCranie & Nelson (2016)	<ul style="list-style-type: none"> To test hypotheses that community-dwelling veterans with spinal cord injury (SCI) who receive WSTP in their environments significantly improve their manual wheelchair-skills capacity, retain those improvements at one year and improve participation in comparison with educational Control (EC) group. 	<ul style="list-style-type: none"> Randomized Controlled Trial 	<ul style="list-style-type: none"> 106 veterans with SCI 	<ul style="list-style-type: none"> WSTP Each participant receives either five one to one WSTP or EC sessions for 30-45 minutes. 	<ul style="list-style-type: none"> Wheelchair Skills Test 4.1 (WST). Craig Handicap Assessment and Reporting Technique (CHART) scores. 	<ul style="list-style-type: none"> Participants in WSTP group improved their total and advanced level WST scores and retain their scores at one-year follow-up.
Yeo, Kwon (2018)	<ul style="list-style-type: none"> Examine the effectiveness of wheelchair skills training in improving both wheelchair skills and upper arm skilled performance in adults with C-SCI. 	<ul style="list-style-type: none"> Randomized control Trial 	<ul style="list-style-type: none"> 24 tetraplegia 	<ul style="list-style-type: none"> Wheelchair training session for the intervention group and regular exercise sessions for the control group. The intervention lasted for eight weeks with a frequency of three days (1 hour/day) per week, including warm-ups, training programs of each group, and warm-downs. 	<ul style="list-style-type: none"> Wheelchair Skill Test (WST) Van Lieshout Test (VLT). 	<ul style="list-style-type: none"> Wheelchair skills training is more beneficial for adults with C-SCI than conventional exercise.
Rushton & Daoust (2018)	<ul style="list-style-type: none"> To test the hypothesis that occupational therapy students who receive wheelchair skills training education using a distributed practice university-course approach versus a condensed-practice boot-camp approach results in greater improvements post- 	<ul style="list-style-type: none"> Quasi-experimental, non-equivalent control group design. 	<ul style="list-style-type: none"> 58 occupational therapy students. 	<ul style="list-style-type: none"> For experimental group, a 15-week, 45 hours wheelchair provision course in which a total of 24 hours was dedicated to wheelchair skills testing and training education. 	<ul style="list-style-type: none"> Wheelchair Skills Test Questionnaire (WST-Q) Wheelchair Use Confidence Scale for Manual Wheelchair 	<ul style="list-style-type: none"> Occupational therapy students who receive wheelchair skills training using either a distributed-practice university course or

Author	Aim	Study Design	Sample size	Intervention/ Module	Outcomes measure	Findings
	intervention in relevant outcomes.			<ul style="list-style-type: none"> For control group, an 8 hours wheelchair skills training boot-camp. 	<ul style="list-style-type: none"> User (WheelCon) Self-Efficacy on Assessing, Training and Spotting wheelchair skills (SEATS). 	condensed-practice boot-camp approach demonstrated significant post-training improvements in their WST-Q, WheelCon and SEATS scores, but no significant differences were found between groups.
Park, Jung (2019)	<ul style="list-style-type: none"> To evaluate the modified WSP for improving wheelchair skills capacity, perceived satisfaction, and performance in daily activities for hemiplegia patients in Korea. 	<ul style="list-style-type: none"> Mixed method 	<ul style="list-style-type: none"> 24 hemiplegic patients 	<ul style="list-style-type: none"> Modified version of Wheelchair Skills Training Programs. Emphasize wheelchair fitting for hemiplegic patients. 30 minutes intervention for 6 weeks. 	<ul style="list-style-type: none"> Wheelchair Skills Test used to measure skills capacity. Canadian Occupational Performance Measure (COMP) Korean version of the Modified Barthel Index (K-MBI). User survey on wheelchair training program. 	<ul style="list-style-type: none"> Significant improvements of WST, COPM, K-MBI scores in the experimental group, the WST and COPM score showed statistically insignificant improvement compared to the control group. Modified WSP may prove useful for hemiplegic patients who exhibit low volition or are experiencing wheelchair use for the first time.

3.0 Results and Findings

The search resulted in a total of 380 journal articles and after inclusion and exclusion criteria are applied, a total of 15 journal articles are found to be relevant in this study. The journal article ranges from the year 2004 to 2019. Of the included papers, 13 studies investigated wheelchair users, one paper investigated wheelchair users and health professionals and two paper were conducted among students. Nine of the papers use randomized controlled trials, none focus group, one pre and post intervention study, one case study, one quasi experimental design and one mixed-methods and one paper use a single group design. All the articles focus on wheelchair skills training. It was interesting to note, that nine of the articles were reported by Kirby and team. The articles were relevant because Kirby and team reported their work on the effectiveness of wheelchair skills training from various aspects, such as from wheelchair users' and care takers' perspectives. The effectiveness of wheelchair skills training can be discussed through personal feedback from participants, observation, and the use of standardized outcome measures, including self-perceived assessment.

3.1 Participants' Personal Feedback

Participants' feedback towards the wheelchair skill training in six studies is discussed and indicating wheelchair skills training is practical and effective to implement. Best et al., (2005) have reported that all participants enjoyed and improved their wheelchair skills and confidence after training. Participants also state that training is useful and safe while noted that without training, they would not attempt advanced skills. Coolen et al., (2004) also stated that almost all participants found the training helpful and enjoyable. A study by Kirby et al., (2014) and Kirby et al., (2015), reported that participants had positive perceptions of the training and found the training useful, understandable and would recommend the training to others. Kirby et al., (2016) reported that the training is advantageous and had given them chance to attempt advanced skills that they would never attempt. MacPhee et al., (2004) state that participants' comments on the training were rather positive and they would recommend the training to others. As wheelchair skills training has positive feedback from participants and improved skills, it showed that wheelchair skills training is effective and useful to be implemented.

3.2 Observation

The effectiveness of wheelchair skills training in nine studies was discussed through researchers' observation. A study by Best et al., (2004) reported that during training, participation of family and friends appears to be motivational and trainers were able to provide caregiver advice to improve wheelchair users' skills. Researchers reported that wheelchair skills training improves wheelchair skills (Coolen et al., 2004; Morgan et al., 2017; Park & Jung, 2019; Routhier et al., 2012; Sawatzky et al., 2012; Yeo & Kwon, 2018). Yeo & Kwon, (2019) also reported that wheelchair skills training is more beneficial than conventional exercise. WSTP that have been modified to suit wheelchair users need also be reported for an effective wheelchair training (Park & Jung, 2019; Yeo & Kwon, 2018). Morgan, Engsborg, et al., (2017) also state that learning wheelchair skills would prevent future health and participations restrictions and new wheelchair users need wheelchair skills training that include propulsion techniques, transfer in and out of a wheelchair, providing skills for wheelchair maintenance and wheelchair navigation skill to overcome barriers such as curbs, ramps and rough terrain. Wheelchair skill training improved performance skills in self-care, productivity, and satisfaction (Park & Jung, 2019) and improved caregivers handling skills and their wheelchair skills (Kirby et al., 2010). These papers suggest that wheelchair skill training does improve wheelchair skills and wheelchair users also need to have the knowledge on their wheelchair to improve their skills.

4.0 Discussion

This scoping review is a part of a bigger project on wheelchair modification and training for PWDs. This scoping review was aimed to identify the types of available evidence and analyze knowledge gaps on wheelchair skills training among PWDs in literature.

The available evidence would provide a strong foundation towards developing a wheelchair training program and services.

This review found that wheelchair skills training is more effective than the standard available treatment. Wheelchair skill training was effective in improving health, participations, skills, performance, self-care, productivity, and satisfaction of wheelchair users. Wheelchair skill training is also effective in improving caregivers handling skills. The variability of tests used by the research included in this study shows that wheelchair skills training can also improve wheelchair user confidence, performance, independence and productivity in daily activities, and mobility of wheelchair users. This study also highlights that wheelchair skill training can improve safety awareness and safe practice of using wheelchairs not only for wheelchair users but also for health personnel and caregivers. It is important for wheelchair users to understand the knowledge on wheelchairs and be proficient in wheelchair skills training. Thus, this study highlights the importance and beneficiaries of wheelchair skills training to wheelchair users in Malaysia and provides strong evidence of the needs of wheelchair skills training and the contents of the wheelchair skill training program.

5.0 Conclusion and Recommendations

This study identified the types of available evidence and analyzed the knowledge gap on the effectiveness of Wheelchair Skills Training through personal feedbacks from participants, observation and the use of standardized outcome measures, including self-perceived assessment. This scoping review research found that wheelchair skills training is effective in improving wheelchair skills of wheelchair users and caregivers. The review shows that wheelchair skills training is effective to improve wheelchair skills, performance and safety. Therefore, it is relevant to suggest the need to develop a structured wheelchair training program in Malaysia for PWD. This study may assist health personnel in Malaysia, especially to the occupational therapists to apply a specific wheelchair skills training program during the active rehabilitation process. As this study used scoping review method, it is not as rigorously and comprehensive, therefore a more thorough study can be done through a systematic review. Nevertheless, these findings may provide a strong foundation for future research on wheelchair skills training in Malaysia as well as on the effectiveness of wheelchair skills training in Malaysia.

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Paper Contribution to Related Field of Study

The findings of this study suggest the need to develop a structured wheelchair training program in Malaysia for PWD. This study may help health personnel in Malaysia to apply a specific wheelchair skills training program during the active rehabilitation process.

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