IMOVE: IMPROVING MOBILITY VIA EXOSKELETONS

The collaborative initiative of Alexandra Hospital (AH), Saint Luke's Hospital (SLH), Stroke Support Station (S3), NTUC Health, Saint Luke's Eldercare (SLEC), Jurong Community Hospital (JCH) won the "Adoption Medal" at the National Healthcare Innovation and Productivity Medals 2022.

By Tjut Rostina, CHI

More than 80 percent of stroke survivors have impaired walking ability, with 50 percent of them suffering long-term motor deficits.

As improved mobility is connected to decreased morbidity, mortality and complications across diseases, it is vital to consider rehabilitative solutions that would accelerate the recovery of mobility in patients.

With a drive to improve mobility for patients, the collaborative team of physiotherapists and research professionals undertook the efforts to implement Robotic Exoskeleton Training (RET) across the continuum of rehabilitative care (hospital to community).

To optimise implementation, the team studied the effectiveness and manpower utilisation in different settings.

The RET initiative was implemented through the collaborative efforts of the team comprising of physiotherapists Nur Shafawati Kamsani (AH), Suresh Ramaswamy (AH), Yap Thian Yong (SLH), Alexis Lau (S3), Jean Tan (NTUC Health),Lui Yook Cing (SLEC), Qiu Wenjing (JCH), as well as Research Fellow Tang Ning (NUH) and Research Coordinator Evania Wong (NUH).

Problem & Background

As rehabilitation of mobility in acquired neurological diseases is labour-intensive, and requires effort from both therapist and patient, those with severe deficits (abnormal function of body area), may not achieve the optimum intensity of therapy and consistency of assistance.

The team also found that patients' compliance to post-discharge rehabilitation is low, with only 25 percent continuing their rehabilitation for a month, and subsequently only 9.8 percent at the 6 months mark.

Reasons cited for this decline in post-discharge rehabilitation included transportation and inconvenience, and subsequently a lack of interest/motivation and financial concerns.

In a study by Jan Mehrholz (2017), he stated that RET is more effective than conventional physiotherapy when rehabilitating to restore independent walking and movement speed for stroke and spinal cord injury.

Patients that have more acute conditions, and those unable to walk independently stand to benefit most from RET.

While there are clinical studies on the advantages of RET, the impact when adopted in real life and its cost effectiveness in the local context is unknown. Adoption of rehabilitation technologies have typically been hampered by lack of guidance, inadequate awareness, conflicting priorities and staff attrition.

Evaluation Considerations

To find out how feasible it would be to implement the RET, the collaborative team first evaluated the utilisation and effectiveness of wearable RET across the continuum of rehabilitation care, from hospital to the community, including the manpower utilisation.

The participating sites across this care continuum are:

- Inpatient & outpatient rehabilitation facility of a tertiary rehabilitation unit (Alexandra Hospital)
- Inpatient & day rehabilitation at community hospitals (Saint Luke's Hospital, Jurong Community Hospital)
- Community day rehabilitation centres (Saint Luke's Eldercare, NTUCHealth Nursing Homes)
- Community stroke survivorship rehabilitation centre (Stroke Support Station)

They then sought to identify and overcome barriers to effective utilisation of RET. The team conducted a case-controlled study comparing outcomes of patients who underwent 12 sessions of RET vs Conventional Physiotherapy. The patients were stratified into acute, subacute and chronic phases.

The participants of the study were patients who were deemed to benefit from mobility training with the wearable robotic exoskeleton. Those who chose not to undergo RET were recruited as controls.

The team sought to improve access to RET to improve effectiveness of rehabilitation in order to improve mobility outcomes faster, and to evaluate manpower requirements associated with this. Allied health leads of the various organisations evaluated the needs/benefit of RET in their organisations before joining the programme.
The lessons learnt from this study experience was applicable across the whole healthcare system and would inform RET adoption and practice in all settings, resulting in better outcomes for people with impaired mobility.

The End User Experience

The team designed a semi-structured interview to assess therapists' and patients' perceptions towards RET. Physiotherapists across all settings reported RET gave patients confidence, improved posture and produced the desired gait patterns. Patients walked better, improved speed, endurance, and time to achieve tasks such as sitting and standing.

Therapists shared that some patients had initial concerns about injury and ability to move in the device, but most quickly came to enjoy the training and had a positive experience with it. Older patients were less likely to prefer RET.

In a satisfaction survey of 182 patients, the mean rating for ease of donning and doffing was 5.0/7, comfort was rated 5.5/7, on whether they felt safe when moving in the exoskeleton, the rating was 6.0/7, on whether they felt their affected limbs were adequately supported, the rating was 6.0/7, on whether they felt RET improved their walking ability, rating was 5.2/7. Overall, their experience with RET was rated 5.8/7.

Of the factors impacting patients' decision on whether to use RET, 74.2 percent cited cost, 30.5 percent cited time commitment required, and 26.3 percent cited usability.

With adequate training, therapists could appropriately identify patients and took to RET positively.

Patients required comprehensive instructions to allay initial fears. Education of the RET helped to increase awareness amongst clinicians and therapists to facilitate recruitment.

With the required information and date on hand now, the team conducted regular reviews of the implementation process. With greater practice and experience, confidence with the technology is built.

The Results

In conclusion, the adoption of RET increased the efficiency of mobility training, and decreased manpower requirements for rehabilitation of dependent ambulators.

Patients took 3 times more steps and walked 3 times further with RET per session vs conventional physiotherapy, and less manpower utilised in the rehabilitation process.

It resulted in 34 percent better improvement in functional mobility compared to conventional physiotherapy in this group. However, the benefits in an already-ambulant population have not been established yet.

RET could be effectively implemented in facilities associated with inpatient rehabilitation, which has the most suitable profile of patients.

For RET to be successfully implemented in community day rehabilitation centres, the site should have adequate space and manpower to manage all programmes, and be resourced to address holistically complex rehabilitation needs of RET patients.

About the National HIP Medals

Launched in 2016, the National HIP Medals is a prestigious, national-level award that recognises local healthcare and community care institutions that have demonstrated thought leadership through the implementation of innovative productivity projects. It is open to all local healthcare institutions from the primary, acute and community care sectors.

The recipients of the National HIP Medals have shown how the spirit of innovation is thriving and continuously progressing to deliver value in healthcare, while building resilience in the face of future challenges. To find out more about the winning projects, watch their video **here**.

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