

Rationale

More than 197 000 Canadians use a manual wheelchair (MWC) for mobility (1). In recent years, many variations in MWC design and new propelling aids (PA) have become available. PA is defined in this study as a **design of MWC whose specifications are different from a regular MWC, or a technology (i.e., mechanical or electric component or accessory or inherent feature) added to a MWC, with the aim of optimizing its use in terms of moving and helping users stay active.**

With the recent introduction of new products and designs, there is a need to explore the available literature about those systems and the relevant evidence regarding their propelling efficiency, safety and their impact on daily activity. Furthermore, to inform future research and development efforts, it is important to classify these devices according to a standard assistive technology framework.

Objectives

To draw up an inventory of the existing PA for MWC through a scoping review aiming at identifying the categories and specific products, or product features that are PA (e.g. power add-on, lever add-on), and classify them according to The International Classification of Functioning, Disability and Health framework (2).

Methods

Literature search has been conducted throughout

- Six indexed databases (Pubmed, Medline, Embase, CINAHL, Compendex, IEEE Xplore), Google and Google Scholar
- Proceedings of the Rehabilitation Engineering and Assistive Technology Society of North America conference abstracts: 2003 to 2016
- Proceedings of the International Seating Symposium: 2001 to 2016 (not available in 2002)

Inclusion/Exclusion Criteria

- Search results must be in French or English, present original content with quantitative and/or qualitative empirical data obtained in humans and related to effects/impacts of PA on ICF component(s).
- Wheelchairs must be manual with or without electric components.
- Empirical data must be related only to MWC users.
- Search results considering sports wheelchair, or MWC not intended for use in activities of daily living, or training/techniques/adjustments' effects must be excluded.

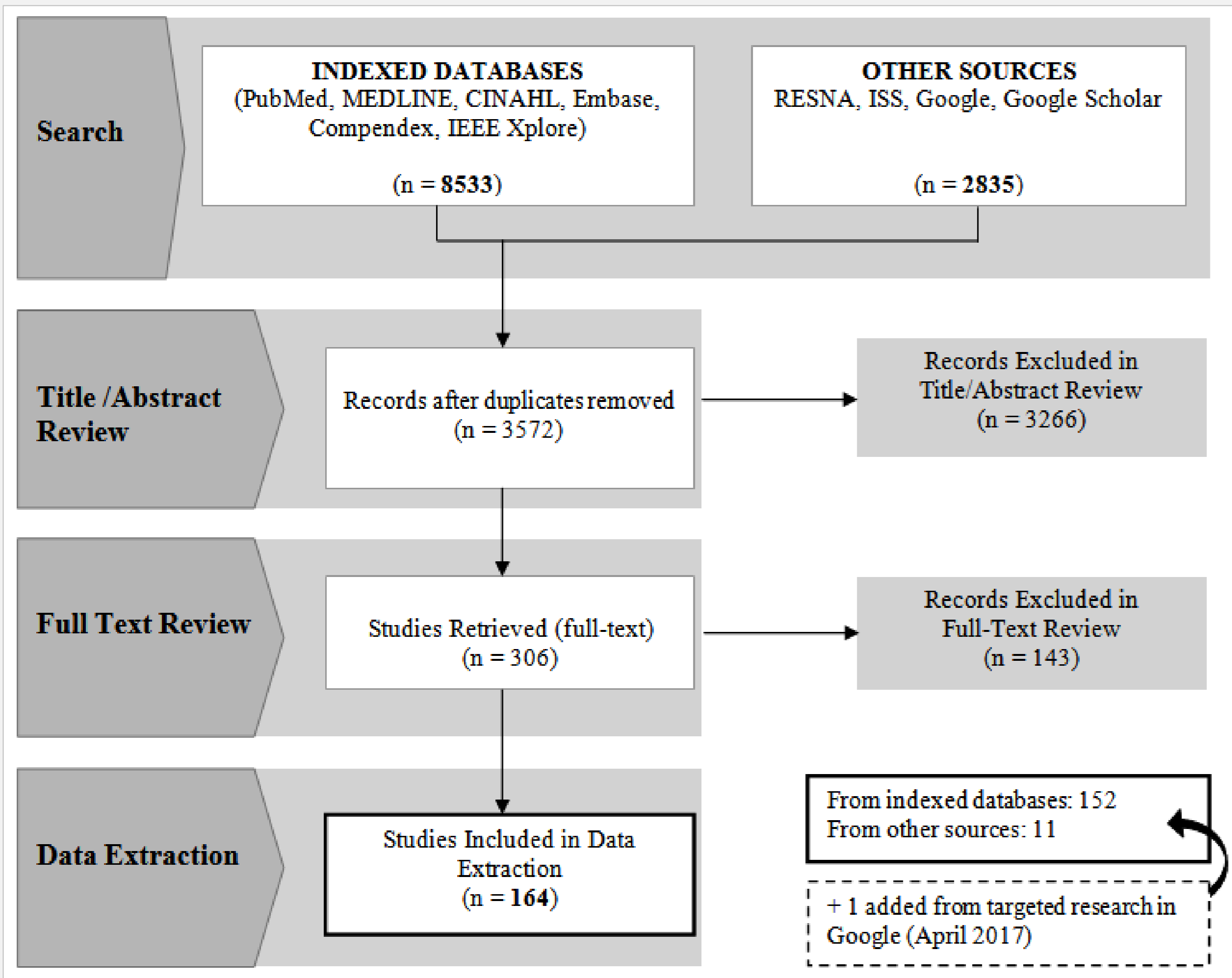
Search strategy includes both controlled and free-text search terms including commercial and generic names of PA for MWC. Each search result has been assessed independently and in duplicate by 2 reviewers and a third reviewer was consulted if needed.

Results

164 studies were retained among 11,368 initial studies including abstracts, scientific articles, proceedings, posters, website contents, guidelines and journal articles [1950-2017].

81 % of studies were published between 2000 and 2017.

Country	USA	JPN	CAN	NLD	GBR	FRA	KOR	CHN	TWN	BRA	IND
n Publications	76	27	18	11	9	5	5	4	3	2	2
% of Publication	46.3	16.5	11.0	6.7	5.5	3.1	3.1	2.4	1.8	1.2	1.2



Flow diagram for study selection



Classification of Propelling Aids

(N=24)

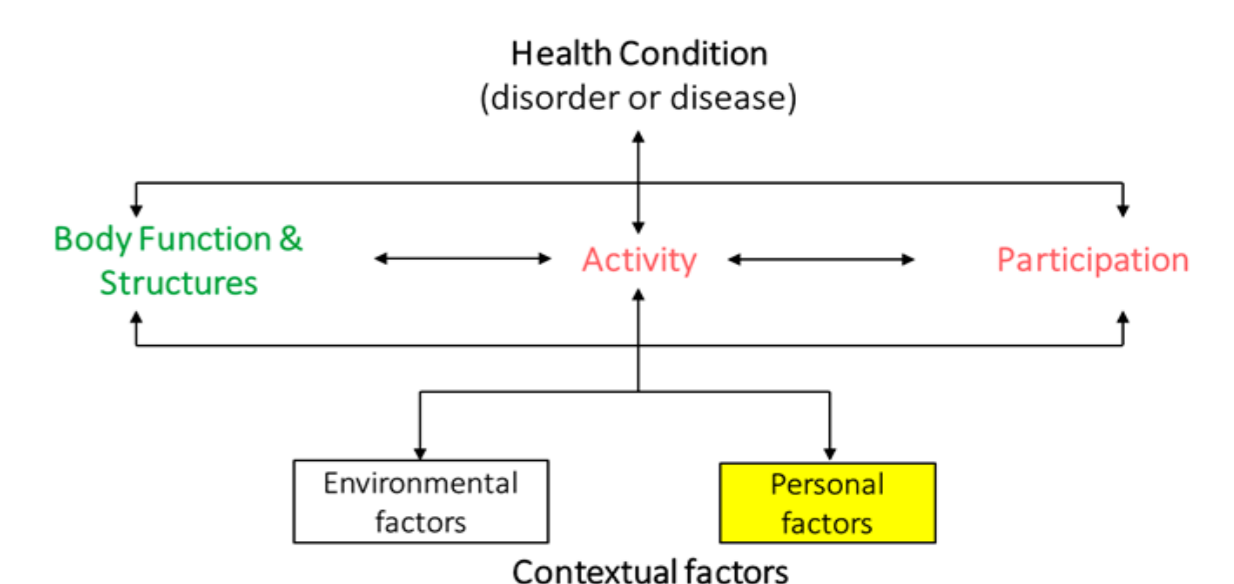
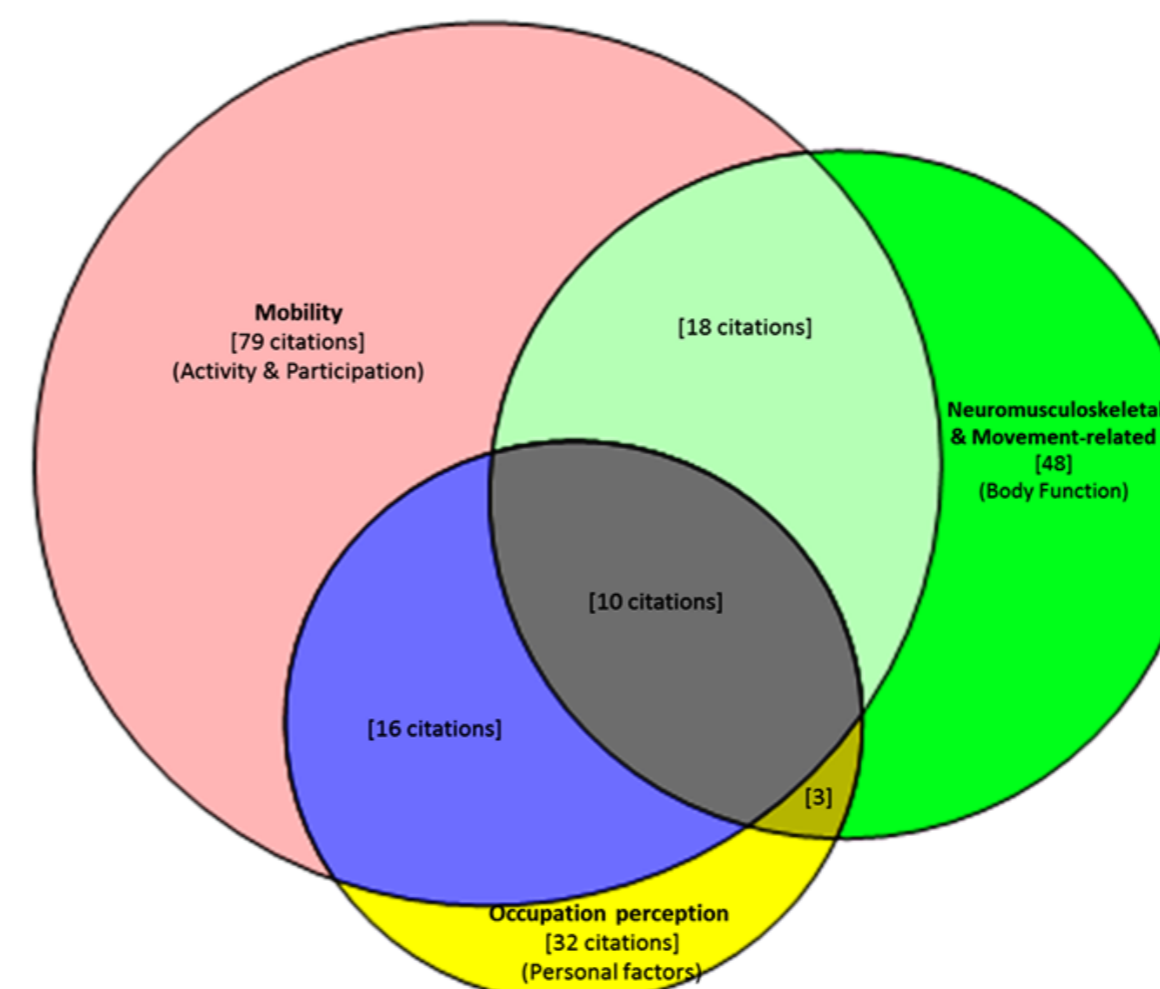
Category	N
Propelling Aids Involving Human Power Only	15
Power-Assisted Propelling Aids	5
Both	4

Category	Propelling Aid	Production Status	N publications	% of publications	
Propelling Aids Involving Human Power Only	One-Arm Drive WC	Existing	6	11.0	
		Prototype	12		
	Handrim	Existing	7	10.4	
		Prototype	10		
	Lever-Activated WC	Existing	6	7.9	
		Prototype	7		
	Wheel	Existing	8	5.5	
		Prototype	1		
	Arm Cycling WC	Existing	5	3.7	
		Prototype	1		
	Seating & Backrest	Existing	4	3.7	
		Prototype	2		
	Ultralight / Lightweight WC	Existing	5	3.0	
	Brake	Existing	4	2.4	
	Leg WC	Existing	2	2.4	
		Prototype	2		
	Caster	Existing	3	1.8	
	Glove & Splint	Existing	3	1.8	
	Suspension	Existing	2	1.2	
	Step & Stair Climbing	Prototype	2	1.2	
Anti-Tipping WC	Prototype	2	1.2		
Low Cost WC	Existing	1	0.6		
Frontal Drive Axis	Existing	1	0.6		
WC Attachment	Existing	1	0.6		
Pneumatic Tire	Existing	1	0.6		
WC with an assistive power unit	Prototype	1	0.6		
Power-Assisted Propelling Aids	Pushrim-Activated Power-Assisted WC	Existing	26	22.6	
		Prototype	11		
	Assistance Dog	Existing	13	7.9	
	Step & Stair Climbing	Prototype	10	6.1	
	Servo Brake	†	Prototype	2	1.2
	Arm-Cycling WC	†	Existing	1	0.6
	One-Arm Drive WC	†	Existing	1	0.6
	Detachable Motor Drive	Existing	1	0.6	
	Solar power-assisted	Existing	1	0.6	
Leg WC	†	Prototype	1	0.6	

(†) Also exists as a PA involving human power only ; (WC) Wheelchair



Number of citations of- and the relationship between the three most cited ICF subdomains



International Classification of Functioning, Disability, and Health framework (ICF) (2)

Conclusion

Literature about PA for MWC presents a variety of variables emanating from a wide range of study designs. Consensus is lacking as to how the effects/impacts of PA on MWC users should be studied and reported within predefined framework(s) and homogenous terminology for consistency and to inform future research and development efforts.

References

- (1) Smith E.M., Phys Ther., 2016, 96(8):1135-42
- (2) World Health Organization 2001, 18

Acknowledgement

