Enhancing the lives of older people through digital health and assistive technologies

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CATCH

The University Of Sheffield.

Centre for Assistive Technology and Connected Healthcare

CATCH brings together and coordinates the activities of over 70 academics, across 17 departments and five faculties at the University of Sheffield, including healthcare scientists, engineers, psychologists, computer scientists, architects, and social scientists.

70	17	5
academics	departments	faculties

Assistive Technology

- Daily living and mobility (including care robotics)
- Human communication

Connected Healthcare

- Self management and wellbeing
- Healthcare and rehabilitation delivery

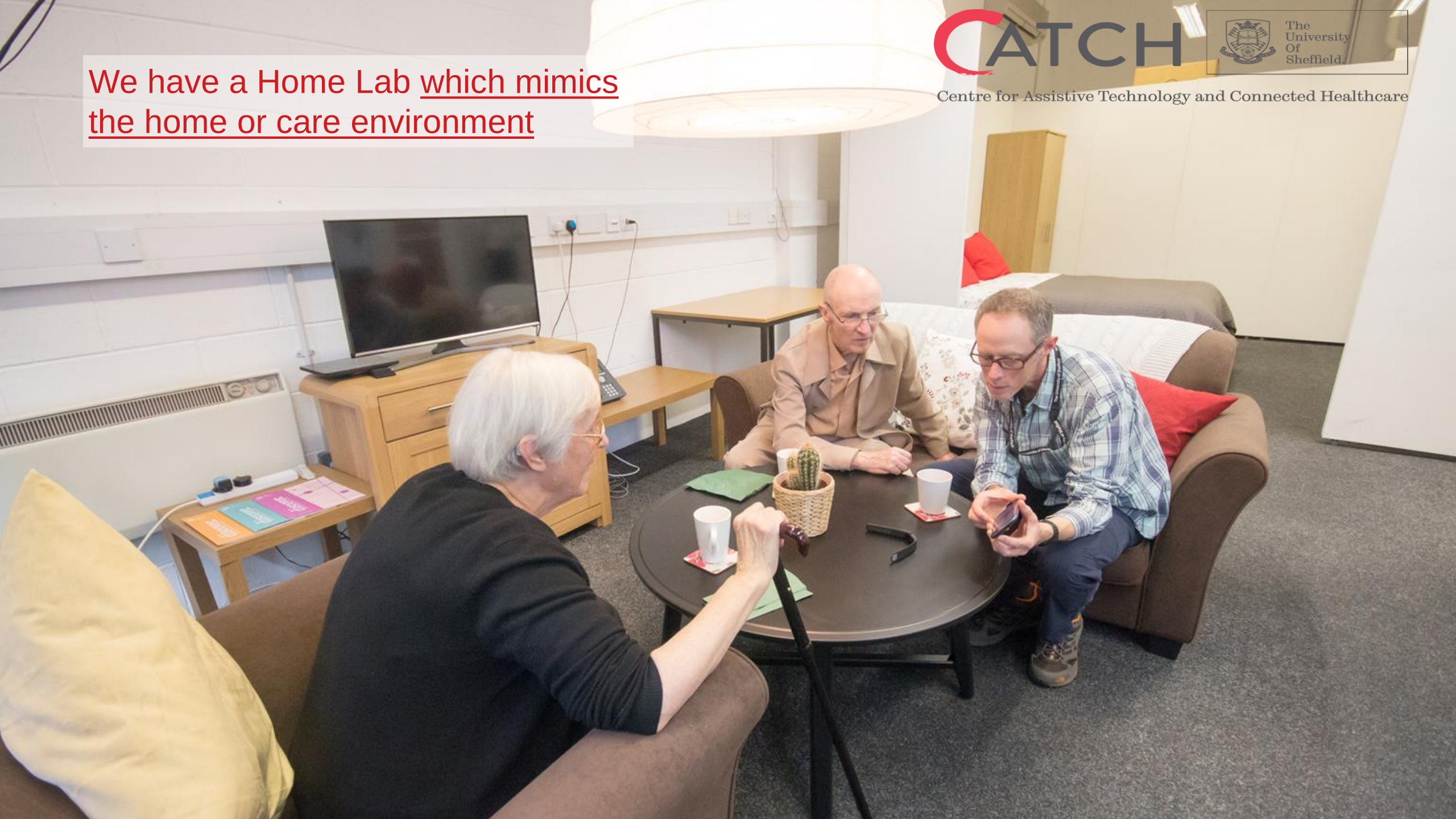
CATCH's research is focused around co-production which means that every project we work on will always involve collaborations with one or more of industry, patients and the public, charities, NHS, clinicians, social care providers and local authorities.

Co-design and development

User needs and wants

Evaluate
(summative)

We have a Home Lab which mimics the home or care environment



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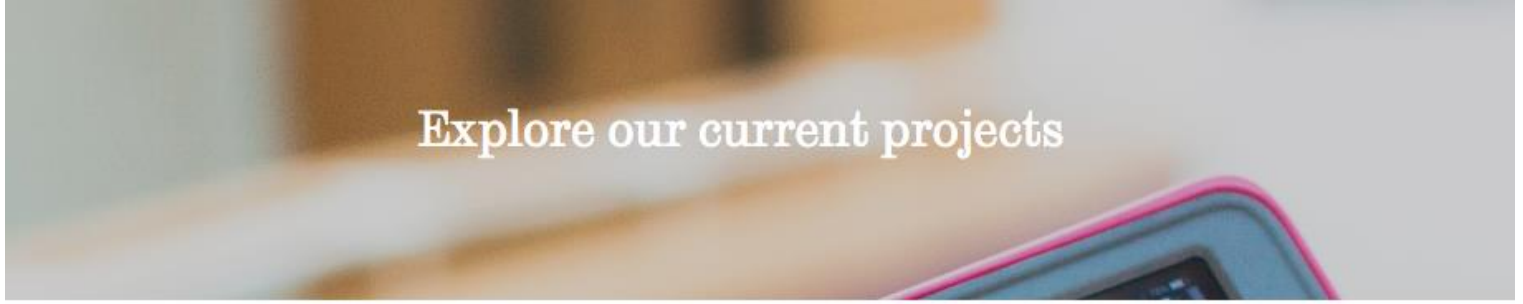


AcTo Dementia


Adopt a Care Home Evaluation


Applying Relationships Science to Contemporary Interventions (ApReSCI)


Automatic analysis of speech and language for detecting signs of dementia

Big CACTUS


CABOT


CASELOAD feasibility trial


CloudCAST

CloudVent


DeepArt

Emego


Energee


InLife


Neural Response Control

Perfect Patient Pathway


Project Title: Online course on emotional well-being for University Students: thriving not just surviving


Robots for Care


Sight Loss Care Services Study (SiLCSS)


SMART COPD


SMART-Stroke

catch.org.uk

Challenge: How do we meet the needs of the growing number of older people with long-term health conditions, multi-morbidity, frailty and disability (within current resources)?

- Identifying people at risk, monitoring, prevention and early intervention
- Supporting independent living at home
- Supporting self-management

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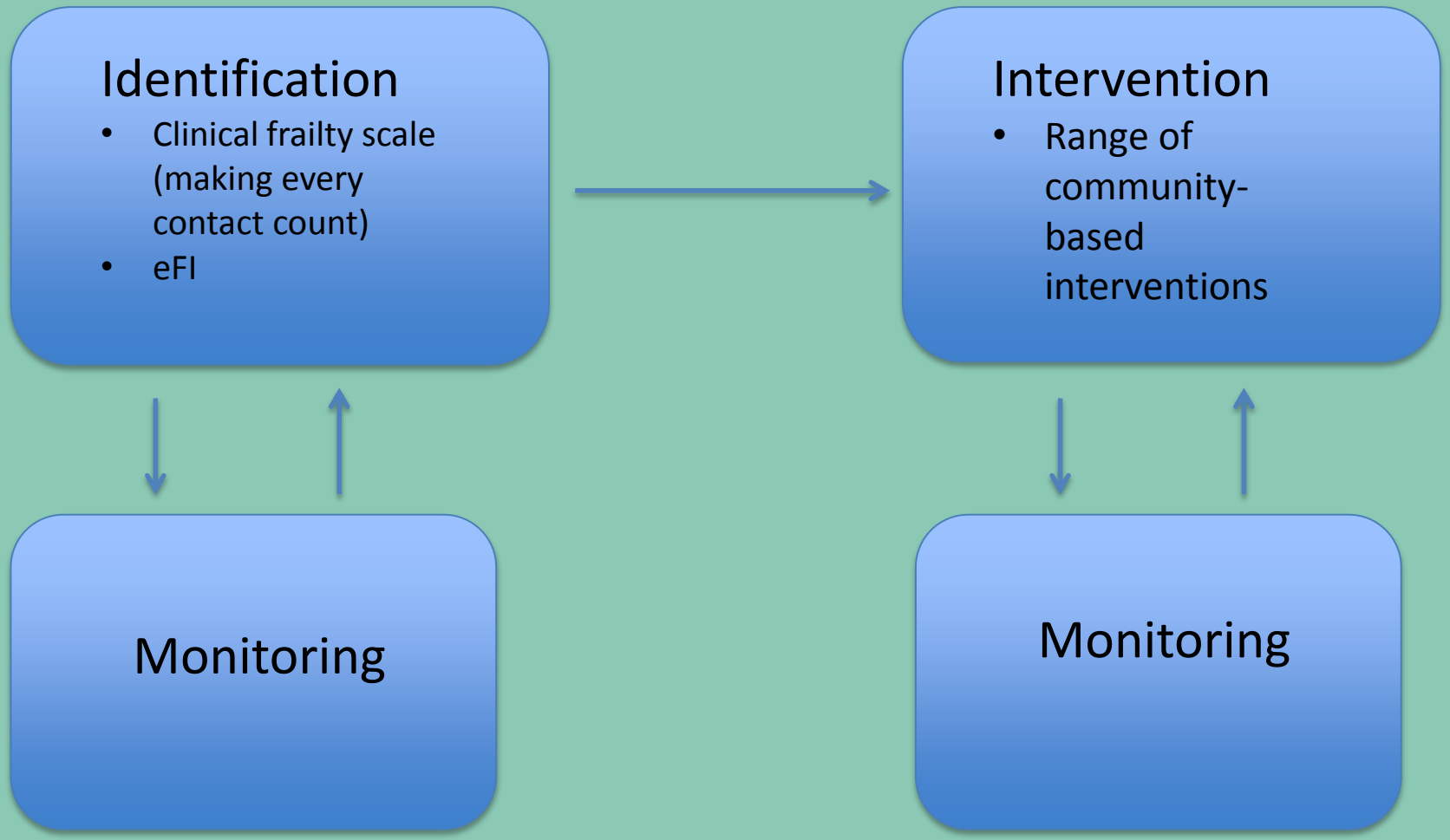
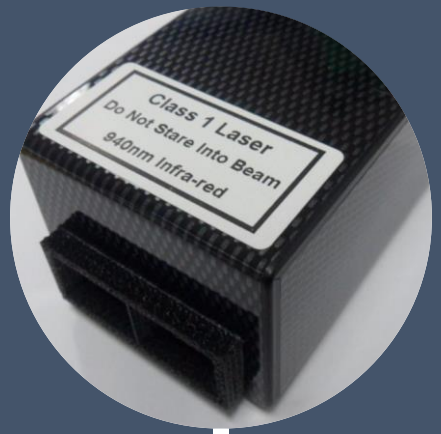
Barnsley Alliance – Frailty pathway

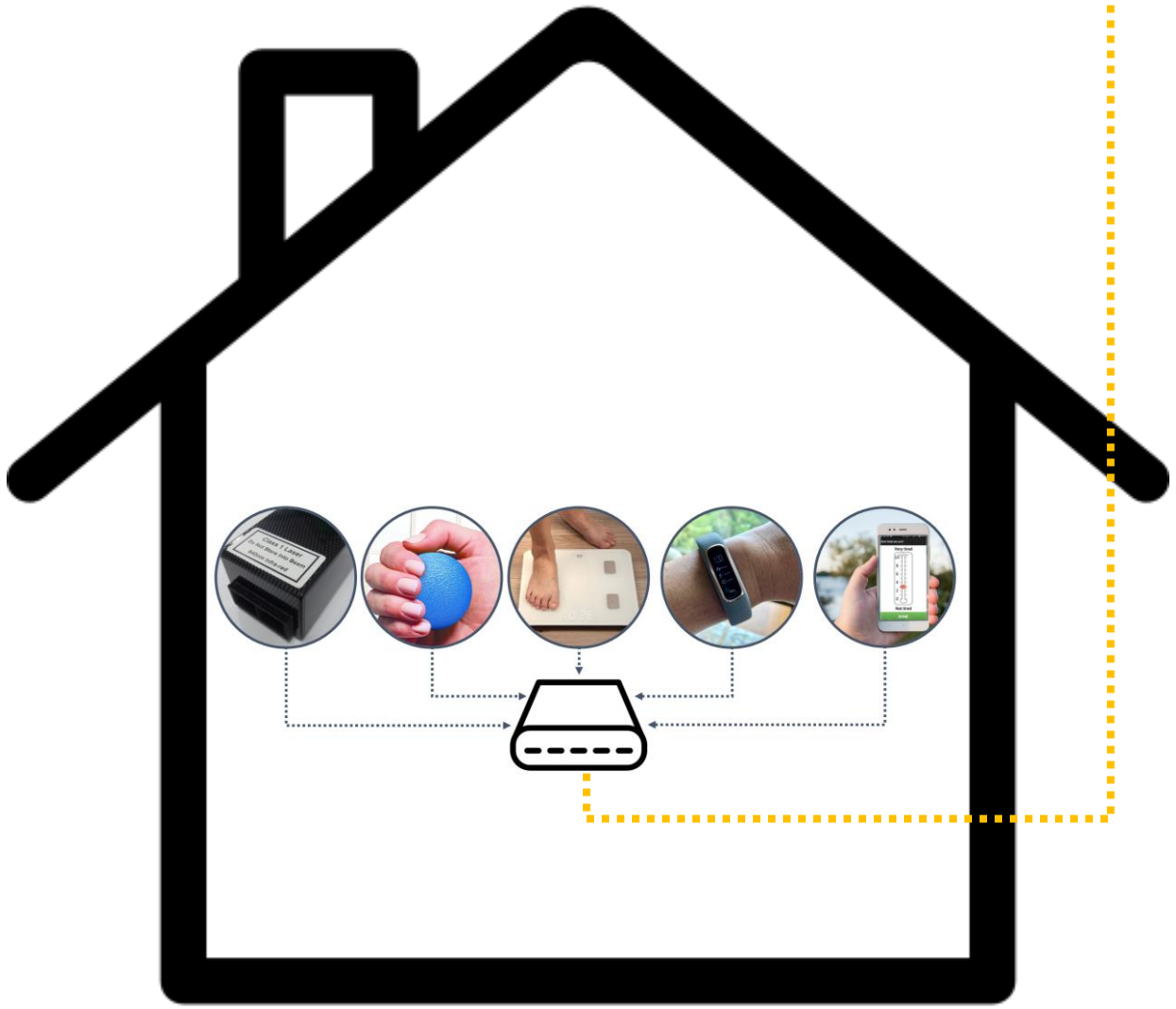


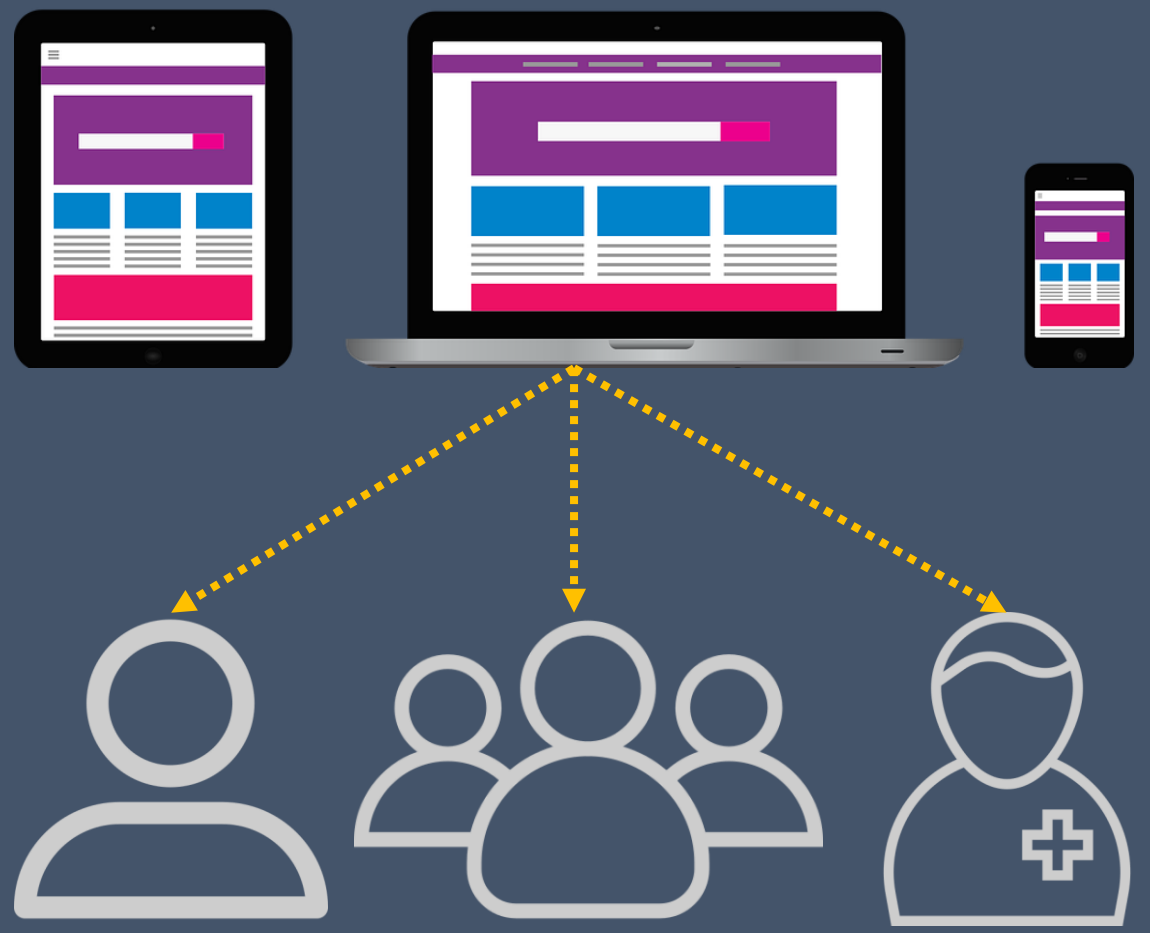
Phenotype model of frailty

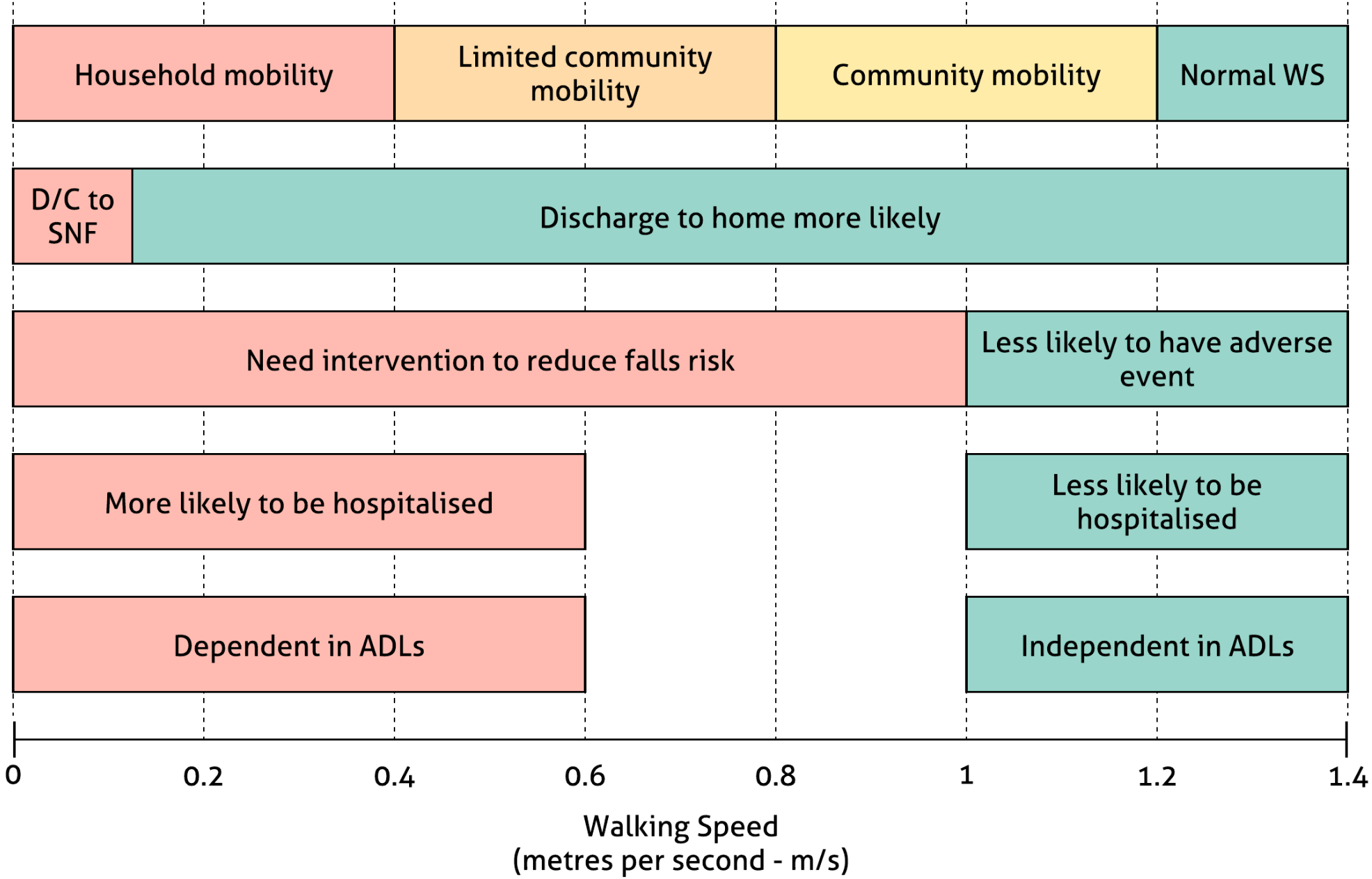
(Fried et al 2001)



Frailty



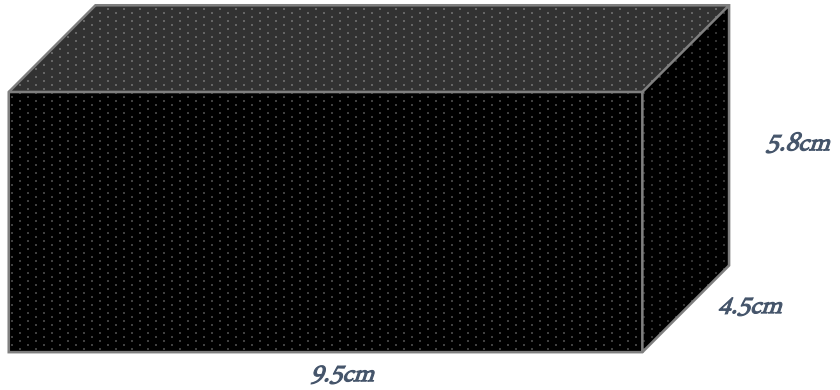




Adapted from Fritz, S. & Lusardi, M. (2009). White Paper: Walking speed: the sixth vital sign. Journal of Geriatric Physical Therapy, 32(2), 2-5

Walking speed sensor

- Developed by GSPK Design (UK)
- Based on LIDAR
- Measures walking speed each time a person walks past it



Aim

Our aim was to test whether it is feasible to measure walking speed frequently and unobtrusively in the home and evaluate whether technology is:

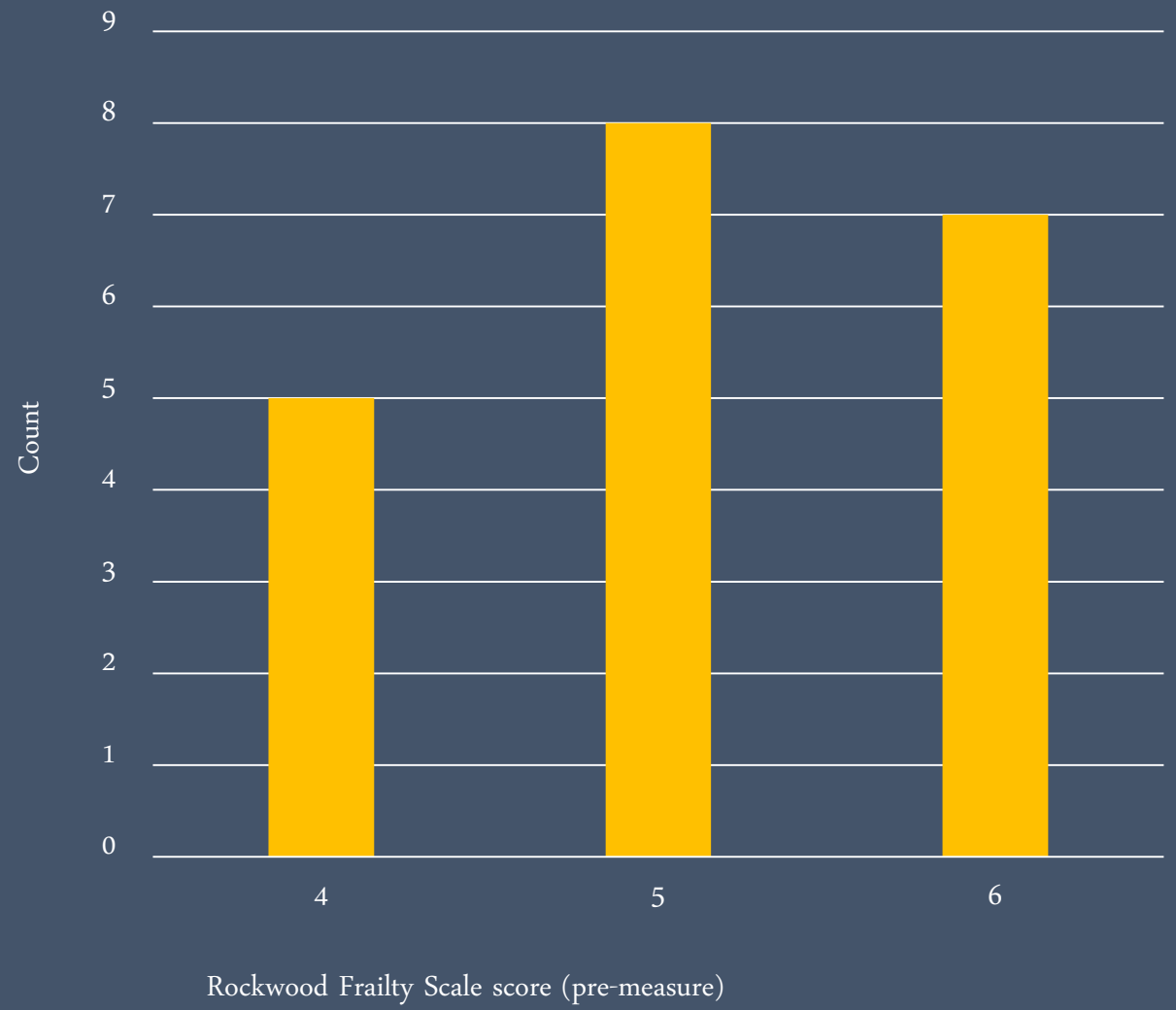
- easy to install
- reliable
- acceptable to older people
- low cost

- Secondary aim: to examine the data for examples of changes in walking speed tracking changes in frailty or health status

Method

	Installation	Week 1	Month 1	Month 2	Month 3
Rockwood Frailty Scale	✓		✓	✓	✓
Self-report health rating			✓	✓	✓
Self-report health symptoms			✓	✓	✓
Data check		✓	✓	✓	
Participant interviews					✓

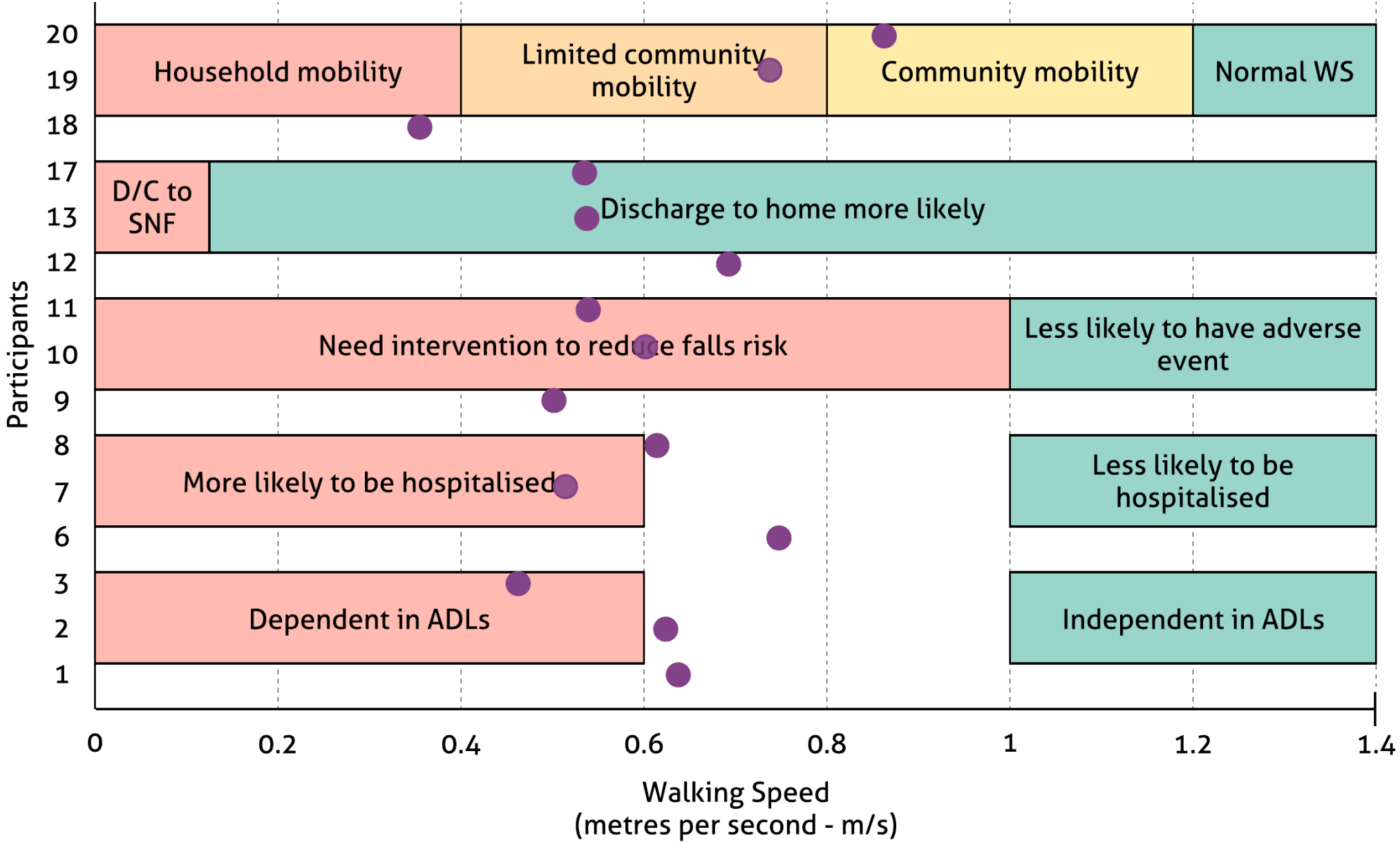
Recruitment



4 Vulnerable – While not dependent on others for daily help, often symptoms limit activities. A common complaint is being "slowed up", and/or being tired during the day.

5 Mildly Frail – These people often have more evident slowing, and need help in high order IADLs (finances, transportation, heavy housework, medications). Typically, mild frailty progressively impairs shopping and walking outside alone, meal preparation and housework.

6 Moderately Frail – People need help with all outside activities and with keeping house. Inside, they often have problems with stairs and need help with bathing and might need minimal assistance (cuing, standby) with dressing.



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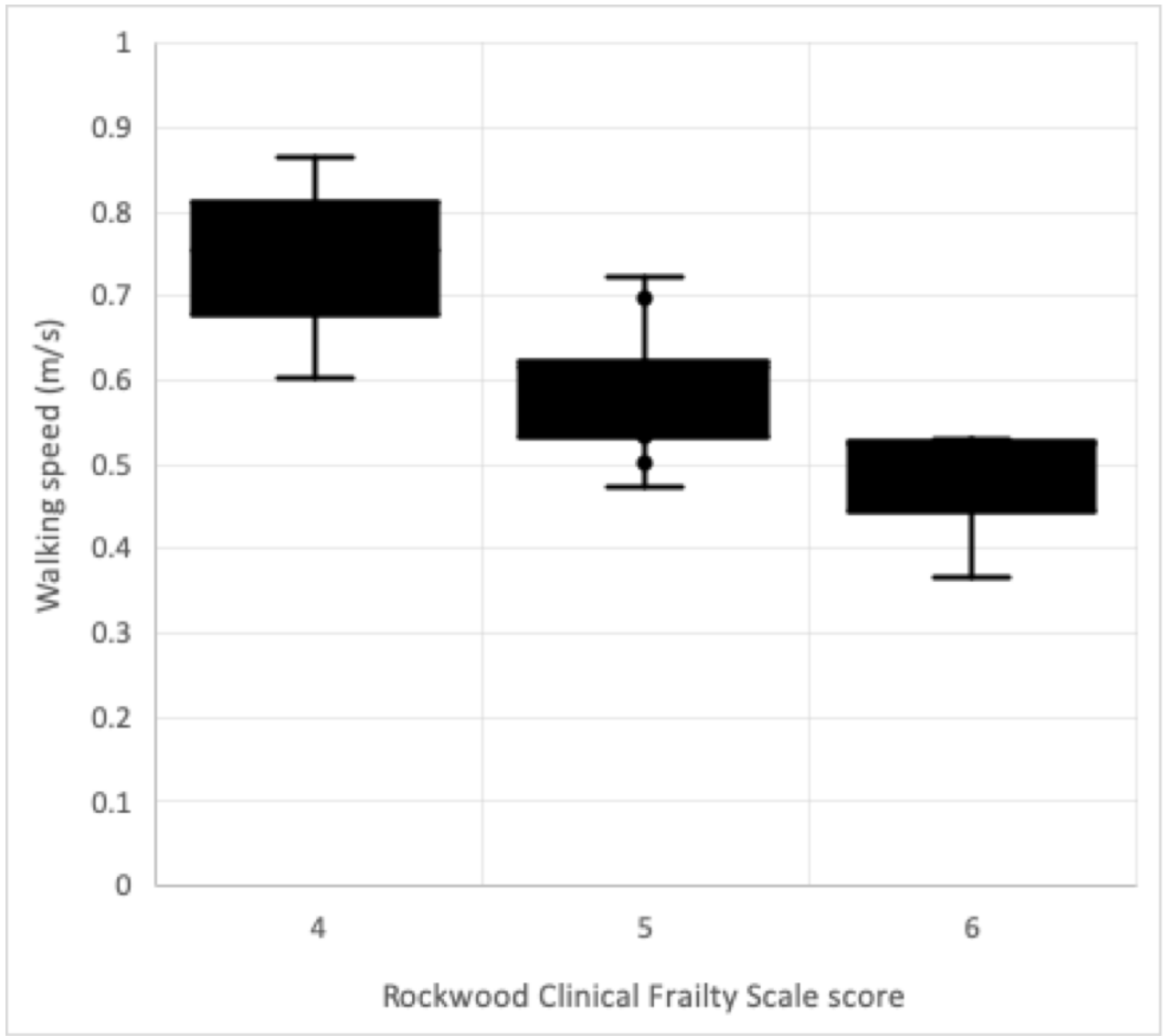

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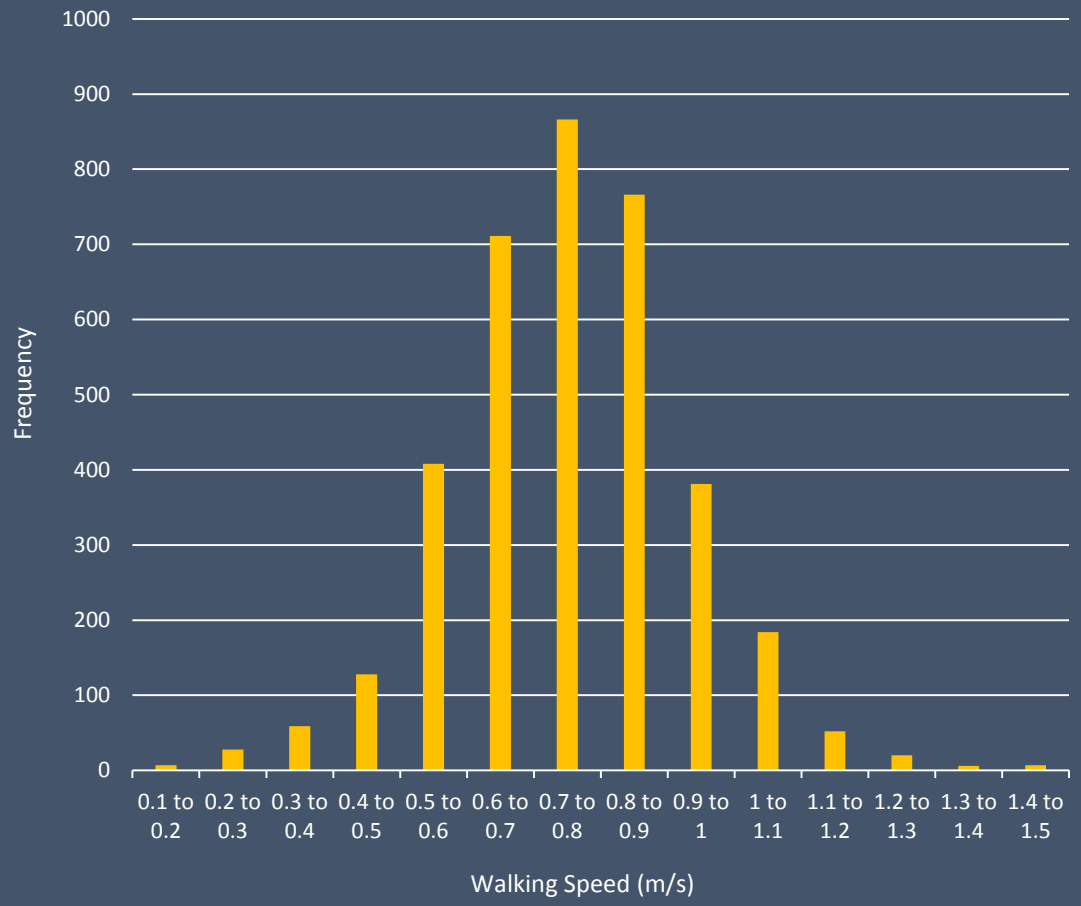
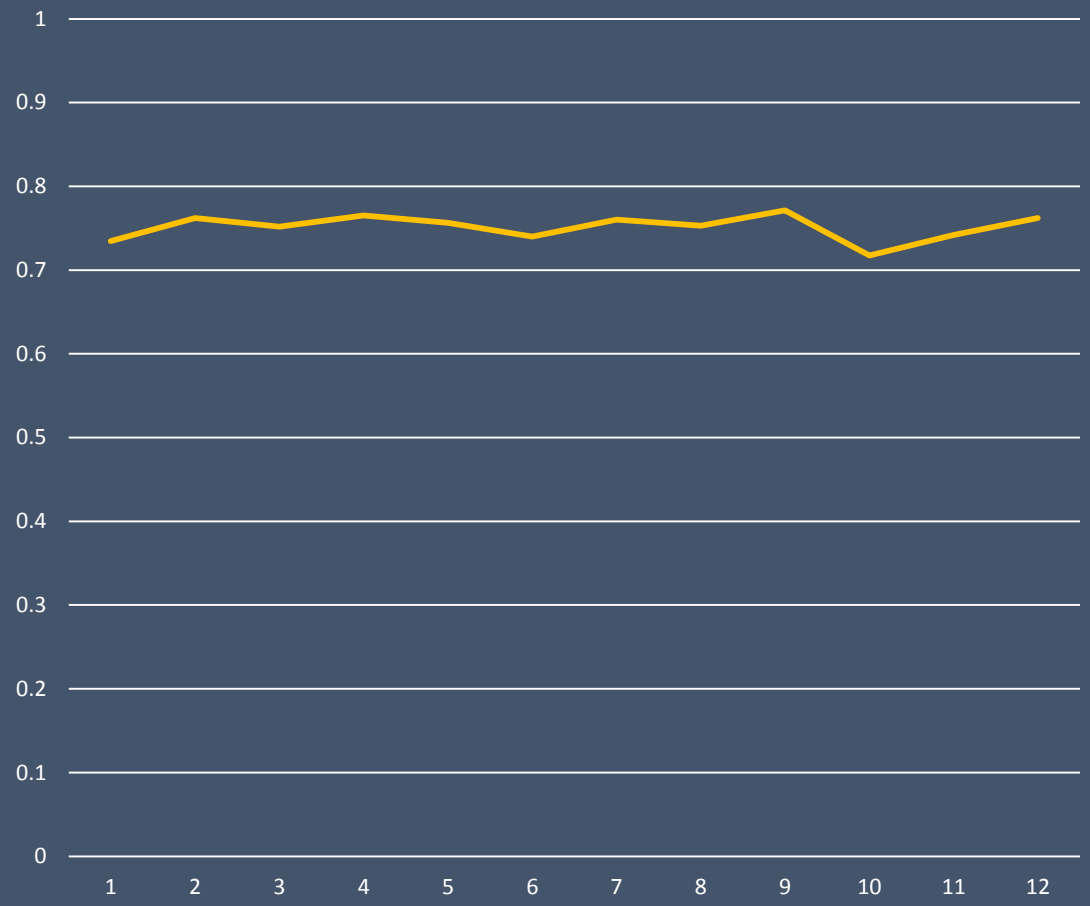
Participant example



The distribution of walking speeds as measured by the sensor for the participant over the 12-week duration of the study



The weekly mean of the daily median walking speeds of the participant

Qualitative results

Summarised data from participant interviews:

- Positive responses to the concept of measuring walking speed, receiving feedback on speed and to the design/appearance of the sensor
- Mixed response on awareness of the sensor in the home
- Negative response to the idea of long-term walking speed measurement
- Positive responses to the notion of health data being shared with others; family most common, also supported living staff and clinicians

Walking speed sensor feasibility - Conclusions

- Demonstrated proof-of-concept and acceptability of approach to target population
- People with greater levels of clinical frailty walk more slowly at home
- Short-term feasibility trial – not enough time for changes in frailty status
- Need to demonstrate ability to detect change

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Systematic review and qualitative interviews with older people

Activities and participation

Self-care

- Difficulty with washing oneself
- Difficulty with dressing
- Difficulty with toileting
- Maintaining health

Domestic life

- Difficulty with household tasks (e.g. Cleaning, hoovering etc.)
- Difficulty with shopping
- Difficulty with preparing meals

Mobility

- Walking difficulty
- Difficulty with changing body position
- Difficulty with lifting and carrying objects
- Difficulty with hand and arms use

Interactions and relationships

- Social isolation and loneliness
- Difficulty with engaging in hobbies
- Lack of support at work
- Need to participate in voluntary and non-voluntary work

Abdi S, Spann A, Borilovic J, De Witte L, Hawley M: Understanding the care and support needs of older people: a scoping review and categorisation using the WHO international classification of functioning, disability and health framework (ICF), BMC Geriatrics, (2019) 19:195.

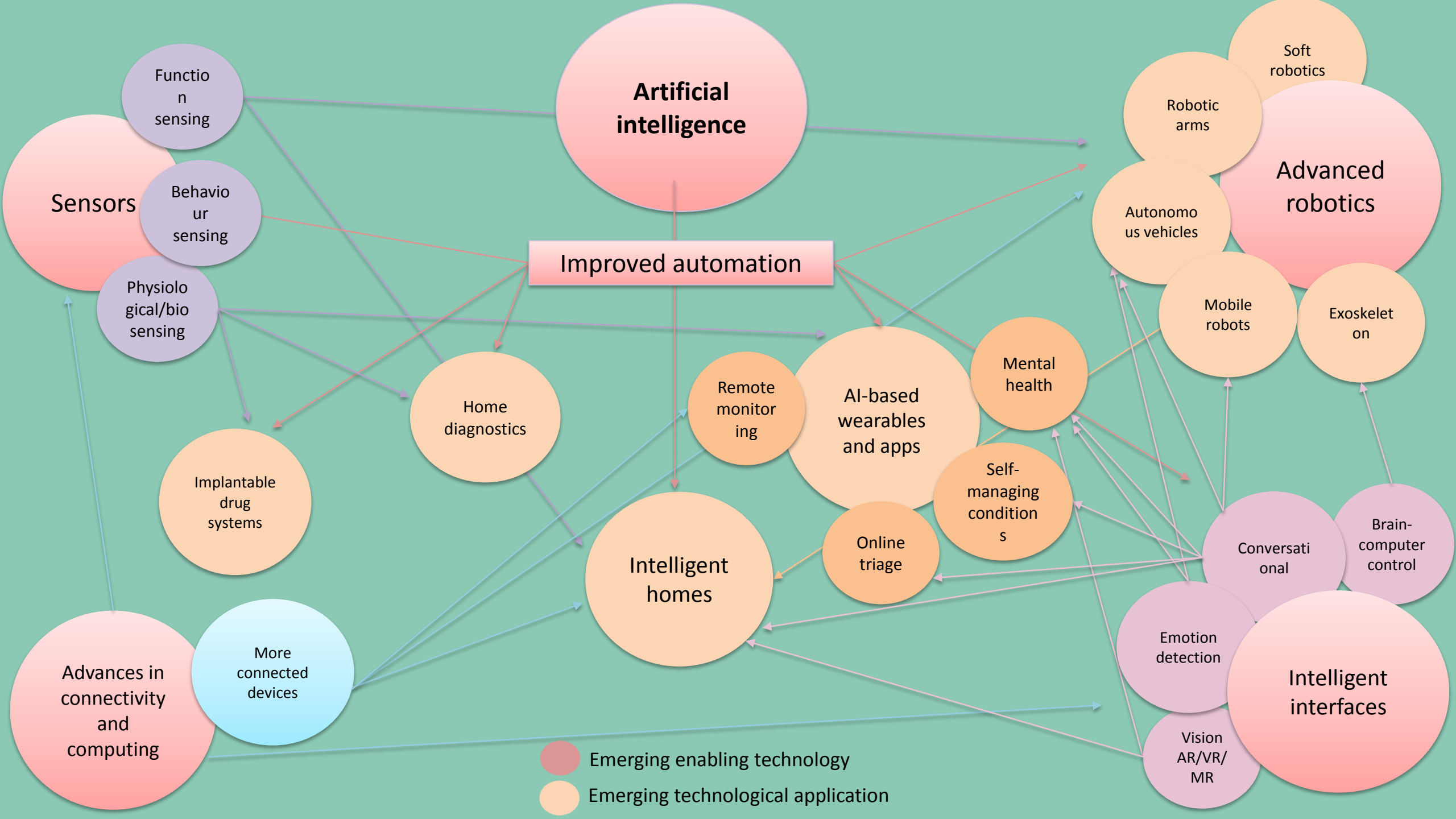
Artificial intelligence

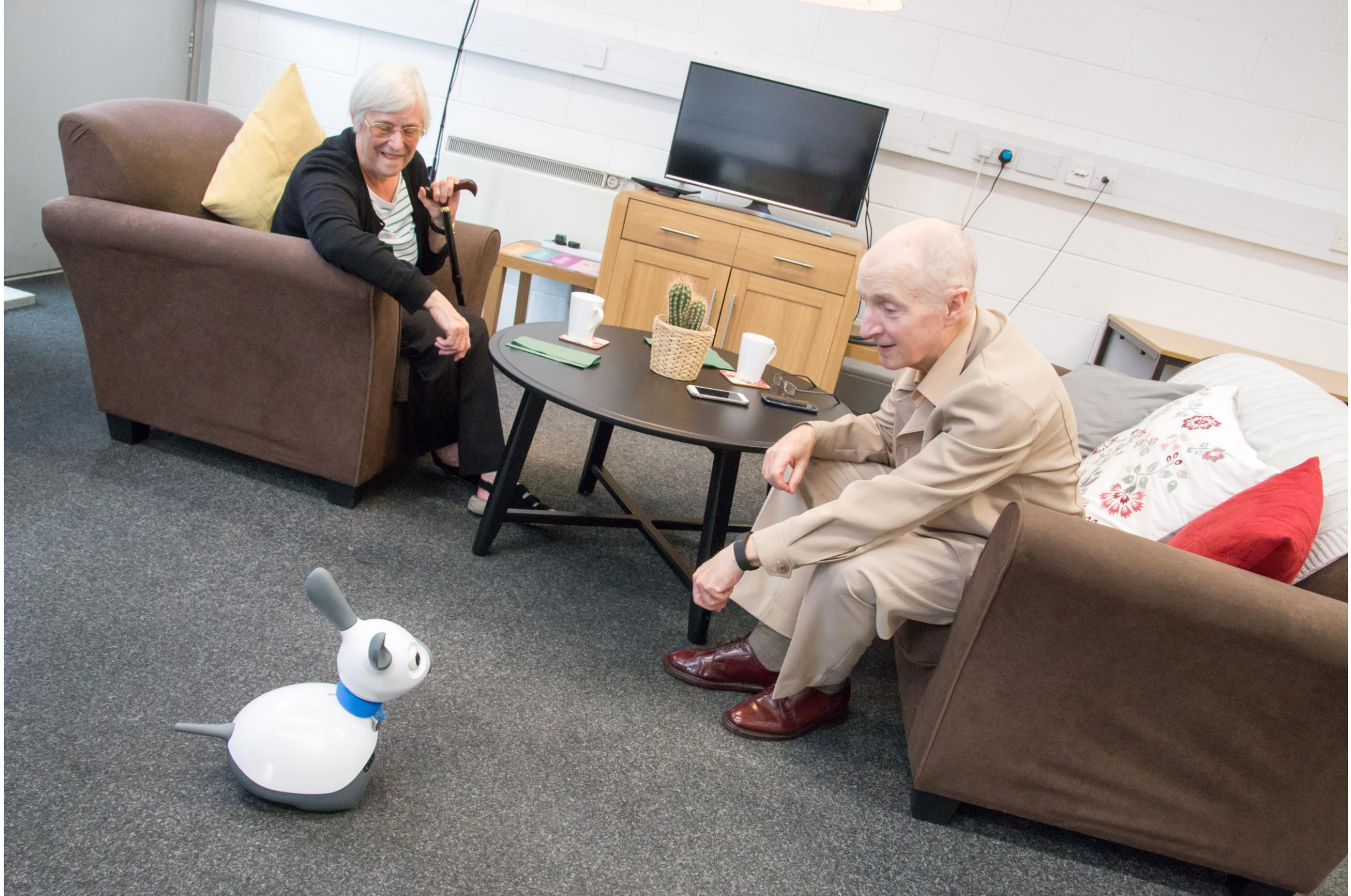
Sensors

Advanced robotics

Advances in connectivity and computing

Intelligent interfaces


Artificial intelligence
Improved automation
Sensors
Function sensing
Behaviour sensing
Physiological/biosensing
Implantable drug systems
Home diagnostics
Remote monitoring
AI-based wearables and apps
Mental health
Self-managing conditions
Online triage
Intelligent homes
Advances in connectivity and computing
More connected devices
Soft robotics
Robotic arms
Advanced robotics
Autonomous vehicles
Mobile robots
Exoskeleton
Conversational
Brain-computer control
Emotion detection
Intelligent interfaces
Vision AR/VR/MR
Emerging enabling technology
Emerging technological application



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AvaChat What we did

- Conducted co-design workshops and a proof-of-concept implementation of an autonomous virtual agent with natural language processing capabilities

- This formed the basis for video-based scenario testing of acceptability

What we found

- Adults with a diagnosis of COPD and health professionals specified 4 priority self-management scenarios for which they would like to receive support:
    - at the time of diagnosis (*information provision*),
    - during acute exacerbations (*crisis support*),
    - during periods of low mood (*emotional support*),
    - and for general self-management (*motivation*).

Easton K, Potter S, Bec R, Bennion M, Christensen H, Grindell C, Mirheidari B, Weich S, de Witte L, Wolstenholme D, Hawley MS
A Virtual Agent to Support Individuals Living With Physical and Mental Comorbidities: Co-Design and Acceptability Testing
J Med Internet Res 2019;21(5):e12996

Avachat video link

Youtube.com/watch?v=6rBAG-e9bXg

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