Empowering Older Adults: Impact of Lower-Limb Exoskeleton (LLE) on Mobility and Perceived Quality of Life in Hong Kong

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BACKGROUND & OBJECTIVE

Hong Kong is a rapidly aging society. With **80% of local older adults reporting chronic pain**, mobility decline and social isolation are critical issues.

Preliminary research shows exoskeletons positively affect functional mobility, physical health, social skills, and emotional well-being.

Objective: To examine the potential of a consumer-grade LLE beyond clinical use, aiming to integrate it into routine lives to support *ageing in place*.

METHODOLOGY

Participants: 30 community-dwelling older adults (Ages 65-88, Mean=70.13) with self-reported knee pain.

Design: Mixed-methods convergent parallel design.

Quantitative: Timed Up and Go (TUG), 6-minute Walk Test (6MWT), User Acceptance Test (UAT).

Qualitative: Semi-structured interviews & thematic analysis.

THE DEVICE: VIATRIX LLE

Wearable powered suit for walking, running, & cycling featuring AI adaptive mode.

50%
Strength Increase

30-40%
Less Energy Used

QUANTITATIVE RESULTS

Objective metrics showed slower performance initially due to the learning curve and device weight, but user acceptance remained promising.

TUG Test (Lower = Better)
Baseline: **9.51s**
With LLE: **10.85s**
* 10% showed improvement

6MWT (Higher = Better)
Baseline: **362.3m**
With LLE: **341.5m**
* 20% walked further

User Acceptance (UAT): 60% found walking easier, **86.7%** felt comfortable, BUT **76.7%** found it too bulky.

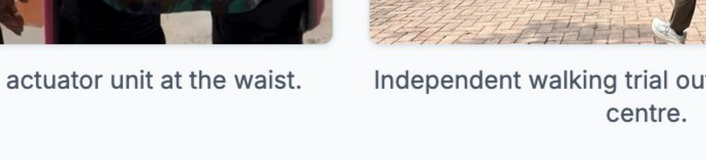
THEME 1: FUNCTIONAL MOBILITY

Participants felt physically supported, noting reduced fatigue and decreased knee strain.

High perceived usefulness, BUT functional benefit ≠ automatic adoption

THEME 2: USABILITY BARRIERS

Device heaviness and complex strapping required external assistance, threatening perceived independence.



Independence outweighed usefulness

THEME 3: DESIGN & THEME 4: SAFETY

Design Constraints & Conditional Adoption:
Users demand weight reduction, simplified donning, and discreet aesthetics.

Psychological Safety:
Initial fears of falling and AI unpredictability. Trust is a prerequisite.

MOBILITY & QOL

Mobility was directly linked to mood, confidence, social participation, and identity:

> *"Walking independently protects dignity. Older adults feel happier when they can go out by themselves." - **P21***

> *"I prefer walking — it makes me feel like a normal person. This device gives me hope to keep walking." - **P29***

DISCUSSION & CONCLUSION

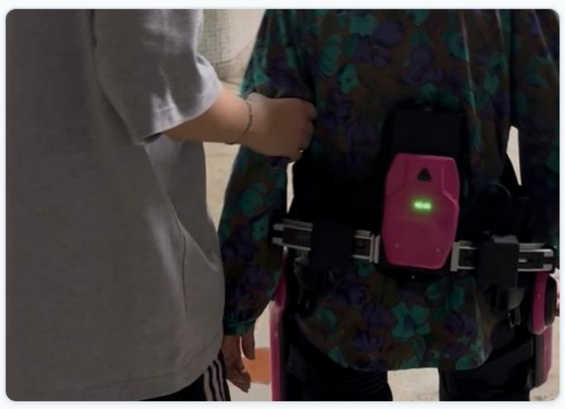
Autonomy is the Gatekeeper: Functional usefulness is necessary but insufficient. Older adults declined adoption when autonomy was threatened by the need for caregiver assistance.

Sequential Evaluation: Acceptance unfolds in stages. Psychological safety and independence must be satisfied before functional advantages become meaningful.

Future Directions: To successfully integrate LLEs for ageing in place, engineers must prioritize **lightweight materials, independent donning/doffing, and psychological reassurance** over pure biomechanical performance.

THE STUDY IN ACTION


Guided donning of the LLE, often requiring assistance.


The AI-powered actuator unit at the waist.


Independent walking trial outside a community centre.


Supervised walk test in a real-world setting.

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