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TECH
VOICE OF INDUSTRY
Melanie Davidson
Chief Executive Officer, Medilink Midlands

SIG STRATEGIC INNOVATION GATEWAY

MEDILINK MIDLANDS

Rehab Technologies Network

Rehabilitation Technologies

Wednesday 1 May
Charnwood Campus, Loughborough

SIG

STRATEGIC INNOVATION GATEWAY

MEDILINK MIDLANDS

Rehab Technologies Network

Programme	
9:40am	The National Rehabilitation Centre (NRC) Programme, Miriam Duffy, NRC Programme Director, Nottingham University Hospitals NHS Trust
9:55am	Defence Medical Rehabilitation Centre (DMRC) Rehabilitation Priorities, Wg Cdr Alex Scott – Consultant Rehabilitation Medicine and NRC Interoperability Project Lead
10:05am	Rehabilitation Sciences – Working with Industry, Professor Mark Lewis – NRC Academic Lead, Loughborough University and Professor Pip Logan – NRC Academic Lead, University of Nottingham
10:30am	Case Study Project Spotlight, Dr Jacqueline Hicks – Research Network Manager, EPSRC Network+ in Rehabilitation Technologies, University of Nottingham
10:30am	Panel Q&A Session
10:50am	NIHR i4i Programme Review, Dr Helen Compton, Stakeholder Engagement Manager, NIHR
11:00am	Break, refreshments and networking

SIG STRATEGIC INNOVATION GATEWAY

MEDILINK MIDLANDS

Rehab Technologies Network

Programme continued	
11:30am	Working with the NRC to overcome pragmatic barriers and challenges in the use of rehabilitation technology, Praminda Caleb-Solly – Professor of Embodied Intelligence, University of Nottingham
11:45am	Breakout groups: what would be useful to industry when looking to do R&I within the NRC, with university and clinical partners?
12:20pm	Feedback from breakout groups
12:50pm	Closing remarks and next steps
13:00pm	Lunch and networking
14:00pm	Close

MEDILINK MIDLANDS BUSINESS AWARDS 2024

THURSDAY 9 MAY 2024 | 7:00PM - 12:00AM

ATHENA LEICESTER

#MMBizAwards24

8 AWARDS TO BE WON

BOOK YOUR TICKETS NOW!

Award Finalists

MEDILINK MIDLANDS

Advances in Digital Healthcare

- Black Space Technology
- Blüm Health
- iethico
- Select Research
- Emerging Markets Quality Trials (eMQT)

Export Achievement

- Addfield Environmental Systems
- BioCare
- Cellomatics Biosciences
- Salts Healthcare

Delivering Innovation into Health and Care

- Cytecom
- iethico
- Informed Genomics
- MICA Biosystems
- VUIT Data Labs

Innovation

- Ademen
- Bioxhale
- Eureka inventions
- Guardtech Group
- Neurotherapeutics

Award Finalists

MEDILINK MIDLANDS

Outstanding Achievement

Clinitouch by Spirit Health
Neurotherapeutics
Upperton Pharma Solutions

One to Watch

Ademen
Black Space Technology
MICA Biosystems
Neurotherapeutics
Sanera Innovations

Start Up

ChangeXtra
ExpHand Prosthetics
MESOX
Moti Me
VUIT Data Labs
The Essential Baby Co in the Community CIC

Sustainability

iethico
Pennine Healthcare
Zanzo Facilities Management
PBS Innovations trading as The Social Architex

Award Finalists

City of Glasgow College (Faculty of Education and Humanities) & i3 Simulations

Faculty of Science/School of Psychology University of Nottingham (UoN) & Neurotherapeutics

Healthcare Technologies Institute (HTI), School of Chemical Engineering, College of Engineering and Physical Sciences, University of Birmingham (UoB) & Salts Healthcare

Nottingham Trent University & Medical Technologies Innovation Facility (MTIF)

University Hospitals of Derby and Burton NHS Foundation Trust & Telea

National Rehabilitation Centre (NRC)

NRC
TURNING
ADVERSITY
INTO OPPORTUNITY

Programme Background

- 2009 Defence and National Rehabilitation Centre Programme (DNRC), formal programme with National Rehabilitation Centre (NRC) at the heart
- 2012, national recognition through Olympic legacy and major trauma system of the huge gap in rehabilitation services
- 2018 Defence Medical Rehabilitation opened
- NUH to deliver NHS facility which will be a **national centre** of clinical and academic excellence to transform outcomes for patients requiring rehabilitation
- 2021 the NRC became part of the National New Hospital Programme (NHP) as a front runner scheme and test bed for digital innovation, Carbon Net Zero and MMC. Due to be complete in Nov 2024

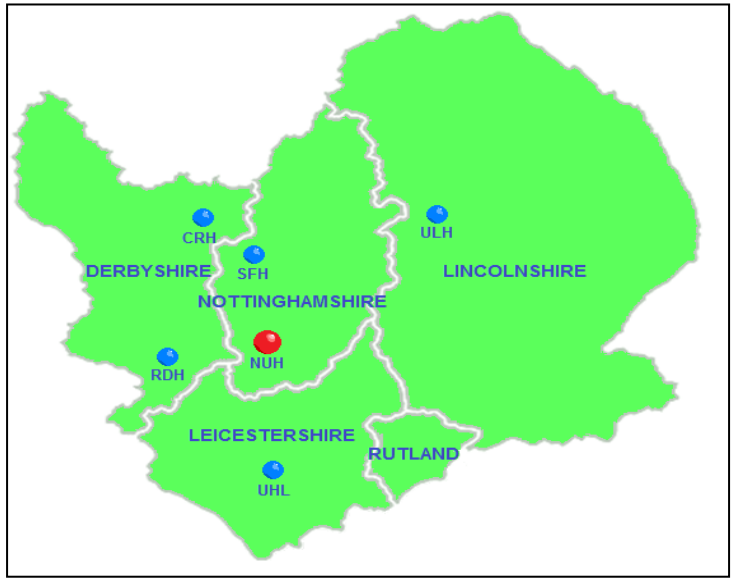
Rehabilitation opportunity

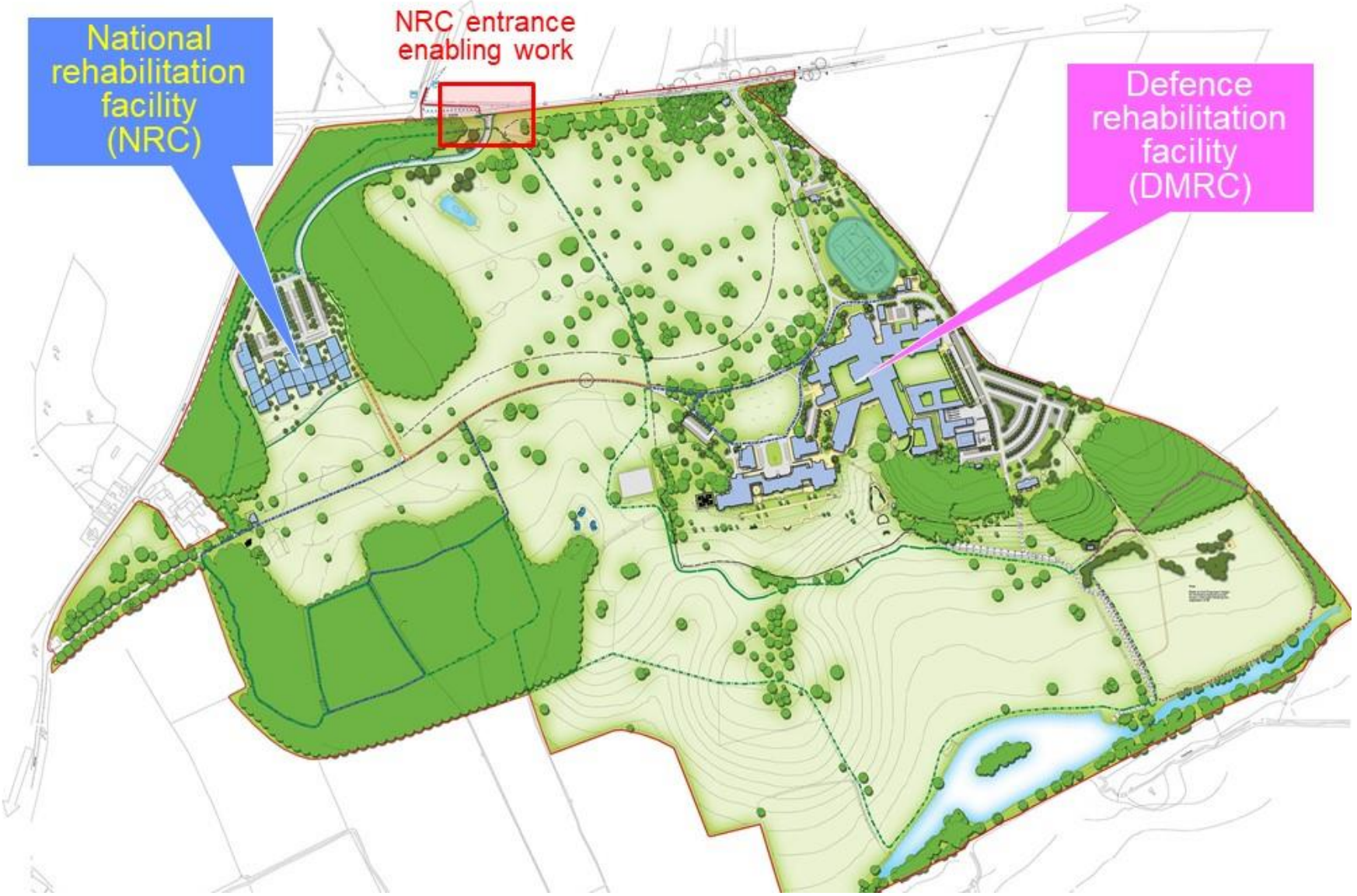
- Ambition to become world leading rehabilitation centre in clinical, training and research providing a national hub with shared facilities with the Defence Medical Rehabilitation Centre.
- A new 70 bed facility configured as a three storey, 10,121m2 building on the at Stanford Hall Rehabilitation Estate (SHRE).
- The building is configured as a series of five pavilions including integrated shared facilities to the ground floor with 2 x 35 bed wards on levels 1 and 2.
- Opportunity for the first time for industry to work with clinical teams and researchers in one space.
- Reconfigure and roll out new rehabilitation clinical model to deliver better outcomes and cost-efficient service
- Ambitious research programme of work

NRC Site Location

Colocation of facilities on the Stanford Hall Rehabilitation Estate;

- Trim trails
- Hand cycle track
- Pitch and putt
- Fishing lake

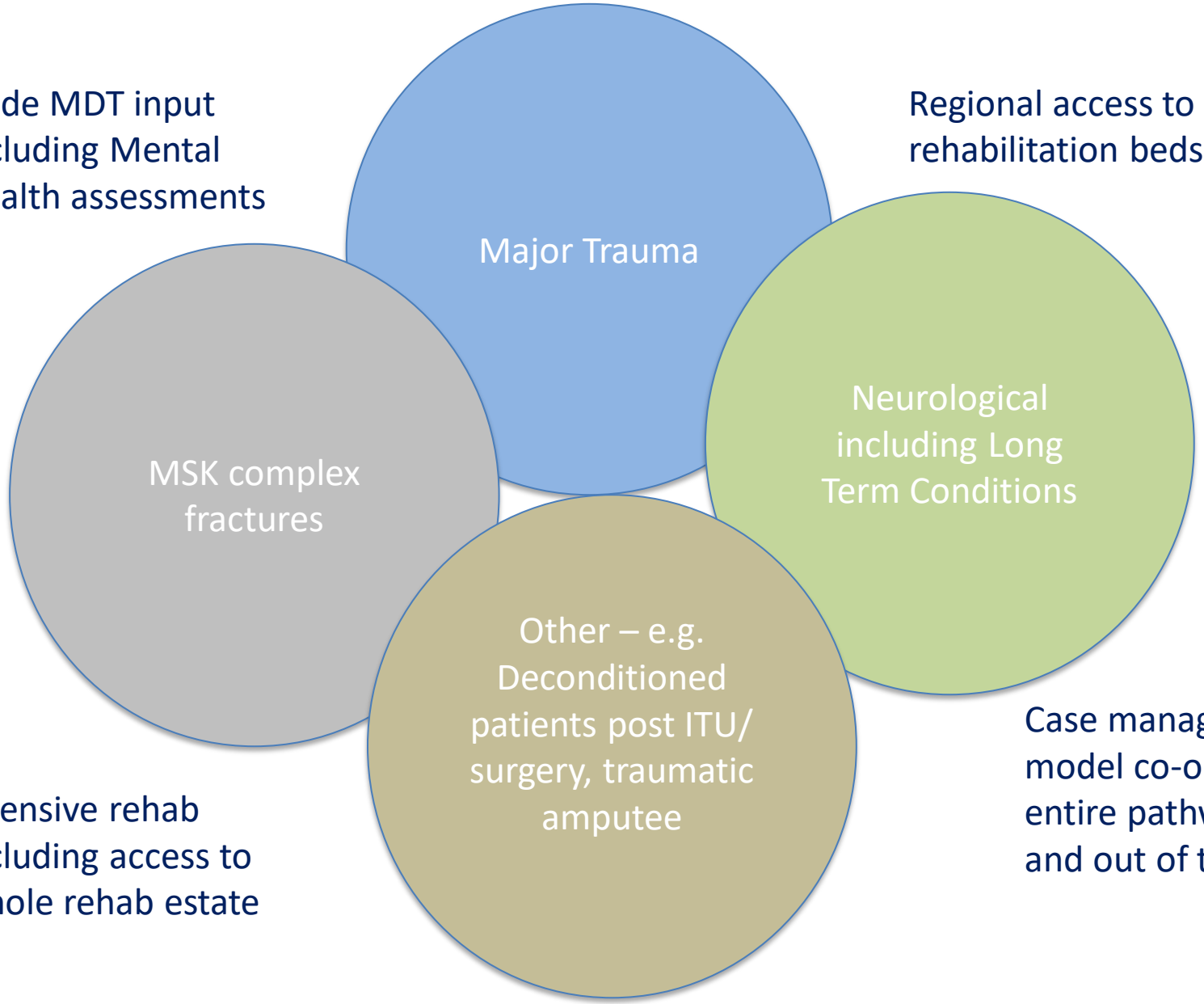




Patient cohorts

Wide MDT input including Mental Health assessments

Regional access to rehabilitation beds



Intensive rehab including access to whole rehab estate

Case management model co-ordinating entire pathway into and out of the NRC

Sharing with DMRC

Opportunity for shared access to state of the art facilities at the defence site

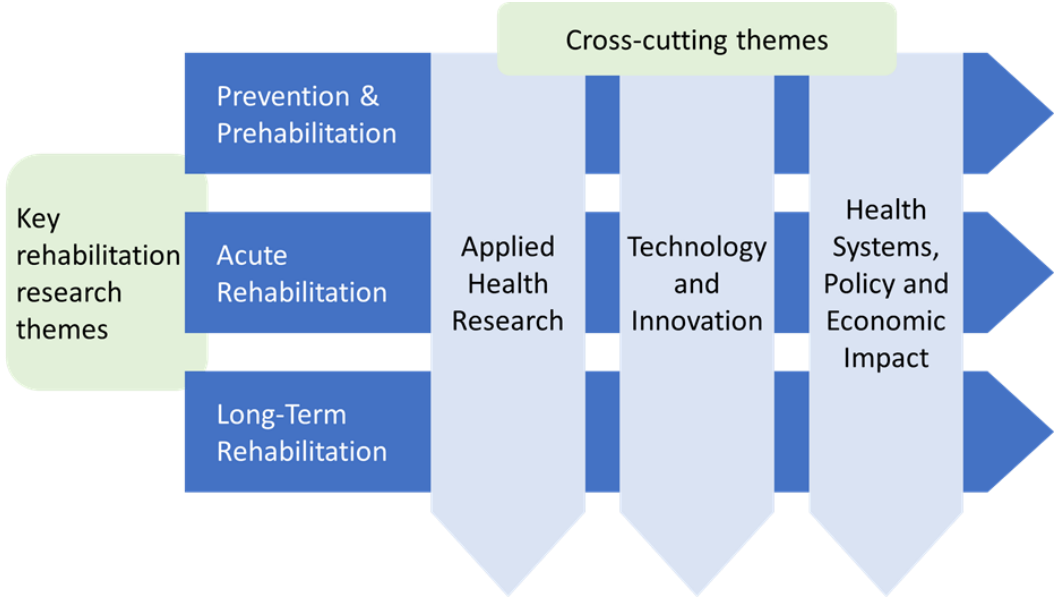
- Virtual reality gait lab (CAREN)
- Hydrotherapy pool
- Diagnostics
- Wider rehabilitation estate gardens and parkland
- Sharing expertise as we as research opportunities

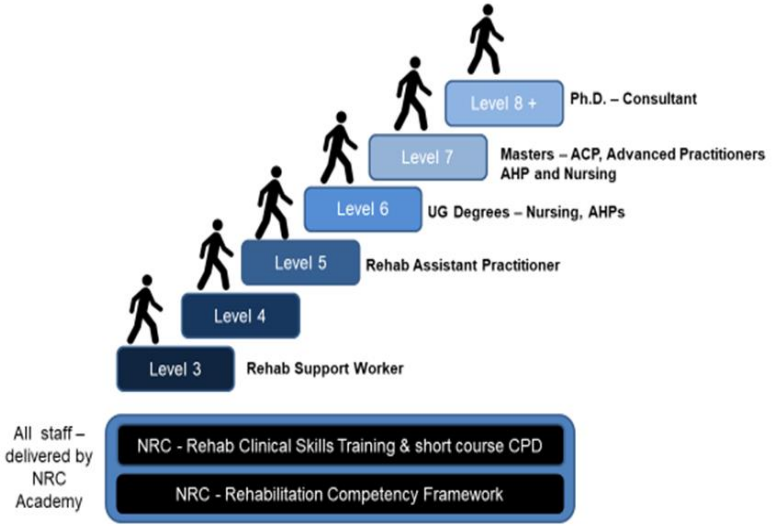
Academic Partnership

Academic Partnership

Home to the NRC Training Academy, we will:

- Provide evidence-based, cutting-edge training to address the needs of the rehabilitation speciality across all disciplines
- Improve patient outcomes by equipping staff with evidence-based training opportunities
- Put research and innovation at the heart of education and training to drive the field of rehabilitation forward





Innovation space

Innovation space

- Dedicated space in the building
- Offer to work with NRC
- Enable partnerships
- Accelerate design process

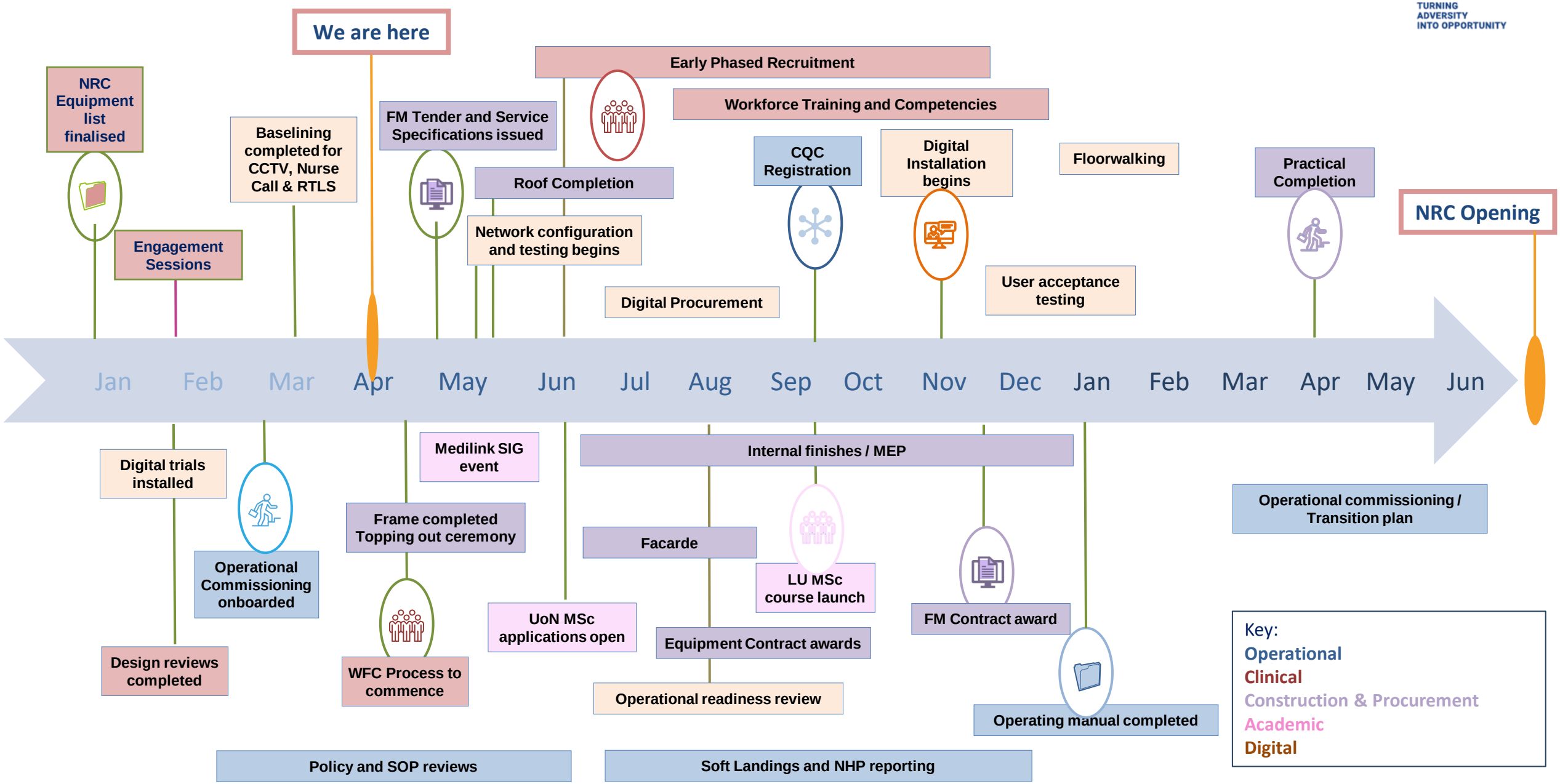
Clinical teams

Research

Product design

Innovation space

NRC 24/25 Milestones Roadmap



nrc@nuh.nhs.uk
www.nationalrehabilitationcentre.nhs.uk
National Rehabilitation Centre: About | LinkedIn

Loughborough University

Rehabilitation Sciences Research
Working with Industry

Professor Mark Lewis

#InspiringWinners since 1909

Why LU?

Internationally-recognised research

MEMBER OF THE IOC MEDICAL RESEARCH NETWORK 2015-18

MEMBER OF THE IOC MEDICAL RESEARCH NETWORK 2019-22

Performance Health

- Optimisation of assistive device - athlete combination
  - Interdisciplinary approach
  - Shoulder health
  - Sports performance
  - Towards bespoke assistive technologies
- Optimisation of sports performance
  - Advanced textiles for sports apparel
  - Training aids
  - Explosive strength training
- MSK Biomechanics
  - Modelling and simulation

MSK and Sport Injuries

- Regenerative medicine
- 3D Printing / Additive manufacturing
- Rehabilitation
- Regeneration
- Monitoring
- Tissue engineering
- Surface modification
- Biomaterials
- Microfabrication
- Devices
- Training for injury reduction
- Treatment of sporting injuries
- Muscle metabolism and function
- Medical imaging
  - Tendinopathies (disrepair, diagnosis)
  - Bone health

Mental Health and Wellbeing

- Disordered eating
- Enabling independence
  - Dementia
- Effectiveness and concordance of interventions

Exercise as Medicine

- Optimising "Dose-response" of physical activity
  - Long-term conditions
  - Lifestyle behaviour change
  - Modelling physiological systems
  - Support self-management
- Ageing
  - Post very severe injury

Prevention

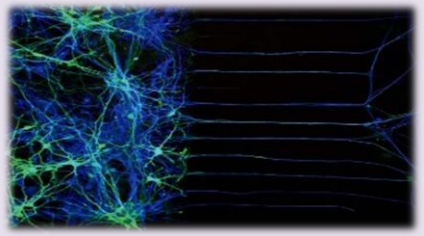
- Digital health / medical technologies
  - Wearables / nearables / visibles
  - mHealth
  - Internet of things
- "Systems of systems" approach
- Behavioural phenomics (physiology meets behaviour)
- Sensor development
- Big data

Defence Medicine Research

The history

Prevention of MSKi in the military environment (PRIME)

EPSRC Next generation prosthetics mini-CDT



EPSRC & MRC CDT in regenerative medicine

School of Sport, Exercise and Health Sciences

School of Mechanical, Electrical and Manufacturing Engineering

School of Design and Creative Arts

LUIL

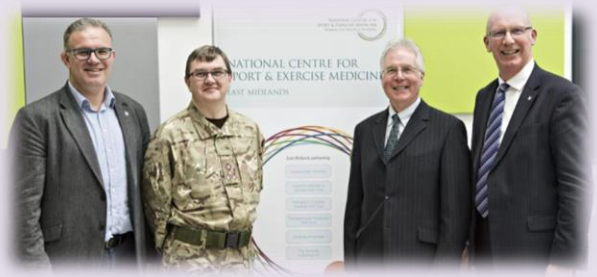
School of Science

Chemical Engineering

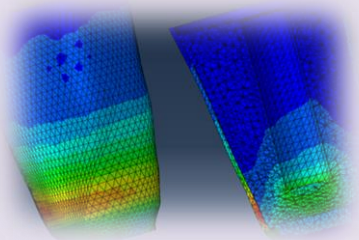
Biomechanical associations and efficacy of injectable therapies in tendinopathy (BEFIT)

ADVANCE study

Defence mini-CDT & MOU with DMS



Residual Limb Characterisation Platform for Patient-specific Prosthetic Socket Manufacturing



The NRC as a national centre of excellence in rehabilitation research

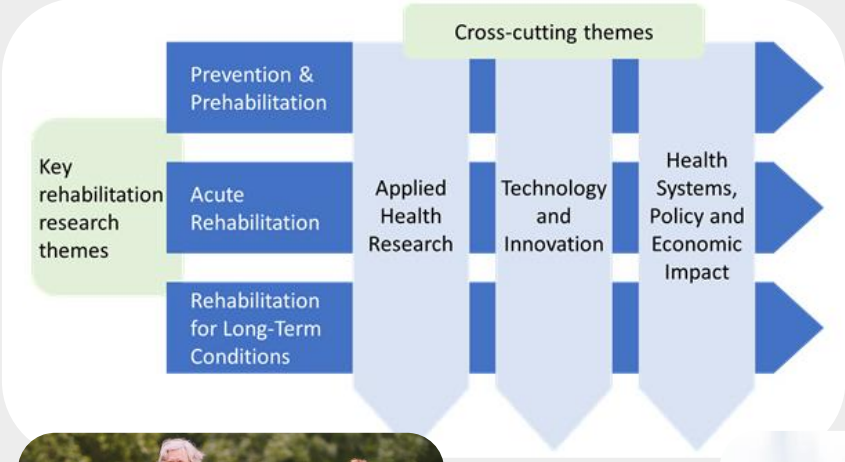
- At the NRC, research and innovation will be fully integrated with clinical practice, putting academic staff and postgraduate students at the heart of pioneering international research into clinical rehabilitation and rehabilitation products and technologies
- Part of the NRC research strategy is to deliver better rehabilitation and patient outcomes as well as strengthening the national and international research community
- At LU we have academic leads aligned to each research theme – ongoing projects linked to the NRC research aims detailed in the following slides to highlight a selection from across our academic Schools
- 7 PhD studentships (4 for LU) – part of larger rehabilitation sciences postdoctoral researcher cohort
- Outreach an important component, see our Revolutionising Rehabilitation Royal Society Summer Exhibition, 2023 and hopefully will be showcasing work at the Summer Festival “on tour”, Jodrell Bank, August 2024.

Rehabilitation Activity at LU

Developing veterans' resilience through physical activity
Jamie Barker, SSEHS

Facilitating adherence to rehab programmes
Ian Taylor, Jennie Hancox, SSEHS

Eye tracking for concussion measurement
Thom Wilcockson, SSEHS



Super smart textiles for remote monitoring
Ishara Dharmsena, WSMME

AI and voice technologies in disability and social care
Saul Albert, SSH

Improving physical activity in older adults with hearing loss
David Maidment, SSEHS

NHS England collaboration to deliver patient safety course
Mike Fray, DCA

Recent NRC-linked applications and awards

Ongoing projects:

- Rehabilitation high-potential opportunity (HPO, Department for International Trade) Link
- EPSRC Network+
  - Next generation rehabilitation technologies (with UoN) Link
  - Transformative innovation in the delivery of assisted living products and services (TIDALN+, UCL & Global Disability Innovation Hub) Link
- NC3R's CRACK IT challenge funding Model for the identification of novel wound therapeutics that restore skeletal muscle function after significant soft-tissue injury Link
- NIHR HealthTech research centre in rehabilitation Link
- Armed Forces Covenant Trust, Veterans resilience programme Link

Rehab Technologies Network

THE ARMED FORCES COVENANT FUND TRUST

NIHR | National Institute for Health and Care Research

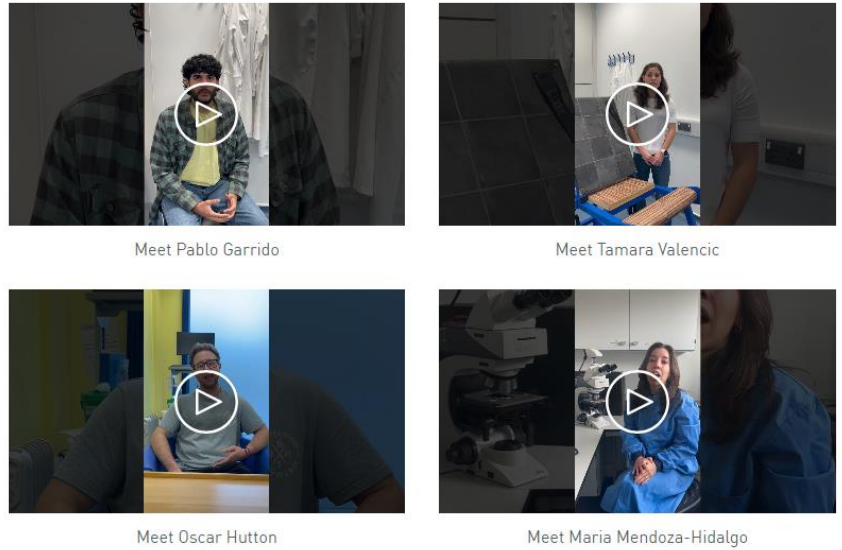
Applications:

- EPSRC Place-based impact accelerator bid, EMERGE – led by NTU
- EPSRC Partnership hub bid (unsuccessful)
- EPSRC CDT in rehabilitation technologies (unsuccessful)

Rehabilitation Sciences Doctoral Researchers

Tamara Valencic	Enhancing rehabilitation outcomes post ACL rupture
Pablo Marco Garrida	3D Bioengineered skeletal muscle to mimic human tissue
Maria Jose Mendoza Hidalgo	Lab models of neuromuscular tissue
Oscar Hutton	Mediated-reality technologies as alternative pain therapies
Ahmet Begde	Home-based dual task exercise programmes for dementia
Maria Fernandez-Rhodes	Extracellular vesicles / bone health
Nicole Gwynne	Enhancing adherence to exercise in stroke survivors
Bettina Pasztor	Stroke rehab – adherence in transfer from hospital to community
Lynsey Speirs	Influence of design on attitudes to physical activity
Rebecca Hooker	The interaction between the bionic limbs and the soft skin tissue.

Hear more from our Doctoral Researchers below:



[Our doctoral researchers | National Rehabilitation Centre | Loughborough University (lboro.ac.uk)]

Psychology of Exercise Rehabilitation

MSc

Exercise Rehabilitation

MSc

Sport Rehabilitation

MSc

- Three new Masters programmes developed for 2024 intake
- Undergraduate and postgraduate courses at Loughborough, and the broader NRC academic network, [NRC Academic Network - National Rehabilitation Centre]
- CPD and short courses in development
- Keen to work with industry to develop bespoke courses

Education

Collaborate with us

We are keen to collaborate with businesses, charities, public sector and voluntary organisations around the world to drive research and innovation and create impact.

Examples of collaboration with our staff include:

- **Consultancy** offers collaborations with individual academics, or an expert team drawn from different areas of cutting-edge research
- A **Knowledge Transfer Partnership (KTP)** enables a business to bring in new skills and the latest academic thinking to deliver a specific, strategic innovation project through a knowledge-based partnership.
- **Collaborative research** projects enable real world challenges to be tackled in a systematic and substantial way
- **Short courses and training** (Continuing Professional Development) provide bespoke skills development for a workforce
- **Secondments** are a great way of directly engaging with us in a day-to-day working environment and developing hands-on expertise. Your staff could be seconded into the University or academics could be seconded into your workplace
- **Sponsoring a Doctoral Researcher** towards a PhD qualification enables work on a research project, with support from academic expertise
- We are interested in working with business to support spin out activity

Engaging with our students

Our students offer fresh ideas to add to business in various ways.

- A **student** placement: a fantastic opportunity for an organisation to employ, on a fixed term, highly skilled individuals, with new ideas that can deliver tangible benefits to your business
- **Graduate recruitment:** can add fresh ideas, energy and the latest skills and knowledge to an organisation. Our qualified and motivated graduates are constantly sought after by top employers
- **External** stakeholder expertise: becoming a guest lecturer will help future professionals learn from your business experience sand our students enjoy hearing from real industry specialists
- **Student projects, competitions and real-life briefs**: are a great way to inspire students to generate new ideas with difference concepts.

Loughborough University

Thankyou

Any questions?

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Current rehabilitation science projects

Understanding how EV particles can be applied for regenerative therap

- EVs express a complex arrangement of molecules on their surface that act like a biological postcode
- Aim to decipher this unique postcode to manufacture next generation drug delivery platforms for the treatment of clinically challenging diseases, such as bone cancers
- By understanding and exploiting the natural bio-stimulatory properties of EVs we can drive complex regenerative responses that are comparable to natural tissue development
- Funded through EPSRC New Investigator grant and Academy of Medical Sciences Springboard Fellowship
- More information: https://youtu.be/_0MHVubid8o

Current rehabilitation science projects

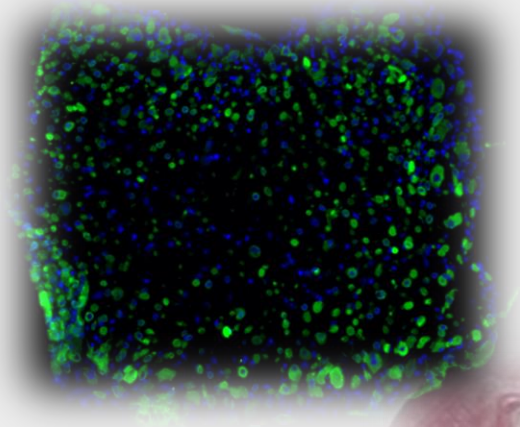
Facilitating adherence to rehabilitation programmes

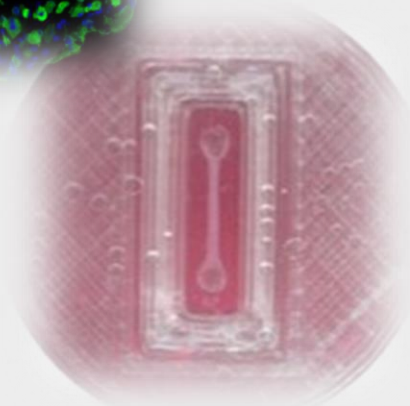
- The benefits of effective rehabilitation programmes can only be realised if patients adhere to them
- Poor adherence to rehabilitation significantly impacts treatment outcomes and increases the risk of poor recovery, complications and additional health care costs
- A greater understanding of motivation and adherence to rehabilitation will help alleviate the individual, societal and financial costs associated with poor adherence
- The research will provide the basis for clinicians and patients to implement motivational strategies aimed at optimising adherence to rehabilitation, and stimulate training and education opportunities for rehabilitation staff

Current rehabilitation science projects

Bioengineering the musculoskeletal system

- Bioengineered models recapitulating the complex structures and physiological response of musculoskeletal tissues provide an alternative experimental platform to the animal models currently used to recreate injury and rehabilitation
- Model has the power to provide new understanding into why soft tissue fails to recover after significant trauma
- Allows the underlying biological processes to be identified and can be used to test new targeted therapeutics that may be able to aid soft tissue regeneration





Current rehabilitation science projects

Exercise for persons with a spinal cord injury

- Physical activity guidelines for people with spinal cord injury (SCI) only existed in Canada
- An international group of researchers, clinicians, community organisations and people with SCI developed scientific guidelines to inform people with SCI how much exercise is necessary for important fitness and health benefits
- More information: http://www.sciguidelines.eu - translated into several European and Asian languages

ìAs a healthcare professional working in the rehabilitation of newly injured individuals with spinal cord injury it is important that clear principles and guidance is imparted from the start, to both promote positive behaviours and prevent avoidable complications following injury.î

Dot Tussler, Head Physiotherapist Spinal Injuries National Spinal Injuries Centre Stoke Mandeville Hospital

Current rehabilitation science projects

Super-smart textiles for remote rehabilitation monitoring

- Technologies like telerehabilitation require real-time, inexpensive, remote and accurate data on patient movements. Conventional techniques such as optoelectronic and IMU devices are becoming obsolete for this due to the need for especial labs and expertise, discomfort, high bulk, cost, restricted range and mobility
- This project develops super-smart textiles, conformal clothing that converts mechanical energy from natural movements into electricity, to sense and communicate data on the motion of targeted body parts
- The technology is based on fabric nanogenerators made of advanced textile yarns and fabrics, providing good wearability and accuracy

More information: https://www.lboro.ac.uk/research/experts/ishara-dharmasena/

Current rehabilitation science projects

Student-athletes recovery from sports-related concussion

- Sports related concussion has become a growing issue which is a particular problem for those in education as it can negatively affect an individual's ability to perform cognitive tasks and significantly affect their academic progression
- An holistic approach to concussion assessment and monitoring is taken to better understand the full range of vestibular-oculomotor, cognitive and academic dysfunctions
- The effect of sub-symptom exercise on time to recovery is currently being investigated in a prospective study
- Partially funded by the Musculoskeletal Association of Chartered Physiotherapists and the Association of Chartered Physiotherapists in Sports and Exercise Medicine

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NRC

National Rehabilitation Centre

Rehabilitation Sciences Research

Working with Industry

Professor Pip Logan
University of Nottingham

NRC National Research Board

- **Representation from across our network of partners**

Membership

- **Barbara Todd**, NRC Ambassador
- **Claire Brindley**, University of Derby
- **Mark Lewis**, Loughborough University
- **Kristen Clements**, Loughborough University
- **Pip Logan**, University of Nottingham
- **Steven Hardy**, University of Nottingham
- **Rory O'Connor**, University of Leeds
- **John Hunt**, Nottingham Trent University
- **Tom Nightingale**, University of Birmingham
- **Sandy Walsh**, NUH
- **Amy Collins**, NUH
- **Maria Koufali**, NUH R&I

- **Oversees the development and implementation of the NRC Research Strategy**
- **Development of a national centre of excellence for research**
- **Ensure alignment of research with NRC aims, is of clear patient benefit and is clinically informed**

NIHR HealthTech Research Centre in Rehabilitation

NIHR | National Institute for Health and Care Research

- **NIHR Rehab HRC is hosted by Nottingham University Hospitals NHS Trust**
- People with potentially life-changing injury, trauma and illness deserve the best rehabilitation. New technology is key to advancing this
- **NIHR Rehab HRC** will focus on developing and applying new technologies to transform patients' lives

Nottingham University Hospitals NHS Trust

Our Vision:
Outstanding in health outcomes and patient and staff experience

Mission: Working together with our patients, staff and partners to deliver world class healthcare, research, education and training. A leading teaching hospital and an innovative partner, improving the health and wellbeing of the communities we serve.

Our Promises

Our Patients | Our People | Our Places | Our Performance | Our Partners | Our Potential

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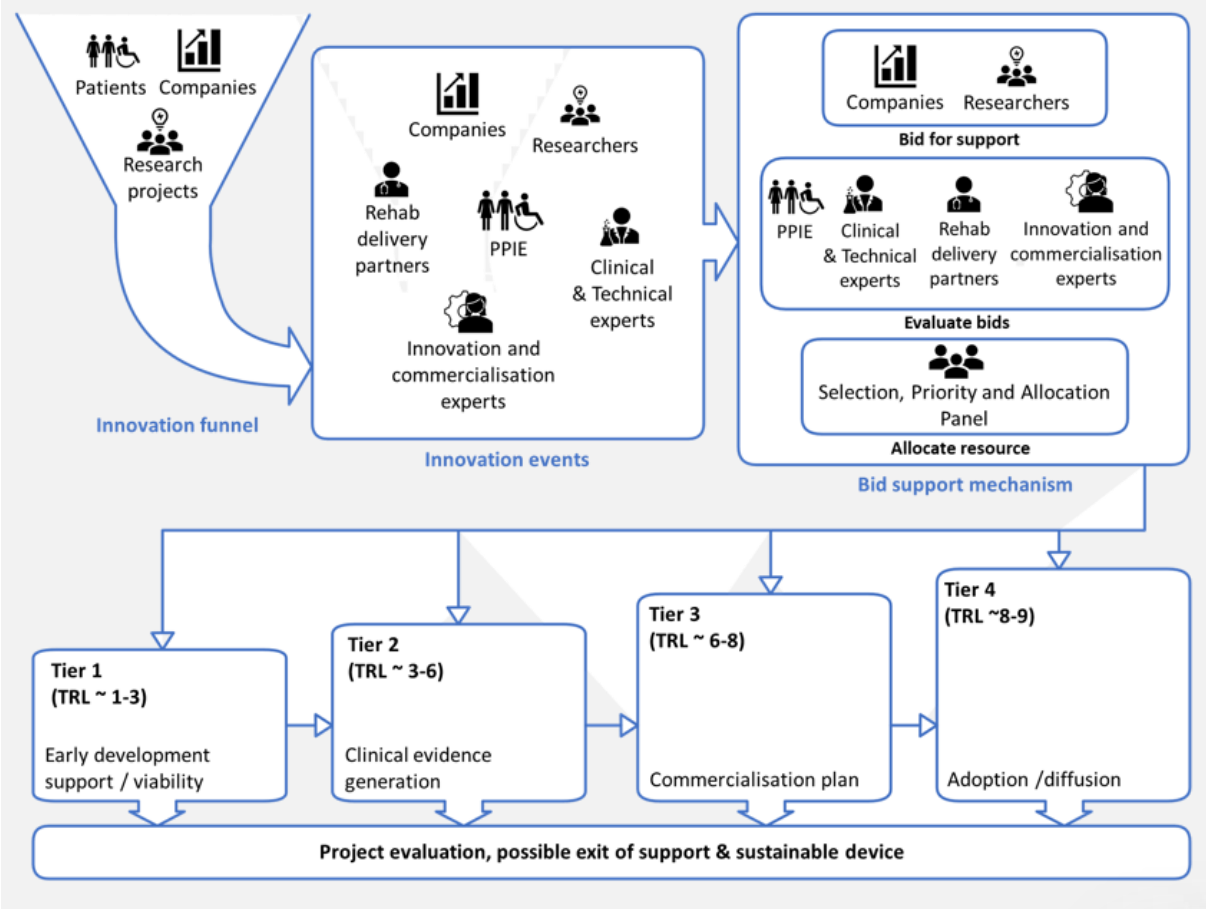
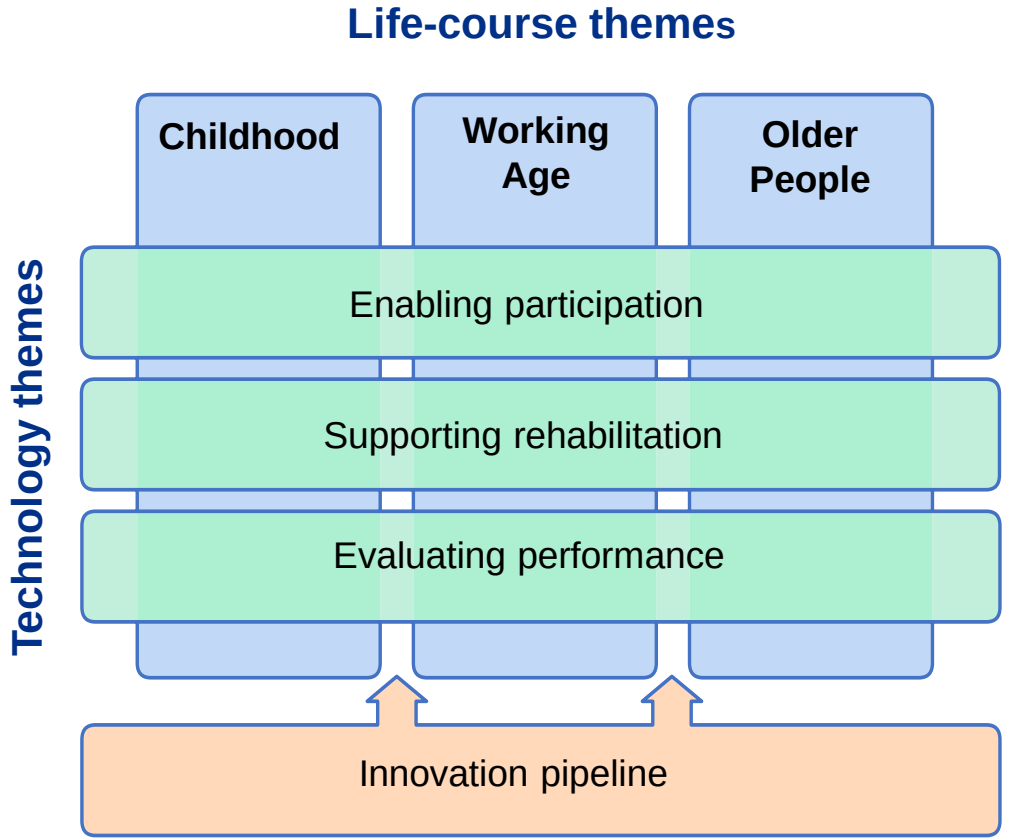
Innovation Pipeline & Life Course Approach





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Education | Research | Impact | Knowledge Exchange

- **Expertise and strengths (A-Z)**
  - allied health professions, engineering, complex interventions development, computer science, imaging, mathematics, medicine, mental health, nursing, pharmacy, physics, psychology, randomised controlled trials
- **Traditional research**
  - medicine, stroke, physiology, vocational, musculoskeletal, applied health, cognitive rehabilitation
- **New areas**
  - Next Generation Rehabilitation Technologies Network
  - BIOREME (Integration of Data Driven BIOphysical Models into REspiratory MEdicine),
  - EMERGENCE (Facilitating the Emergence of Healthcare Robots from Labs into Service)
  - Biomedical Research Centre new bid includes the NRC

Vocational Rehabilitation

- **RETAKE Return to work after stroke; 2018-2023 | £2.2M**
  - 5-year study
  - to determine whether early stroke specific vocational rehabilitation (ESSVR) is more effective at returning stroke survivors to work
  - 20 centres - 760 stroke survivors

- **ROWTATE Return to work after trauma; 2019-2024 | £3.5M**
  - 5-year research programme
  - aims to develop and evaluate a return-to-work programme
  - Comprising intervention development, feasibility study, economic evaluation and process and implementation study
  - 8 UK sites

Biomechanics

- Strengths in spinal mechanics with specific research interests in mechanical function of the intervertebral disc
- Expertise in functional and anatomical imaging, and mechanical evaluation of medical devices
- Development of approaches using mathematical modelling
- Expertise in biomechanical evaluation of human movement
- Specific research aims include increasing the application of biomechanical assessments in healthcare settings to improve clinician's understanding of how musculoskeletal injuries cause secondary and tertiary effects on the musculoskeletal system

BIOREME (2021-2024)

- **BIOphysical models into REspiratory Medicine**

www.bioreme.net

- **Collaborative network of researchers, industry and patient representatives at the interface of mathematical modelling and respiratory medicine**
  - Aims to catalyse research in chronic respiratory illnesses to result in new technologies and treatments
  - >26 network members across multiple disciplines
  - Sandpits, workshops, forums and webinars to bring together researchers with industry and patient representatives
  - Funding opportunities for new research projects

EMERGENCE (2021-2024)

- **Facilitating the Emergence of Healthcare Robots from Labs into Service**

  - Aims to build knowledge and capability needed to enable health care robots to support people living with frailty in the community
  - Collaborative network of researchers, businesses, end-users, health and social care commissioners and practitioners, policy makers and regulatory bodies
  - Up to 10 funded feasibility studies leading to technologies capable of transforming community health and care
  - Development of training content for carers and therapists to address gaps that may prevent effective use of robotic solutions

Rehabilitation Sciences Doctoral Researchers

Researcher	Research
Ahmet Bugra Selvi	Optimal gait rehabilitation protocol with hybrid assistive limbs for acute stroke patients
Ben Sanders	Magnetoencephalography as a tool for monitoring neurorehabilitation
Meri Westlake	How do Healthcare Professionals Recognise and Respond to Deconditioning
Mostafa Ahmed Arafa Mohamed	Development of Children's Biomimetic Adjustable and Adaptive Myoprosthetic Hand with Sensory Feedback
Natalie Gray	The development of an evidence-based protocol for early mobilisation of spinal cord injury patients
Sarah McCracken	Nordic Walking for People with Parkinson's
Hayley Carter	Patient management before knee ligament surgery

Education & Training Ambition

- Delivery of world-class, research-informed education and training, accessible worldwide
- A truly multi-professional approach involving clinical, technological, engineering and vocational professions
- Variety of platforms including digital, remote and on site
- Educate and train a highly skilled rehabilitation workforce, for the future of NHS and other services
- Development of a strong learning culture, developing new ways of working, service improvement to deliver better patient outcomes
- Fully integrated Centre working alongside researchers, clinicians and patients
- Operate as a campus – utilise teaching and research space in different locations and well as hybrid model. Increases access for international students
- Host the National education and training rehabilitation governance board

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Our Rehabilitation Teaching

30-year history of training clinical academics in rehabilitation

- Undergraduate, postgraduate and CPD courses across Faculties of Medicine and Health Sciences, Engineering, Science and Social Sciences
  - >12 UG courses including Mental Health and Social Care (BSc), Sports Rehabilitation (BSc), and Physiotherapy (BSc)
  - >28 PGT courses including Bioengineering (MSc), Trauma Informed Practice (MA) and Rehabilitation Psychology (MSc)
- CPD courses include Complex Interventions, Sports Injury Assessment, and Contemporary Practices in Injection Therapy
- Broad experience in training medics, nurses, physiotherapists
- Innovative and interprofessional MSc programmes in rehabilitation:
  1. Rehabilitation MSc
  2. Exercise and Remedial Instruction MSc
  3. Neurological Rehabilitation MSc
  4. Sport Injury Rehabilitation MSc

Education & Centres for Research Training

- **Healthcare profession-specific mentors ensure scholars remain connected to their primary professional groups**
  - Aim is to nurture scholars to leave the programme as well-rounded clinical academics
  - £7.24m Wellcome Grant in collaboration with Universities of Leicester, Warwick, and Birmingham, supported by MHS trusts

The University of Nottingham
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The University of Nottingham
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NRC

Thank You !

pip.logan@nottingham.ac.uk

Professor Pip Logan
University of Nottingham

Rehab Technologies Network

MEDILINK MIDLANDS

MEDILINK: Rehabilitation Technologies Strategic Innovation Gateway

RTN+ Feasibility Projects

Wednesday 1st May 2024

Lead partners

University of Nottingham UK | CHINA | MALAYSIA

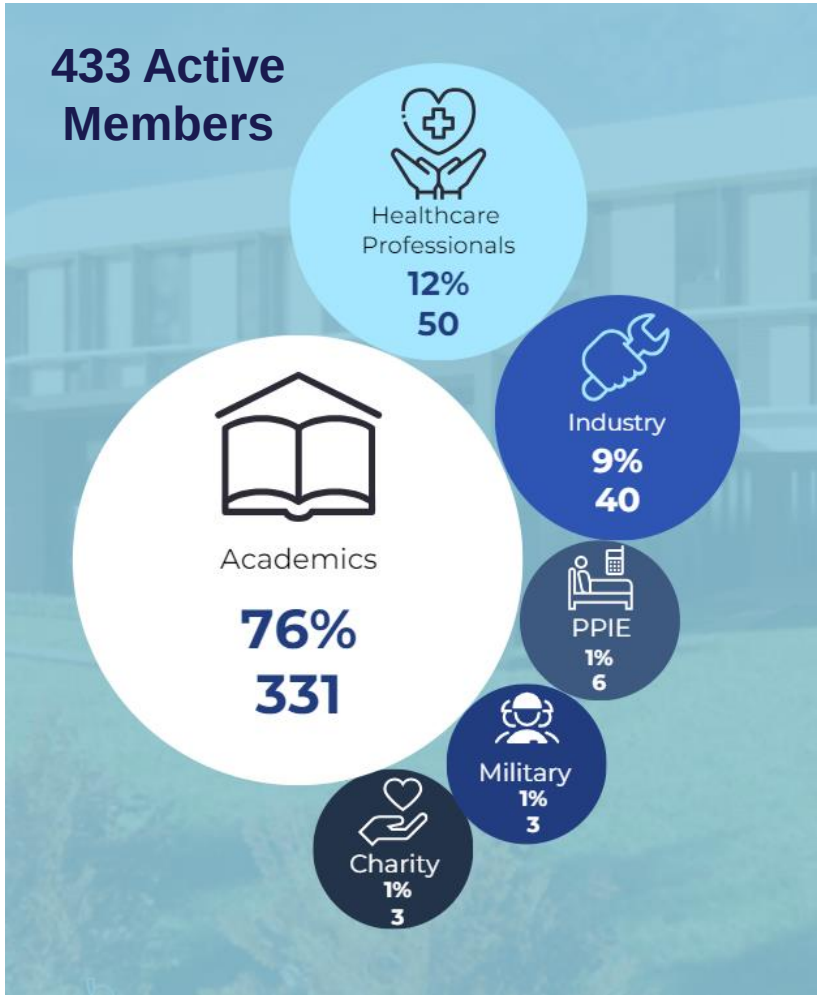
Loughborough University

NRC

Funded by

UKRI Engineering and Physical Sciences Research Council

What is the Rehabilitation Technologies Network?



Fostering the co-creation of innovative technologies that will support people to regain fulfilling, independent lives, post-illness or trauma.

Guidance & Advice

Networking

Workshops

2024 Conference

PPIE

Funding

Webinars

Resources & Learning

Early Career Researcher Forum

Rehab Technologies Network

University of Nottingham UK | CHINA | MALAYSIA

Loughborough University

NRC

UKRI Engineering and Physical Sciences Research Council

Feasibility Projects Funded by RTN+

Overview of all projects

Grand challenge Workshop 1: Cardiorespiratory Rehabilitation	**Grand challenge Workshop 2: Musculoskeletal Rehabilitation**
Grand challenge Workshop 3: Neurological Rehabilitation	**Online all themes call**

Feasibility Projects Funded by RTN+

Overview of all projects

Sam Winter Loughborough University **Non-invasive breathing pattern assessment, monitoring and retraining.**	Hubin Zhao University College London **Wearable multimodal imaging and monitoring technology for cardiac functional assessment.**	Pasindu Lugoda Nottingham Trent University **Texo-Skeleton: transforming everyday clothing into self-adaptable exoskeleton for musculoskeletal rehabilitation.**	Huiru Zheng Ulster University **AI-empowered mobile application system for amputee gait training and assessment.**
Abdel-Karim Al-Tamini Sheffield Hallam University **R-SPEAK: Revolutionising speech enhancement in aphasia using knowledgeable AI.**	Anirban Dutta University of Birmingham **Co-production of a platform technology for VR biofeedback training under operant conditioning for functional lower limb weakness.**	Sibylle Thies University of Salford **Can objective stability assessment of walking aid use outside the clinic facilitate stroke rehabilitation?**	Michael Grey Loughborough University **Feasibility of wearable sensors for virtual reality rehabilitation of vestibular dysfunction.**

Non-invasive breathing pattern assessment, monitoring and retraining

Dr. Sam Winter

5 month project

~£50k

Cardiorespiratory Grand Challenge Workshop: July 2022

University of Kent:
Prof. Richard Guest
Prof. John Dickinson

University Hospitals of Leicester NHS Trust:
Dr Tom Ward

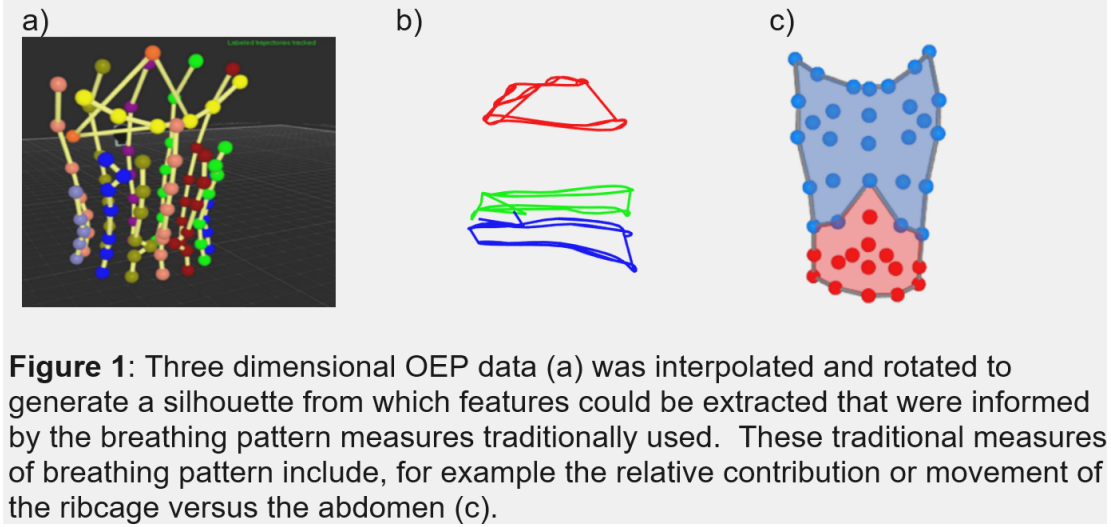


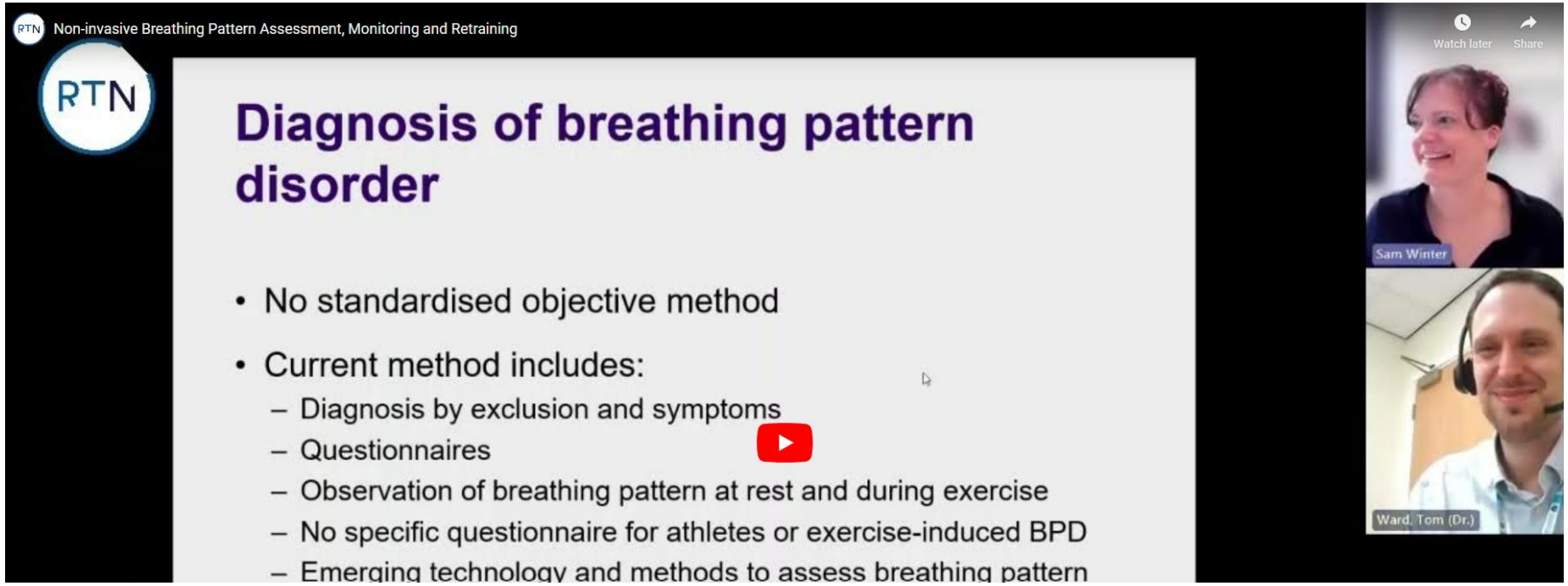
Figure 1: Three dimensional OEP data (a) was interpolated and rotated to generate a silhouette from which features could be extracted that were informed by the breathing pattern measures traditionally used. These traditional measures of breathing pattern include, for example the relative contribution or movement of the ribcage versus the abdomen (c).

- Created a model to distinguish between healthy and BPD individuals.
- Met with clinicians and patient groups to discuss the needs of the system including design.
- Derived a model using silhouette features – need to use two torso views (side and back) and used Dynamic Time Warping to assess temporal alignment.

Recorded Webinar

Rehab Technologies Network

About Activities Resources Funding Get Involved



https://www.rehabtechnologies.net → Resources → Media

Get Involved

rehabtechnologies.net/contact-us

UKRI Engineering and Physical Sciences Research Council

NRC Rehabilitation Technologies Conference

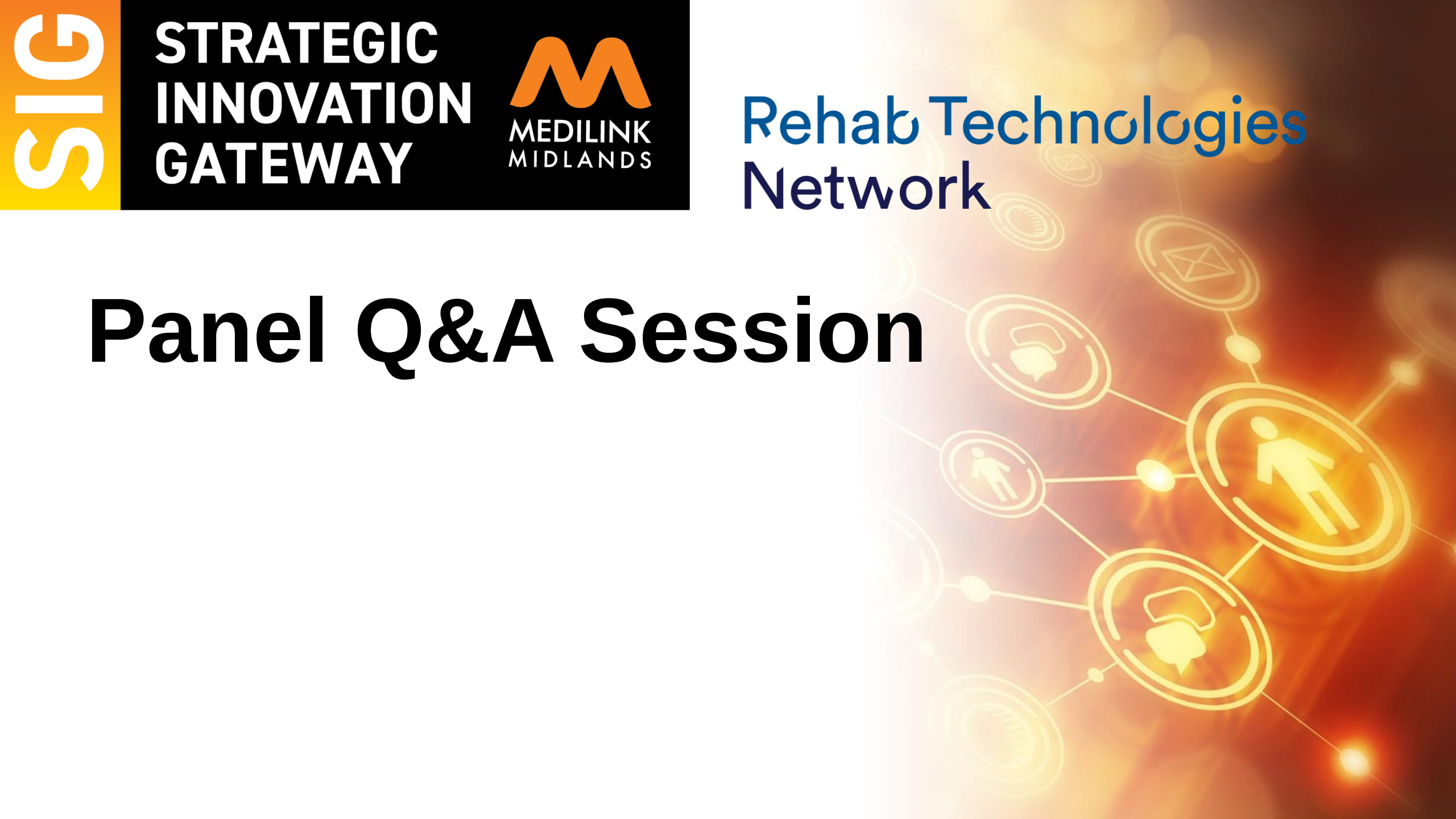
17 and 18 September 2024
University of Nottingham

SIG STRATEGIC INNOVATION GATEWAY

MEDILINK MIDLANDS

Rehab Technologies Network

Panel Q&A Session



NIHR | National Institute for Health and Care Research

Medilink Midlands Rehabilitation Technologies Strategic Innovation Gateway

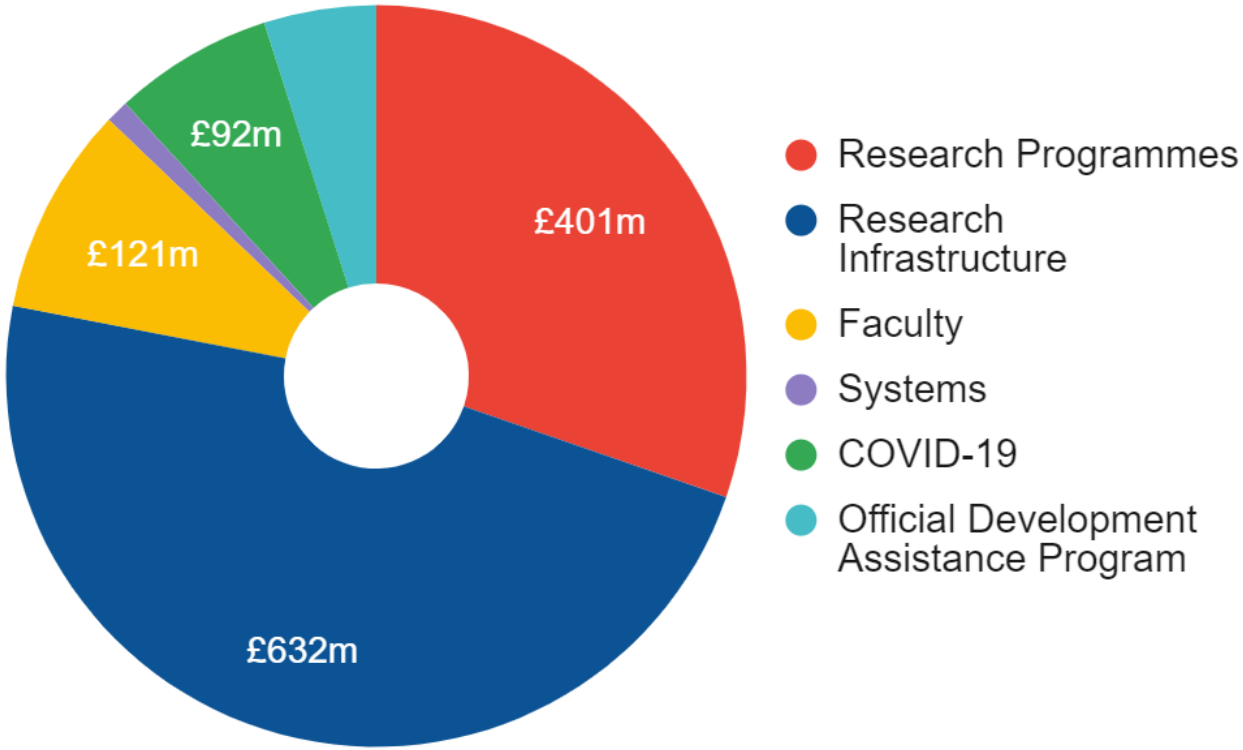
1st May 2024

Dr Helen Compton, Innovation Programmes, NIHRCC

NIHR's mission is to improve the health and wealth of the nation through research

Our aim is to improve and support the UK research infrastructure and world leading life sciences sector

We are one of the largest funders of health and social care research in Europe



£1.32 billion

NIHR Total Funding (2021/2022)

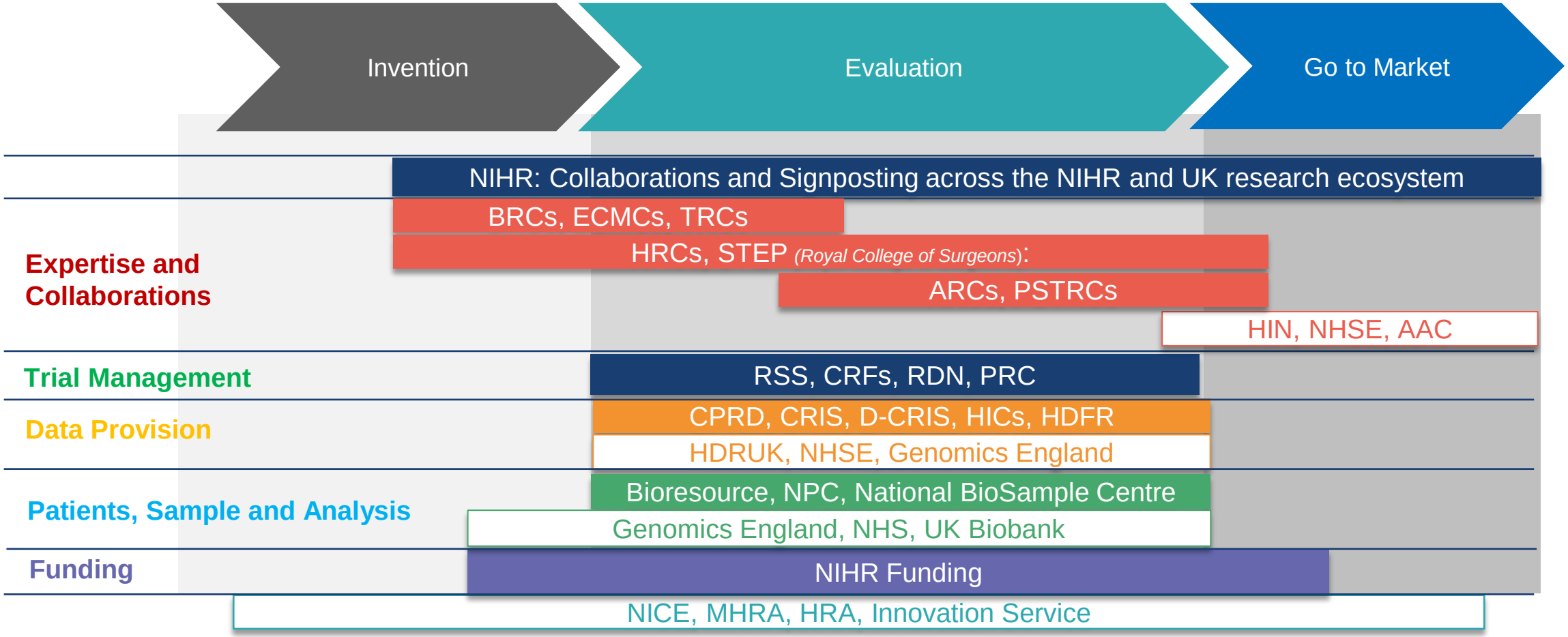
NIHR services for innovators

Access to expertise and facilities

Support to set up and deliver trials in the NHS

Funding for research

We can help you navigate the UK's Research and Health System



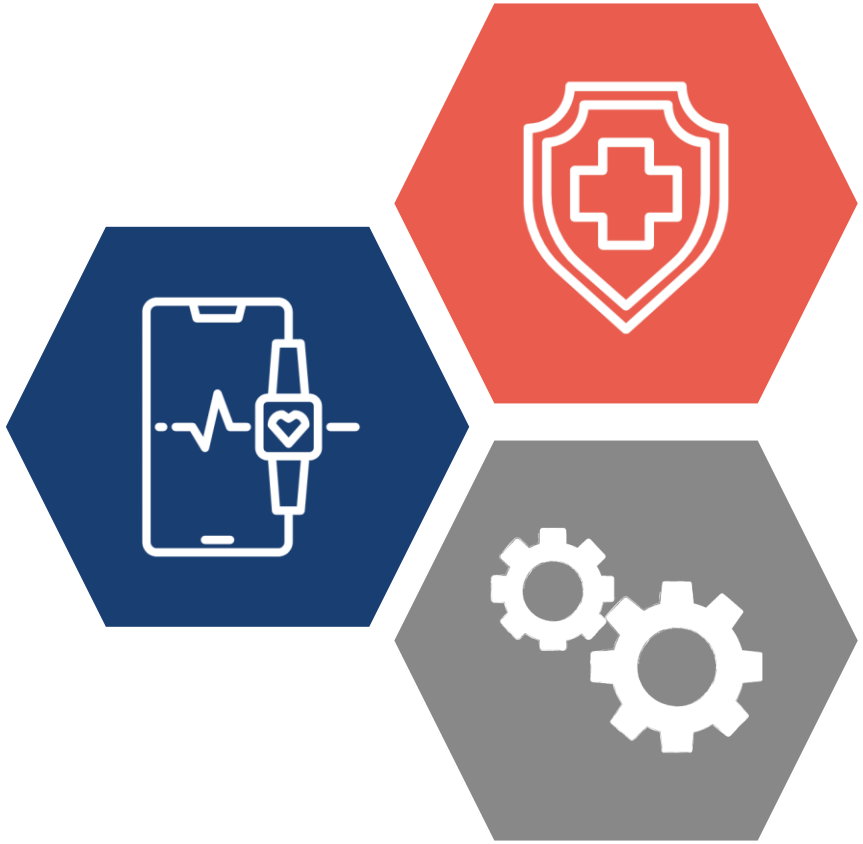
- Single portal for innovators on our partnering page https://www.nihr.ac.uk/partners-and-industry/
  - A “contact us” form is on this page and select areas for advice e.g. Advice on funding, access to expertise and / or opportunities to collaborate, help to design a study, help to run a study, advice on samples and data

- For researchers subscribe to our funding competitions page via the newsletter sign up at the bottom : https://www.nihr.ac.uk/researchers/

Invention for Innovation (i4i)

is our translational research funding programme for medtech innovations

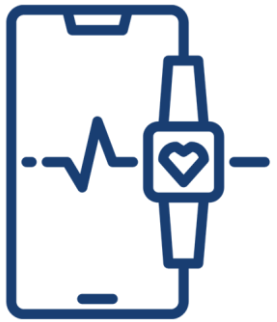
open to any UK lead applicants



i4i funds breakthrough technologies and de-risks projects for follow-on investment

Medical devices

In vitro diagnostics



Digital Health Tier C and Artificial Intelligence Tech

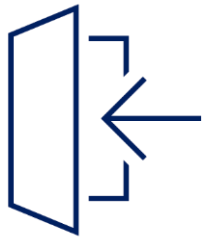
The i4i funding programme is designed to support your R&D

i4i funding

- Dedicated medtech funding programme
- Assessment by technical, clinical & commercial experts
- Uncapped awards with 100% funding
- Due diligence throughout assessment process
- Academic, clinical or SME lead
- Exposure to early-stage investor community
- Proactive risk and impact monitoring

Supporting research across the innovation pipeline

Entry point



Eligibility of Innovation Readiness Levels (Technology)

TRL-1 TRL-2 TRL-3 TRL-4 TRL-5 TRL-6 TRL-7 TRL-8 TRL-9 TRL-10

Basic Research

Idea, unproven, concept, no testing

Concept and application formulated

Pre-Clinical Research

First laboratory tests completed

Small scale prototype built in a laboratory

Manufacturing Validation / Late Pre-Clinical Research

Large-scale prototype tested in unintended environment; simulation suite

Clinical Research

Performance-scale prototype tested in an intended environment close to expected performance

Demonstrate innovation operating in an operational environment at pre-commercial scale

Regulatory Approval

Regulatory Clearance and Market Preparation

First-of-Kind commercial innovation. Manufacturing and integration process outlined

Full commercial application: innovation available for consumers

Post-Launch

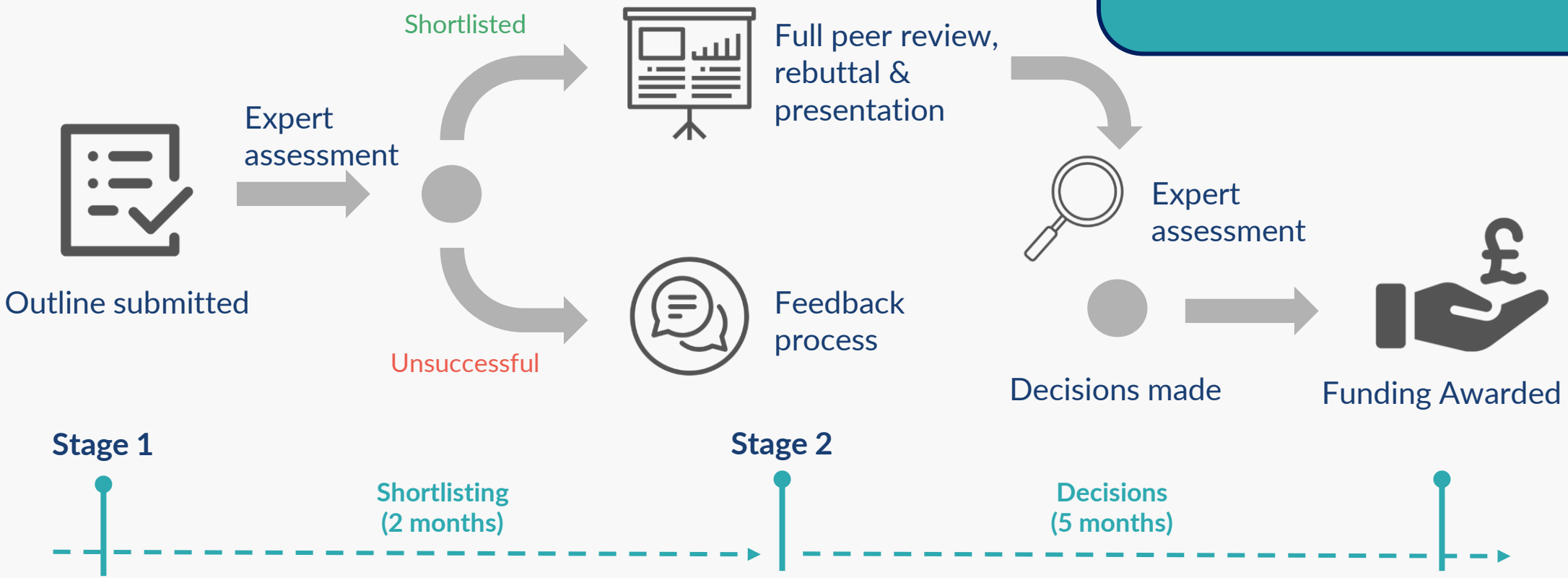
Innovation marketed; generation of real-world evidence / impact evaluation

PDA application process: 2 calls a year

Collaborative projects led by SMEs, NHS providers or HEI

24-36

Projects lasting a minimum of 24 and a maximum of 36 months



NIHR | National Institute for Health and Care Research

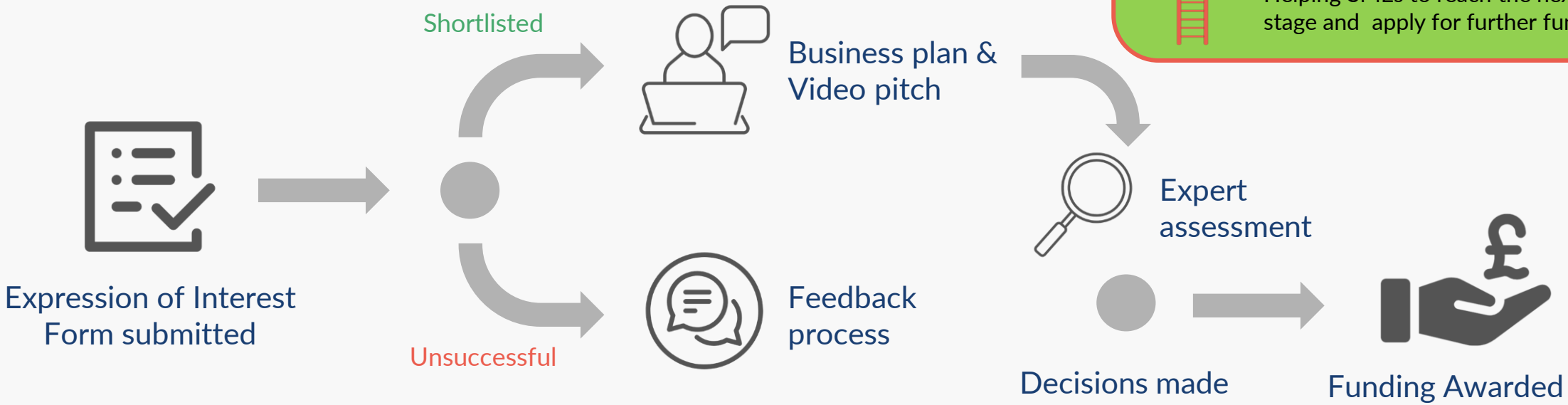
Connect application process: 1 call a year

Connect – SME led

£ Upper funding limit of £150,000

6-12 Shorter term projects lasting between 6 and 12 months

Helping SMEs to reach the next stage and apply for further funding



Stage 1 **Stage 2**

4 month total timeline

i4i FAST Scheme: 1-2 calls per year

Commissioned / themed

Funding at the Speed of Translation (FAST) open to any type of organisation

Rolling call with no submission deadline

Funding a single activity or filling a specific evidence gap

£15k - £50k

Applications between £15k and £50k

What makes a good i4i application?

Project management elements to include

- [ ] Proof-of-concept
- [ ] Project plan
- [ ] Team
- [ ] NHS adoption strategy
- [ ] IP & commercial strategy

Remit and emphasis

- [ ] Clinical need and initial use case
- [ ] Patient benefit
- [ ] Value for money for pathway
- [ ] Patient & public involvement

Case study: therapy box

Digital healthcare company that develops apps to help support people with communication difficulties.

Created a speech articulation rehabilitation app for children with dysarthia.

- Access to expertise, support and patients by collaborating with the NIHR Devices for Dignity (D4D) Co-operative
- Received an NIHR Invention for Innovation (i4i) funding award to develop the app

Additional projects

- Won an i4i connect award for a language disorder screening app.
- Working with the NIHR Cambridge Brain injury Co-operative to develop an assistive patient app

NIHR | National Institute for Health and Care Research

Thank you

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Working with the NRC to overcome pragmatic barriers and challenges in the use of rehabilitation technology

Praminda Caleb-Solly
Prof of Embodied Intelligence

Addressing gaps and challenges across the rehabilitation technology TRL continuum

TRL 1 to 4

- Involving relevant stakeholders
- Early impact analysis
- Understanding real-world deployment challenges
- Testing early to Fail Fast
- Concept-Testing with Patient Public Involvement

TRL 5 to 7

- Serving as a living lab test facility
- Expertise to plan and carry out testing
- Usability and user experience product design
- Testing against relevant benchmarking metrics
- Safety assurance

TRL 8 to 9

- Care workforce training
- Sustainable business models and cost-effective solutions
- Obtaining regulatory approvals and certification
- Continuing improvements and scaling up

Ensuring an inclusive participatory user-centred approach in design & collating evidence of efficacy

Providing an interdisciplinary understanding of barriers and opportunities which will enable the scoping of a range of new key services

Top 10 Rehabilitation Technology Trends in 2023

Rehabilitation Technology

- Immersive Technologies
- TeleHealth
- Advanced Rehab Wearables
- Rehabilitation Robotics
- Personalized Pre-rehab Diagnostics
- Photo & Electro Therapy
- Artificial Intelligence
- Neurofeedback
- Unweighting Technology
- Big Data & Analytics

848

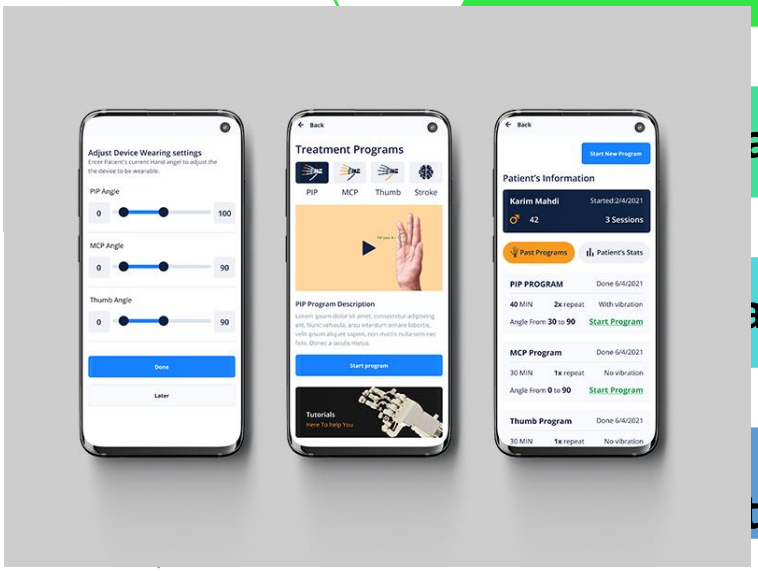
Startups & emerging companies analyzed

Data provided by StartUs insights • January 2023

Barriers and Challenges

- What problem is the technology actually solving, and do the stakeholders understand what it is?
- How do you show that the technology is cost effective? What are the metrics?
- Is the technology straightforward to set-up, integrate and maintain? Who will do this?
- What skills and resources are needed to set-up, integrate and maintain the technology?
- and accessible is the technology for the "end-user"?
- ata from the system kept, who is responsible for it?
- in place and capable of dealing with this additional intervention? How will thways change?

NUREAB



From a Nordic Test Bed Study:

If an innovation is not useful in a care process,

you are doing the entrepreneur a disservice if you cannot create an understanding of this

https://www.vinnova.se/m/testbadd-sverige/guider-och-analyser/

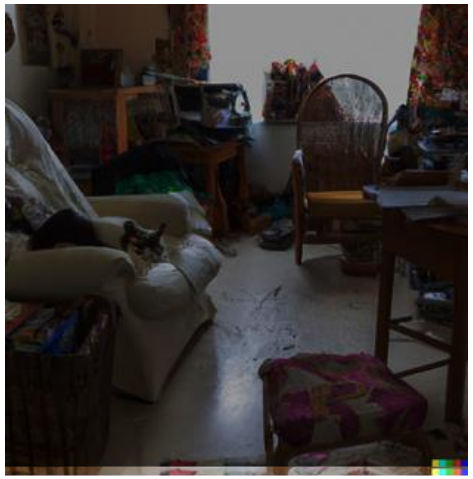
People have a varying range of impairments which result in different accessibility needs

Visual Impairments
- Varying visual acuity
- Limited field of view
- Light sensitivity
- Impaired depth perception
- Colour perception
- Blurred vision

Cognitive Impairments
- Memory loss
- Reduced attention
- Language comprehension
- Spatial cognition
- Anxiety
- Reduced ability for multitasking

Physical Impairments
- Weakness from Frailty
- Fatigue
- Balance problems
- Pain
- Reduced mobility

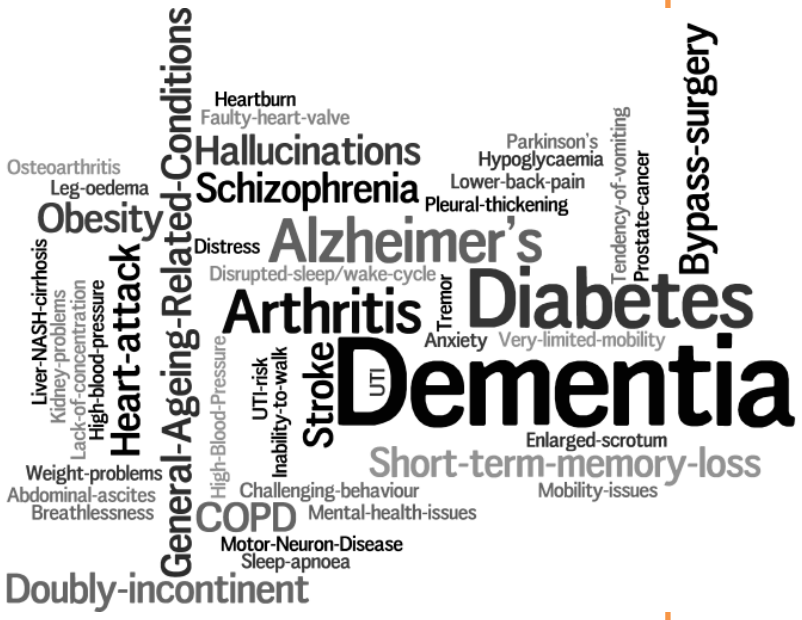
Hearing Impairments
- Conductive Hearing loss
- Sensorineural Hearing loss
- Tinnitus
- Auditory Neuropathy
- Sensitivity to loud noises

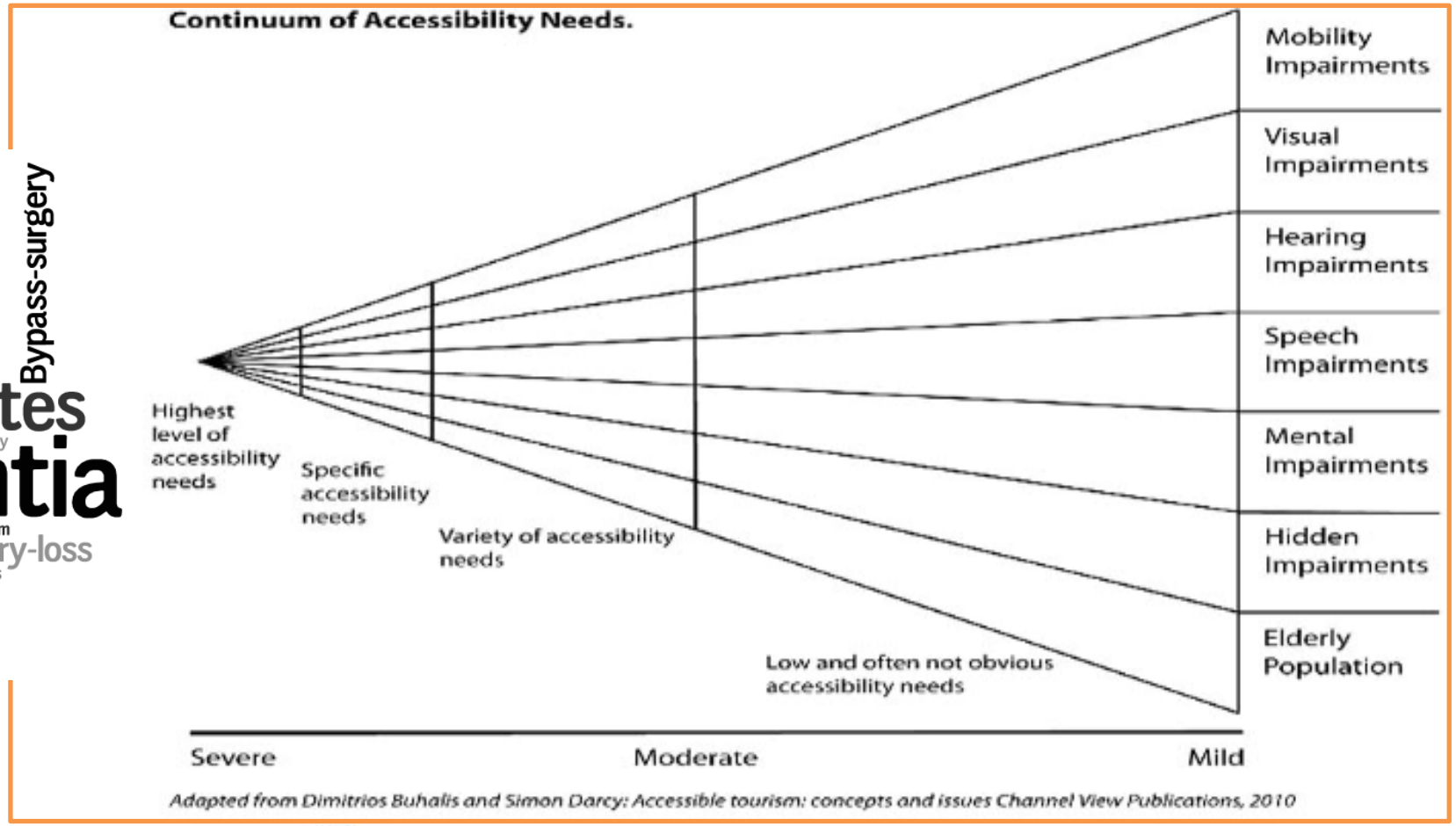


These impairments will also be affected by the spaces that people are in…..

Caleb-Solly, Praminda: 'Person-environment interaction' (Healthcare Technologies, 2016), 'Active and Assisted Living: Technologies and Applications', Chap. 8, pp. 143-162, DOI: 10.1049/PBHE006E_ch8 IET Digital Library, https://digital-library.theiet.org/content/books/10.1049/pbhe006e_ch8

Changes in impairments through a person's life course





Trailblazers Training Together

Trialling telepresence robots as part of a volunteer support scheme to encourage social interaction and increase physical activity to address frailty

Healthier Together

Improving health and care in Bristol, North Somerset and South Gloucestershire

Bristol age UK

NHS Bristol, North Somerset and South Gloucestershire Clinical Commissioning Group

Bristol Health Partners

Robotics for Good Smarter Living

University of Nottingham UK | CHINA | MALAYSIA

KIRSTY BROWN FITNESS FOR LIFE

Self-directed Rehabilitation for Stroke

Enhancing self-directed arm exercise practice using a GripAble gaming device and Lycra arm sleeve in people with stroke

UWE Bristol University of the West of England

brl Bristol Robotics Laboratory

BRISTOL after stroke

University of Nottingham UK | CHINA | MALAYSIA

Learning from Real-World Deployments of Technology

Social	Learning and Response
Anxiety about reduction of in-person visits	Identify those who actually do need much more human-human contact and consider the quality and quantity of interaction they are currently receiving
Can be seen as an imposition and chore	Gain better understanding of the clients' personal issues, such as time spent socially isolated or housebound Gain better understanding of staff roles and responsibilities
Anxiety about technology	Focus on purpose and provide evidence of benefit. Sharing of other user's stories
'Not for me'	Explore alternatives devices

Learning from Real-World Deployments

Logistic	Learning and Response
Training – goes beyond just feeling confident to use the technology – need skills to interact and set it up	Bespoke training packages ‘Driving and Interaction Training’
Ensuring privacy	Dependent on the integrity of the volunteers
Safety	Remote monitoring of physiological information
Support and Maintenance	On-call service design
Clutter in the home and arrangement of furniture can limit how and where the robot can be moved	Consider whether the technology is the right solution for the client

Learning from Real-World Deployments

Technical	Learning and Response
Lack of high bandwidth and low latency wireless connectivity	Mobile 5G sims – cost is an issue
Old buildings with thick walls	Mesh networks (to some extent)
Ambient noise	Directional microphones and speakers, speech to text
Lack of Accessible interfaces	Explore alternative augmentative communication devices
Lack of power sockets	Need infrastructure changes
Limited space for docking station and access (obstacles)	Setup adaptive collision avoidance thresholds

Exploring Legal, Social and Ethical issues: Using the PICT Framework

Anna-Maria Piskopani, Research Fellow in IT Law

People:

Legal Rights

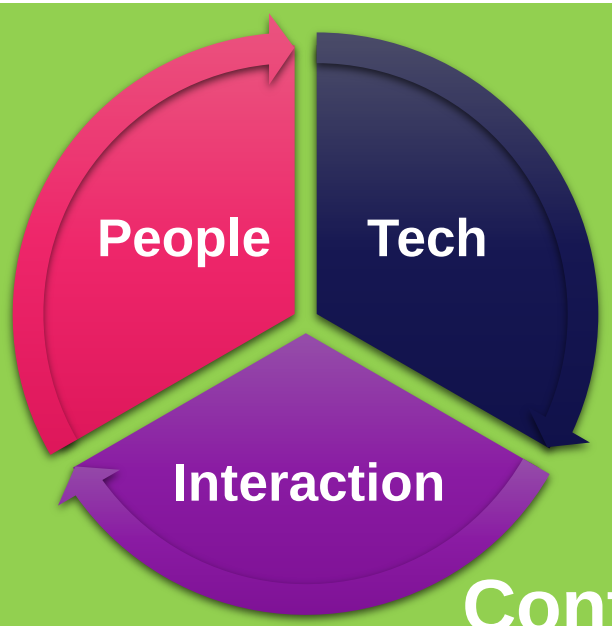
- Respecting privacy, freedom, autonomy, Identity, liability

Social issues :

- Public acceptance/trust
- Ensuring wider community benefits
- Concerns over changing roles of those working in the health services
- Concerns over lack on patient/clinician interaction
- Concerns over increasing healthcare inequalities
- Concerns about the effects on the environment

Ethical principles:

- Patient wellbeing/welfare
- Prevention of negative effects on vulnerable people: deception, social isolation, autonomy
- Prevention of harm (physical or psychological)
- Avoiding dependency



Context

- Privacy expectations in different spaces (private - patient rooms, public areas, semi-private areas – cafes in hospitals, care facilities)
- Physical Obstacles
- Light levels
- Ambient Noise

Technology:

- Interoperability
- Sustainability
- Issues of malfunction
- Machine learning safety issues
- Medical Device Standards
- Copyright/patents law
- Data bias, fairness and equity
- Privacy by design
- Cyber Security (data breaches/malicious uses)
- Adaptability

Human-Technology Interaction:

- Risks from poor understandability/usability of technology's function
- Safety during operation
- The degree of autonomy in decision making
- Accountability/transparency/ responsibility/culpability
- Ensuring inclusion and diversity

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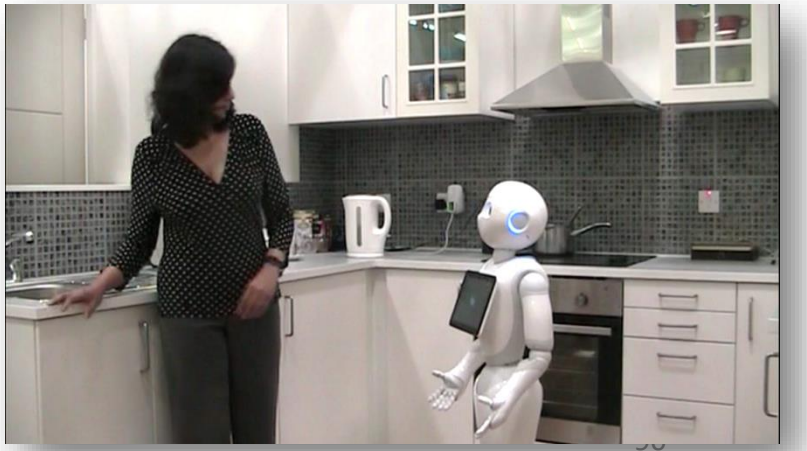
Empowering the Future Care Workforce Scoping Capabilities to Leverage Rehab Technologies through Co-Design

- Healthcare professionals
- Social care professionals
- Unpaid carers (family and friends)
- Informal assistants (volunteers)

https://www.tas.ac.uk/research-projects-2022-23/empowering-future-care-workforces/

Who does what and when and how often?

- Rehabilitation technology safety assessment
- Initial configuration and setup (personalisation)
- Training the **user(s)** on how to use technology
- Verification of performance (human factors, clinical efficacy and safety)
- Updating the technology's 'behaviour' and operational parameters as the user's condition's changes
- Routine maintenance (cleaning)
- Scheduled maintenance (re-calibration and system performance testing)
- Breakdown support and repairs
- Ongoing system review of clinical efficacy



Working with the NRC and Partners

NHS Digital Technology Assessment Criteria

- Clinical Safety
- Data Protection and Privacy
- Technical Assurance
- Interoperability
- Usability and Acceptability

Regulatory Processes
- Medical Devices & CQC
- BSI and ISO Standards

Benchmarking
- Reliability and Safety Testing
- Functional Performance Testing

Evaluation
- Usability Study Frameworks
- User Experience & Acceptance

Clinical Efficacy
- Evidence Base from controlled studies
- Trials setup and implementation support

Cybersecurity Review
- Security Assessment
- Threat Intelligence

Ethical and Legal Procedures
- Approvals processes
- Indemnity insurance

Healthcare Innovation Support
- Business Value Proposition
- Financing and Marketing Services

Care Workforce Education

PATIENT WARDS

STATE OF THE ART TEST EQUIPMENT

CLINICAL SERVICES AND DIAGNOSTIC FACILITIES

EDUCATIONAL PROGRAMMES

NHS Nottingham University Hospitals NHS Trust

MEDILINK

East Midlands Academic Health Science Network Igniting Innovation

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Expert Webinar Series

Emergence

Safety, regulatory and ethical considerations for the integration of assistive robotics

May 8th, 2024
12:00pm BST

Emma Glass
University Partnerships Manager, BSI

Prof. Alan Winfield
Professor of Robot Ethics, UWE

July 3rd, 2024
16:00pm BST

Prof. Ronald Arkin
Regents' Professor, Georgia Tech

Elaine Gemmell
Head of Regulatory Affairs, InnoScot Health

September 11th, 2024
12:00pm BST

Prof. Jim Torrenson
Professor of Computer Science, University of Oslo

Dr. Natalie Leesakul
Asst. Prof in Law and Autonomous Systems
University of Nottingham

November 13th, 2024
12:00pm BST

Sean Clarkson
Head of Strategic Operations, YHAHSN

Clive Gilbert
Head of Accessible Transport, Policy Connect

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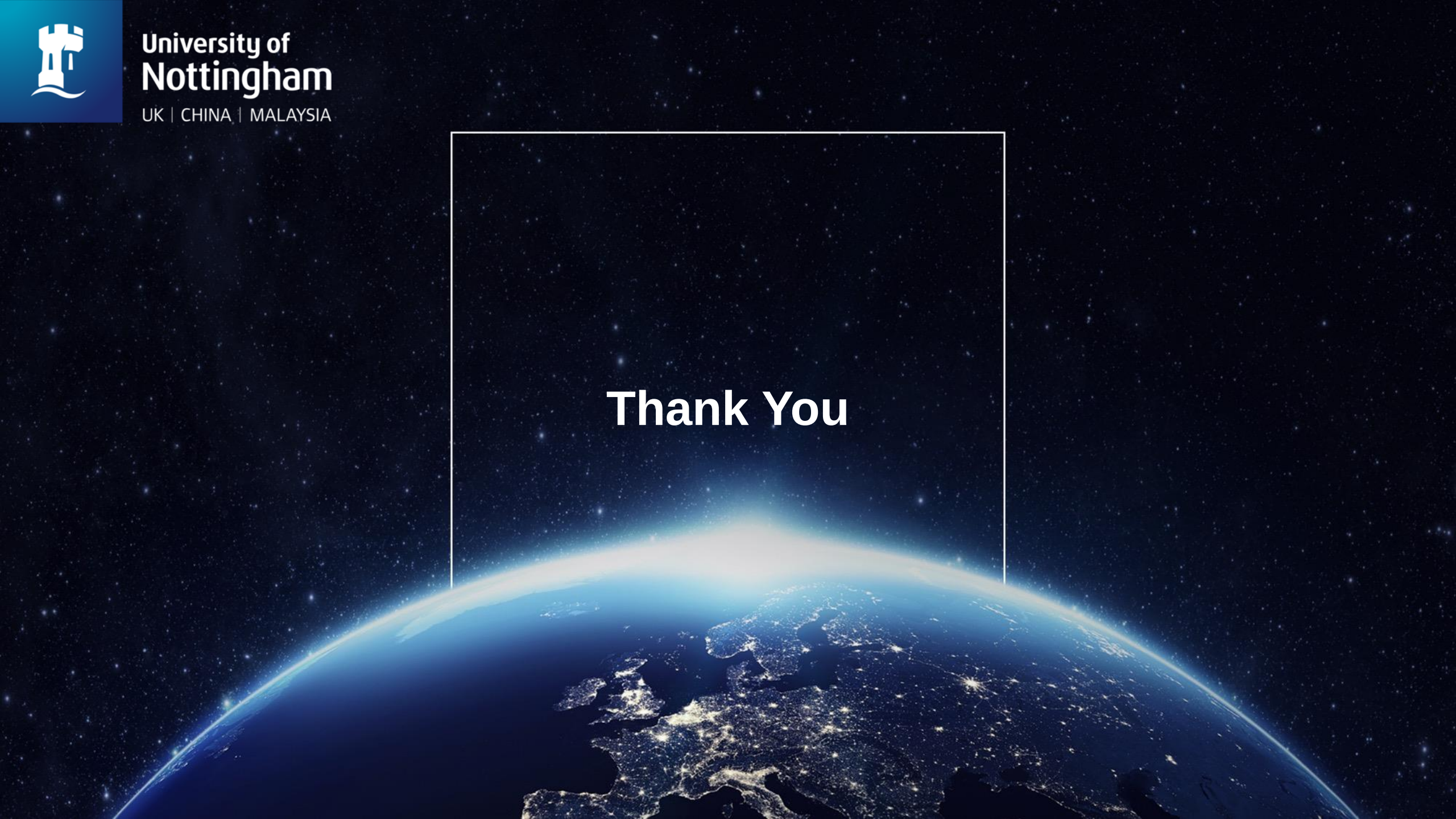
Thank You



SIG STRATEGIC INNOVATION GATEWAY

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Rehab Technologies Network

Breakout Groups

What would be useful to industry when looking to do R&I within the NRC, with university and clinical partners?

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VOI MED TECH

VOICE OF INDUSTRY

Get in touch

Medilink Midlands

info@medilinkmidlands.com