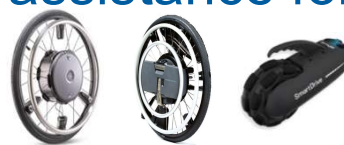




Clinical perspectives on power assistance for self-propelled wheelchairs

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Introduction

Pushrim-activated power-assist wheels (PAPAWs) are battery-powered electric motors which reduce the effort of propelling a manual wheelchair (Khalili *et al.*, 2021), analogous to an electric bicycle. Previous studies have focussed on laboratory environments and have demonstrated increased distances and speeds, and reduced energy expenditure, compared with traditional wheels (Guillon *et al.*, 2015). However, adoption of PAPAWs within the NHS has been limited, and studies exploring clinical use are rare. This project aims to explore the use of PAPAWs and generate evidence to help inform prescription choices around power assistance within the NHS context.

Study Design

PAPAWs were chosen as the subject of this study as these devices bridge a gap between self-propelled and powered wheelchair provision. Marketing images of PAPAW products supplied by Invacare, Sunrise and Permobil to the UK market are shown above. A PICO framework (Sackett *et al.* 1997) was used to identify situations where patients may benefit from the use of PAPAWs, with the aim of directing future research clinical effectiveness. NHS wheelchair clinicians in the West Midlands were surveyed to understand their past experience of PAPAWs and investigate barriers to NHS adoption; 19 responses were collected for analysis.

Background - comparison of PAPAWs with self-propelled and powered wheelchairs (Kloosterman *et al.*, 2012)

Advantages of PAPAWs

- Reduced strain on the arm and cardiovascular system compared to standard self-propelled wheelchair use
- Tasks which require more torque are easier than standard self-propelled wheelchair (over carpet, dimple strips, ramp and kerb)
- Precision tasks easier than with a powered wheelchair

Disadvantages of PAPAWs

- Precision tasks more difficult than with a standard self-propelled wheelchair
- Additional weight in relation to removing and replacing wheels for car transportation

Clinical Reasoning

PAPAWs may help to preserve the exercise benefit of self-propelling a wheelchair compared with alternative means of independent mobility such as joystick-controlled power assistance and powered wheelchairs. Some models also have the advantage of being independently programmable to give greater options for modifying assistance levels. This could be tuning the assistance level for the individual user, or over time within a programme of exercise training or rehabilitation, or offering a different assistance level on each side. While these functions make the device more complex, and may make it heavier, they may also offer clinical benefit to a wider group of patients. A PICO framework separates a clinical topic into four aspects: the patient group, the intervention, the comparison, and the outcome of interest. For the technology of PAPAWs, a range of clinically interesting scenarios were considered by the authors:

School use:

PATIENT GROUP: Wheelchair users entering secondary school

INTERVENTION: PAPAWs used only in school

COMPARISON: Self-propelled and Powered wheelchair

OUTCOME: Mobility independence, need for environmental adaptations, effect on educational attainment.

Managing fatigue:

PATIENT GROUP: Wheelchair user with MS experiencing fatigue

INTERVENTION: Exercise program using PAPAWs

COMPARISON: Graded upper limb circuit training program

OUTCOME: Fatigue scale, Borg breathlessness scale

Managing shoulder pathology:

PATIENT GROUP: Long-term self-propelled wheelchair users

INTERVENTION: Long-term PAPAWs use

COMPARISON: Self-propelled wheelchair

OUTCOME: Incidence and severity of shoulder pathology; rotator cuff injury, shoulder pain.

Upper limb hemiparesis:

PATIENT GROUP: Early stroke

INTERVENTION: PAPAWs use during rehabilitation 'window of opportunity'

COMPARISON: Self-propelled and powered wheelchair

OUTCOME: Upper limb function, effect on learned disuse

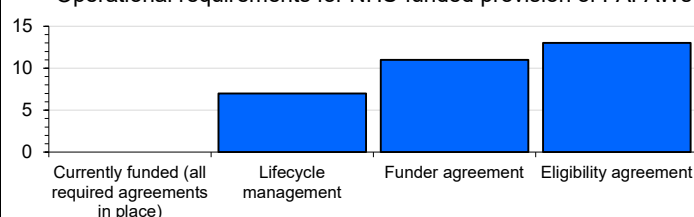
Survey of wheelchair clinicians

Responses were received from a range of wheelchair professions; including occupational therapists, physiotherapists, assistant practitioners, rehabilitation engineers, clinical scientists and trainees. Clinicians surveyed had limited experience of PAPAWs, with only 1/19 reporting previous involvement in their provision. Clinicians agreed that they would need further information on the clinical effectiveness of PAPAWs to inform decision-making, and were interested in evidence on safety, usability, effect on upper limb injury incidence, distance self-propelled, and the impact of fatigue. They reported that organisational agreements would also be needed for PAPAWs to be provided; including definitions of eligibility rules, agreements with funders, and lifecycle management agreements. A majority of clinicians were in favour of offering PAPAWs via a top-up / option 2 Personal Wheelchair Budget (PWB).

Acknowledgements

This work was part-funded by a Healthcare Science Innovation Fellowship in collaboration with NIHR Devices for Dignity MedTech Innovation Co-operative. The authors would also like to thank all survey contributors.

Operational requirements for NHS-funded provision of PAPAWs



Willingness to offer PAPAWs via top-up PWB (funded and maintained by patient at NHS purchase prices)

