

Development of Collision Avoidance and Path Planning Technologies for Older Adult Wheelchair Users: Thoughts of Occupational Therapists.

Krista L Best, PhD Trainee^{1,2,3}, Ben Mortenson, PhD^{4,5}, Laura Hurd Clarke PhD⁶

¹Graduate Program in Rehabilitation Sciences, University of British Columbia; ²GF Strong Rehabilitation Centre; ³Vancouver Coastal Health Research Institute; ⁴Gerontology Research Centre, Simon Fraser University; ⁵Centre de recherche de l'institut universitaire de gériatrie de Montréal; ⁶University of British Columbia, School of Human Kinetics.



Background

- Power wheelchair (PWC) use can facilitate independent mobility and participation in meaningful activities, which are associated with better quality of life. [1, 2]
- However, accidents are a serious concern for all users.
- Users may also have problems with route finding and path planning, especially those with cognitive impairments. [3]
- These safety concerns may lead to under prescription of PWCs, particularly in residential care settings.[3, 4]
- As part of a research program to develop collision avoidance and path planning technologies [5], we conducted a study to explore prescribers perceptions about collision avoidance and path planning technologies for older adults.

Design

- Semi-structured interviews (one time for an average of 1 hour) were conducted with 10 prescribers ranging in age from 29-60 years (9 females).
- This purposive sample included occupational therapists (OTs) who had 4-30 years of clinical experience with PWCs, and worked in a variety of settings (community, rehabilitation, residential).
- Data were analyzed using open and axial coding. Line-by-line coding was initially used to identify all of the relevant raw data that pertained to the overarching themes. Sub-codes were then identified, further analysis was conducted and emergent themes were refined.

Findings

Collision Avoidance

Avoiding PWC collisions through obstacle detection

All OTs thought collision avoidance would have advantages for older adult power wheelchair users.

- *“it would extend the time that people are able to use a power chair” because collisions were “why you start to take chairs away.”* She went on to describe taking away a PWC as *“sentencing [PWC users] to a life of immobility,”* (OT, residential care)

All ten OTs had concerns that included:

- user frustration
- false sense of security
- situational sensitivity: *“If the chair stops when they don’t want it to stop, even though they know they are going to have a bit of a bumped foot. When they are doing it for a bigger reason, they should have control of the chair.”* (OT, long term care)

Path Planning

Environmental scanning and route planning

6 OTs felt path planning could increase independence and safety.

- *“I see pros in the fact that you know they’re safe. [Even though] their control is certainly not 100% there, if [path-planning] increases their independence somewhat, they can actually go out versus not go out.”* (OT, residential care)

But, these 6 OTs also had concerns that were mostly related to safety.

- *“[I’m concerned about] clients who have cognitive concerns or don’t have the reaction or control over the chair to get back on path.”* (OT, rehabilitation)

4 OTs were opposed to the idea of path planning technology .

- *“I feel like somebody who is able to operate a power wheelchair, should be able to navigate their way to the store or to the dining room.”* (OT, community)

Discussion

There are both positive and negative outcomes when a new technology is adopted, yet new technology is often developed without due consideration for the potential negative outcomes [6]. The occupational therapists identified numerous potential undesirable outcomes with both collision avoidance and path planning technologies that need to be considered during their development. This will inform further refinements in such smart technology, and will provide insight about desired outcomes for new technology from an occupational therapists point of view.

Conclusion

There is agreement among OTs that there is applicability and desire for collision avoidance technology for older power wheelchair users, while there is more ambivalence toward path planning technology. Several issues would need to be addressed to prevent potential negative outcomes with both technologies. These findings will inform the CanWheel research team with regard to the development of new PWC technologies and will help in the design of future outcome studies related to PWC use.

Support



References

1. Miles-Tapping C, MacDonald LJ. Lifestyle implications of power mobility. Phys Occup Ther Geriatr 1994;2(4):31-49.
2. Brandt A. The power of independence. Rehabil Manage: Interdisc J Rehabil 2001;14(8):54-58.
3. Frank AO, Ward J, Orwell NJ, McCullagh C, Belcher M. Introduction of a new NHS electric powered indoor/outdoor chair service: benefits, risks and implications for prescribers. Clin Rehabil 2000;14(6):665-673.
4. CanWheel. Improving wheeled mobility of older adults. www.canwheel.ca.
5. Mortenson WB, Miller WC, Boily J, Steele B, Odell L, Crawford EM et al. Perceptions of power mobility use and safety within residential facilities. Can J Occup Ther 2005;72:142-152.
6. Mortenson WB, Dyck I. Power and client-centred practice: an insider exploration of occupational therapists' experiences. Can J Occup Ther 2006;73(5):261-71.

