

Winter mobility and community participation: a scoping review

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INTRODUCTION

In some parts of the world, winter is characterized by below freezing temperatures, high accumulations of snow and ice, and strong winds. These conditions can create challenges to community participation (e.g., access to community spaces, engagement in community-based activities, and involvement in social relationships) for all citizens living in those regions. However, people who report having a mobility-related disability, many of whom use a mobility device such as a cane, walker, or wheelchair, experience a disproportionately high level of challenge. Examples of these challenges include mobility device wheels that become stuck or are unable to gain traction on snow or ice [1,2]; ice or snow-covered outdoor ramps, sidewalks, and roads [1-5]; thermal hand injuries (i.e., frostbite) from having to push or steer mobility devices; and diminished battery capacity in powered devices due to cold temperatures. [5] These obstacles and safety issues often curtail community participation among people with mobility-related disabilities during winter months [2-6].

A survey of wheelchair users in Manitoba, Canada, found 30% ventured out into their community less than once per week during the winter months [2]. Other research has reported increased feelings of loneliness associated with reduced outdoor mobility in winter [7]. While we are aware of many winter-related challenges among mobility device users and the detrimental impact of limited community participation on health and well-being, there is a need to identify effective strategies that address these issues [2,6,7]. Learning the breadth of available evidence on knowledge, products, and strategies for people who use mobility devices in winter will provide foundational knowledge for future research and clinical strategies to improve winter community participation.

AIM

The purpose of this research is to create a web-based toolkit of evidence-based winter accessibility solutions (i.e., knowledge, products and resources) for people who use mobility devices. The research consists of three phases:

1. Completing a scoping review of published winter mobility-related interventions in the published and grey literature;
2. Conducting six online asynchronous focus groups across Canada with people who use mobility devices in the winter; and
3. Implementing a rapid prototyping process to generate web-content through a validation process with three sets of stakeholders.

The focus of this paper is to share the findings from the phase one scoping review of published literature.

METHODS

A modified version of a framework for scoping reviews guided this phase [8]. The following steps were undertaken, with their associated actions:

1. Identify the research question

What are the tools, strategies, resources and recommendations that have been shown to facilitate winter community participation for people who use mobility devices?

2. Identifying relevant studies and content

Searches included peer-review literature of all study designs, including both quantitative and qualitative data, published prior to February 2017. A search strategy was developed (Table 1) in consultation with a health sciences bibliographer. Hand searching the reference lists of selected papers was also conducted. References were managed using EndNote Online.

Table 1. Search Strategy.

“mobility device*” OR wheelchair OR “wheeled mobility” OR seniors OR disability* OR geriatric OR “older adults” OR “spinal cord injury” OR “decreased mobility” OR “limited mobility” OR arthritis OR scooter OR cane OR crutch OR walker OR walking frame OR orthotic)
AND
winter OR snow OR ice OR icy OR “cold temperature” OR freez* OR slush OR slippery
AND
“community participation” OR falls OR safety OR socialization OR isolation OR “mental health” OR depression OR accessibility OR “community integration OR access* OR participation OR engagement

3. Selecting content

Three rounds of review were conducted (title screen; abstract screen; full text screen) with inclusion criteria outlined for each round:

- Title screen: population of people with limited/reduced mobility or mobility device users; winter conditions, fall prevention, or focus on increased community participation; published in English language
- Abstract screen: included an intervention and/or makes evidence-derived/informed suggestions for people with limited/reduced mobility or mobility device users; the aim of the intervention or suggestion was to increase community participation or safety
- Full text screen: involved winter-related environmental conditions

Studies were excluded if they did not address people with limited mobility or use of mobility aids; the study participant was a caregiver; research centered on biomechanical characteristics of slips and falls, without suggestions for prevention; research focused on winter health risks unrelated to mobility; gaps in fall prevention literature were highlighted, but not directly addressed; areas for relevant research were suggested, but not explored; the research focused solely on the mechanics of equipment without consideration of use; the focus was on adaptive winter sports for professional athletes, or the focus was on indoor fall prevention.

Two research assistants independently applied the inclusion criteria at each round. If there was a lack of agreement in the title and abstract screen, we erred on the side of inclusion and carried the study forward into the subsequent round. The first author addressed any lack of agreement between reviewers in the final round.

4. Charting data

The following information was charted in an Excel spreadsheet for each selected source: author; title; year published; country; study aim; study design; study population; outcomes or recommendations.

A process for ensuring consistency of data extraction was enacted with one research assistant extracting all data and a second research assistant extracting data from a sub-sample (n=5) of the selected articles. The extractions were compared and confirmed by the first author and extraction processes clarified as needed.

5. Collating, summarizing, and reporting results

The authors engaged in a process of collating and summarizing the results. Each article was coded as to: whether the focus was a tool (device or technology), strategy (use of a device, or teaching people a method), resource (information gathering or sharing e.g., literature review of policy), or recommendation (suggestion for improving winter access); the primary domain targeted, as outlined in the International Classification of Functioning, Disability and Health (i.e., body structure and function, activity, participation, environment); and, if the domain was environment, whether the article addressed products and technology; natural environment; support and relationships; attitudes; or services, systems and policies [9]. Subsequently, the research team engaged in an on-line dialogue, looking for patterns and themes within the charted data.

RESULTS

The initial search resulted in 1403 articles (AGELINE n=76; CINAHL n=156; OVID Medline n=922; and Scopus n=249). After deleting duplicates, 1180 potentially eligible articles remained. After round one exclusions, 109 articles remained; round two exclusions reduced this number to 40, and after round three exclusions 24 papers were left (Table 2).

Table 2. List of included articles.

Authors/Year	Title
Alexander et al., 2015	Effect of the matter of balance program on balance confidence in older adults
Bennett et al., 1977	Slipping cane and crutch tips. I. Static performance of current devices
Brandt et al., 2004	Older people's use of use of powered wheelchairs for activity and participation
Green et al., 2011	Toward enabling winter occupations: testing a winter coat designed for older adults
Kim et al., 2016	Travel in adverse winter weather conditions by blind pedestrians: effect of cane tip design on travel on snow
Lemaire et al., 2010	Wheelchair ramp navigation in snow and ice-grit conditions
Li et al., 2013	Aging and the use of pedestrian facilities in winter - the need for improved design and better technology
Lindsay et al., 2015	The experiences of participating in winter among youths with a physical disability compared with their typically developing peers
Lindsay et al., 2014	Weather, disability vulnerability, and resilience: exploring how youth with physical disabilities experience winter
McKiernan et al., 2005	A simple gait-stabilizing device reduces outdoor falls and non-serious injurious falls in fall-prone older people during the winter
Morales et al., 2014	Winter: Public enemy #1 for accessibility, exploring new solutions
Morales et al., 2016	Addressing challenges for youths with mobility devices in winter conditions
Nasuti et al., 2010	The risks and benefits of snow sports for people with disabilities: a review of the literature
Odderson et al., 1991	Gel wheelchair cushions: a potential cold weather hazard
Rantakokko et al., 2014	Perceived environmental barriers to outdoor mobility and feelings of loneliness among community-dwelling older people
Ripat et al., 2015	Barriers to wheelchair use in the winter
Ripat et al., 2016	Exploring winter community participation among wheelchair users: an online focus group
Ripat et al., 2017	Patterns of community participation across the seasons: a year-long case study of three Canadian wheelchair users
Shirado et al., 1995	Outdoor winter activities of spinal cord-injured patients. With special reference to outdoor mobility
Shumway-Cook, 2003	Environmental components of mobility disability in community-living older person
Smith, L., 2000	Long-term rehab. Weathering the winter in a wheelchair
Tadano, S., 1998	Driving tests and computer simulations of electric wheelchairs on snow-covered roads
Wall, R.S., 2001	An exploratory study of how travelers with visual impairments modify travel techniques in winter
Yamaguchi et al., 2015	Efficacy of a rubber outsole with a hybrid surface pattern for preventing slips on icy surfaces

Country

Most studies were conducted in Canada (n=14) or the US (n=5); one study was conducted in both Canada and the US, two studies were conducted in Japan, and one study in each of Denmark and Finland.

Study designs

Study designs included: cross-sectional (n=9); qualitative methods (n=5); product/simulation testing (n=4); pre-post design (n=2); case study (n=2); scoping review (n=1); and prospective randomized trial (n=1).

Target populations

Study populations included people who use: wheelchairs (manual n=1; power n=4; mixed wheelchair type n=7); canes (n=3); specialized winter footwear (n=2); gel cushions on wheelchair (n=1); or no device specified (n=6).

Primary focus of paper

Primary focus was related to: tool/device (n=9); strategy (n=4); resource (n=1); and recommendations (n=10).

Primary ICF domain addressed was: body structure/function (n=0); activity (n=2); participation (n=6); and environment (n=16 [products and technology - 9; services, systems and policies - 3; > one area - 4]).

DISCUSSION

Not surprisingly, existing research has been conducted in countries where the population experiences below freezing temperatures during winter months. While most of the studies have been conducted in Canada, many focused on providing recommendations only; intervention-based research is lacking.

Products and technologies were the focus of 9/24 papers. However, there is a paucity of high quality studies investigating categories of products within the wide range and nature of technologies that have the potential for improving winter mobility and participation. As winter mobility is not a population- or disability-specific issue, the available literature has addressed a wide range of individuals. Taken together, this finding signals a need for future research to address specific devices and populations.

The focus of the majority of papers targeted either the environment or participation, suggesting a researcher predisposition towards using a social model of disability, rather than an individual-focused model to study winter mobility and participation issues. The studies confirm that multiple aspects of the environment influence winter mobility and participation, beyond just the mobility devices themselves.

CONCLUSIONS

This scoping review served a twofold purpose: to methodically collect and collate available evidence to identify useful information that could be incorporated in a future toolkit, and to identify knowledge gaps where no or low level evidence research existed. Given the dearth of research on this topic, an important next stage of the scoping review is to include grey literature, especially that found in government documents and user-generated content on the web, such as online forums and any other consumer sources. Once the scoping review, including the grey literature, is complete, findings will be confirmed with expert stakeholders (people who use mobility devices in the winter, health care professionals knowledgeable in this area, and consumer and advocacy organizations representatives) in focus groups during the winter of 2017-2018.

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