NIHR | Children and Young People MedTech Co-operative

BIENNIAL REPORT

JANUARY 2018 - DECEMBER 2019

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FOREWORD

It is with great pleasure that I present NIHR Children and Young People MedTech Co-operative's (NIHR CYP MedTech) first biennial report. NIHR CYP MedTech was launched in January 2018, bringing together seven paediatric NHS centres across the nation to develop health technologies to support the management and care of children and young people. Our aim is to ensure that we address the health needs of children and young people through the development of bespoke and versatile technologies.

It is through the hard work and dedication of our core team, theme leads, partners, and collaborators that the last two years have been busy, leading to a variety of successes. The NIHR CYP MedTech team continually strives to ensure the best and most advanced healthcare for children and young people through developing cutting edge technologies in key areas of unmet need by collaborating with children and their families, industry partners, engineers, computer scientists, and designers as well as many other professionals.

The team at NIHR CYP MedTech have been involved in a broad range of activities including workshops to identify unmet needs, presenting at events and conferences to showcase the latest paediatric technologies, clinical evaluation of novel devices and digital platforms, and leading on the development of child health research and technology.

These activities and others have provided a solid foundation for an exciting time ahead that will include the development and clinical evaluation of technologies for child health using virtual and augmented reality, robotics, 3D printing, artificial intelligence, data analytics, digital platforms, remote monitoring, advanced design, and biosensor technologies.

I would like to personally thank all those who have worked hard in the last two years with and within our NIHR CYP MedTech team to ensure that children receive the best healthcare and a brighter future.

Professor Paul Dimitri
Director, NIHR CYP MedTech

OUR FIRST TWO YEARS IN NUMBERS

ENGAGEMENT & DISSEMINATION

1 communications strategy published

2 website launched

6 peer-reviewed papers published

13 monthly newsletters published

45 conference presentations delivered

showcased at **22** events

Twitter followers gained:
684 NIHR CYP MedTech
289 TITCH Network
110 CHT Conference

1083

WORKSHOPS & EVENTS

8 theme workshops delivered

UK's first
Robotics in Paediatrics and Child Health Showcase

UK's first
conference dedicated to child health technology

PROJECTS & COLLABORATION

114 unmet needs identified from theme workshops

15 funding applications submitted

Over £6 million leveraged in funding

Worked with **71** SMEs and **23** global companies

20 collaboration requests received

178 partnerships established

60 projects worked on
of which **40%** included an industry partner

3 PhD students supervised

INVOLVING CHILDREN & YOUNG PEOPLE

15 events organised for children, young people, and their families

1 patient and public involvement strategy published

WHY CHILDREN MATTER

Children and young people make up 20% of the UK's population and are 100% of our future. The children of today are the leaders, workforce, and parents of tomorrow.

Long-term conditions including asthma, diabetes, epilepsy, neurodisability, and mental health disorders affect millions of children and young people in the UK and cost the NHS billions of pounds annually. How we manage and support the health of children and young people has long-lasting effects on their physical and mental health and healthcare for decades to come.

Rapid advances in technology are transforming the way we deliver healthcare. New technologies enable faster and more accurate diagnoses as well as more comprehensive but efficient management of many conditions. Technological solutions and novel innovations therefore have the potential to greatly improve the health and wellbeing of children and young people, while demonstrating significant savings to the NHS. Despite this, the development of child health technology has taken place in a relatively emergent manner with little formal coordination. In January 2018, the National Institute for Health Research (NIHR) funded the first MedTech and In vitro diagnostic Co-operative (MIC) dedicated to child health and paediatrics, NIHR Children and Young People MedTech Co-operative (NIHR CYP MedTech). NIHR CYP MedTech is hosted by Sheffield Children's NHS Foundation Trust.

There are 11 MICs, each with a specific focus. The MICs collaborate with clinical teams, academics, businesses, and service users to support the development of new medical devices, healthcare technologies, and technology-dependent interventions for the NHS. All 11 MICs have received funding from the National Institute for Health Research (NIHR) for five years from January 2018.

OUR VISION

To become a world leading consortium for the development of child health technology.

OUR MISSION

To develop safe, evidence-based, and cost-effective technologies that improve the health and wellbeing of children and young people with long-term conditions.

OUR OVERALL AIMS

1 Facilitate collaborations to accelerate child health technology development

Our seven themes were chosen because of the disease burden and potential for technology to improve the delivery of healthcare. Our short-term objectives focus on delivering workshops for each theme to identify unmet needs and establish collaborations between key stakeholders.

2 Work in partnership with NIHR MICs and leading clinical experts

We support collaborative technology development with our themes and the other NIHR MICs. We ensure that child health technology is on the agenda of our MIC partners, collaborators, and clinical leads. We meet annually to foster partnerships that accelerate child health technology development.

3 Develop an innovation research pipeline to facilitate the rapid, low cost clinical evaluation of child health technology

We ensure that SMEs, clinical teams, and academics have access to the necessary expertise to support rapid and affordable prototype development and clinical evaluation. We prioritise the involvement of children, young people, families, and clinical teams to ensure products are fit for purpose. Our medium-term objectives focus on our themes delivering projects that address validated unmet needs. We also host the National Paediatric Technology Test Bed, enabling the rapid evaluation of new technologies for child health.

4 Work with the Life Sciences sector, academics, designers, engineers, and national funding bodies to facilitate child health technology development

Access to industry and other partners in the Life Sciences sector is vital to developing cutting-edge technology for child health. Our long-term objectives focus on working with strategic partners and national funding bodies to influence funding calls that support the development of technology and innovation for paediatrics.

THEMES

NIHR CYP MedTech focuses on developing early stage technology in seven themes.

Our seven clinical themes were chosen due to the considerable disease burden experienced by children and young people.

Focusing on seven clinical areas enables us to gain a comprehensive understanding of the unmet needs and challenges faced by each speciality and to develop effective technologies at pace.

NIHR CYP MedTech utilises the TITCH (Technology Innovation Transforming Child Health) Network to support the development of child health technology outside these specialist themes. The experience that we gain in these themes will allow us to develop a framework to develop other clinical themes in child health in the future.

In line with our short-term objectives, our seven themes have completed scoping reviews of the current technology available for their speciality and hosted innovation workshops to identify and prioritise unmet needs. These workshops, combined with the Theme Leads' clinical expertise, has shaped each theme's focus for the next few years.

Each of themes is lead by a key opinion leader in their specialist field who has the knowledge and expertise to support the development of technology from proof of concept to products ready for use in clinical care.

OUR SEVEN THEMES

- CANCER
- RESPIRATORY & SLEEP DISORDERS
- SURGICAL TECHNOLOGIES
- RARE DISEASES
- EPILEPSY, MOVEMENT, & MUSCLE DISORDERS
- LONG-TERM VENTILATION
- TRANSITION (CROSS-CUTTING)

CANCER

THEME LEADS:

DR QUENTIN CAMPBELL HEWSON
Consultant in Paediatric Oncology, Great North Children's Hospital

DR GAIL HALLIDAY
Consultant in Paediatric Oncology, Great North Children's Hospital

Cancer is the **leading cause of death** in children and young people in the UK, despite improving survival rates.

1800

1800 children aged 0-14 years are diagnosed with cancer in the UK every year.

FOCUS

- **Improve triage** for children and young people undergoing treatment.
- Develop technologies that **remotely monitor vital signs.**
- Improve ways of **securing and protecting devices** that enter the body.
- **Reduce infusion pump alarms** while upholding safety standards.
- Improve **integration and functionality of digital platforms** used in healthcare.

"Children's cancer treatment is clearly benefitting from innovative therapies and we are now exploring how innovative technologies can improve our patients' quality of life."

- Dr Gail Halliday

RESPIRATORY & SLEEP DISORDERS

THEME LEAD:

PROFESSOR HEATHER ELPHICK
Professor of Respiratory and Sleep Medicine, Sheffield Children's Hospital

Respiratory disorders are very **common**, with **1.1 million** children in the UK receiving treatment for **asthma.**

Sleep disorders, like narcoplesy, are common and can be **highly debilitating.**

FOCUS

- Improve **long-term monitoring and diagnostic techniques** for children and young people with chronic respiratory disorders and sleep conditions.
- Develop **self-care and supportive aids** for children and young people with chronic respiratory disorders and sleep conditions.
- Improve the **efficiency of pathways** to treatments.

“ Respiratory disease in children is common. Sleep is fundamental to health and wellbeing. Children rely on technology to aid diagnosis, monitoring, and treatment for both respiratory and sleep disorders. Innovative technological solutions are particularly important for self-care and home monitoring. ”

- Professor Heather Elphick

SURGICAL TECHNOLOGIES

THEME LEAD:

MR IAIN HENNESSEY
Consultant in Neonatal and Paediatric Surgery, Alder Hey Children's Hospital

Operating on children is **very demanding** due to the **variation** in anatomy, size, and physiology.

Surgeons are often required to **adapt adult technology** for children, which can lead to **suboptimal outcomes.**

FOCUS

- Develop and integrate **virtual reality** into pre-operative planning, familiarising patients with surgical environments, and simulating clinical scenarios.
- Improve and utilise **3D printed models** to inform pre-operative planning.
- Develop a **pre-operative chatbot** that deploys a natural language interface to enable patients to access tailored information.
- Develop a **fully integrated theatre environment**, including live video feeds and advanced imaging analytics.

RARE DISEASES

THEME LEAD:

DR LARISSA KERECUK
Consultant in Paediatric Nephrology, Birmingham Children's Hospital

8000+

There are **more than 8000 known rare diseases** and many more syndromes with no name.

75% of those affected are **children and young people.**

30% of children **die before their 5th birthday.**

FOCUS

- Improve the **speed and accuracy of diagnosis.**
- Improve **co-ordination of care** for children and young people managed by multiple specialities.
- Develop **effective emergency care plans** for children and young people with rare diseases.
- Improve **information exchange** with families.

EPILEPSY, MOVEMENT, & MUSCLE DISORDERS

THEME LEAD:

PROFESSOR HELEN CROSS OBE
Professor of Paediatric Neurology, Great Ormond Street Hospital

Epilepsy is **twice as common in children** than in adults.

Epilepsy, movement, and muscle disorders often **severly impact quality of life.**

FOCUS

- **Improve communication** between families and clinical teams.
- Develop methods to support the **early detection and prevention of seizures.**
- Develop technology that **aids recognition of and minimises aberrant movements.**
- Develop **assistive technologies** to support children with myopathies.

LONG-TERM VENTILATION

THEME LEAD:

DR RICHARD ILES
Consultant in Paediatric Respiratory Medicine, Evelina Children's Hospital

Children and young people with respiratory disease can require **long-term ventilation.**

Children and young people who need long-term ventilation can require **long-term hospitalisation in intensive care.**

FOCUS

- Improve ventilation assessment to support the **early identification of clinical deterioration.**
- Detect **infection and inflammation** more accurately in children and young people requiring long-term ventilation.
- Develop new methods and technologies to enable young people to better **manage their respiratory conditions from home.**

TRANSITION (CROSS-CUTTING THEME)

THEME LEADS:

DR PRIYA NARULA
Consultant in Paediatric Gastroenterology, Sheffield Children's Hospital

DR HELENA GLEESON
Consultant in Adult Endocrinology, Queen Elizabeth Hospital

Young people are **required to transfer to adult health services** when they reach 16-19 years.

Transition often leads to **poor engagement** with adult health services and **poor health outcomes.**

FOCUS

- Support the **learning and education of young people** to ensure they have a good understanding of how to manage their condition.
- Improve **access to clinical information** for young people and their new clinicians.
- Support remote consultations and improve the **self-management capabilities** of young people.
- Monitor and improve young people's **engagement with adult services.**

"Technology can offer novel opportunities to overcome existing challenges and assist in delivering transition (process of preparing, planning, and moving from children's to adult services with support before and after transfer of care) within the context of developmentally appropriate healthcare."

- Dr Priya Narula

WORKSHOPS

The first step in developing effective technology for child health and paediatrics is to identify the challenges and unmet needs within the current healthcare system. Technology that is developed without fully understanding the needs and priorities of patients and clinical teams is unlikely to succeed.

Our first short-term objective was therefore to plan and deliver an innovation workshop for each of our themes. All our workshops aimed to:

1. **Identify and prioritise challenges and unmet needs for each theme.**
2. **Develop ideas for potential technological solutions for prioritised unmet needs.**
3. **Establish multidisciplinary partnerships that include children and young people to accelerate new innovations in child health technology.**

We partnered with Lab4Living, a multidisciplinary design research group based at Sheffield Hallam University, to deliver eight highly interactive and creative workshops.

We are very grateful to the various organisations who sponsored and supported our workshops.

8 WORKSHOPS

7 LOCATIONS

350 DELEGATES

114 UNMET NEEDS IDENTIFIED

40 PROJECTS TAKEN FORWARD

UNMET NEEDS

Unmet needs are issues which make day-to-day living difficult for children and young people with long-term health conditions or a problem in a healthcare setting that limits or impacts the delivery of care for children and young people with long-term health conditions.

“Children having chemotherapy need anti-sickness medications often and they need access to these medications without having to attend A&E.”

- Unmet need from our Cancer Innovation Workshop

CANCER

NEWCASTLE | **33** DELEGATES
18 JUN 2019 | **25** UNMET NEEDS

FOCUS: Remote triage, continuous monitoring, infusion pump alarms

SPONSORED & SUPPORTED BY: North East and North Cumbria AHSN, MedConnect North, NIHR CRN North East and North Cumbria

RESPIRATORY & SLEEP DISORDERS

SHEFFIELD | **64** DELEGATES
28 FEB 2019

FOCUS: Developing partnerships with new and existing collaborators to accelerate technology already in development

SPONSORED & SUPPORTED BY: Yorkshire and Humber AHSN

SURGICAL TECHNOLOGIES

LIVERPOOL | **30** DELEGATES
02 MAY 2019 | **11** UNMET NEEDS

FOCUS: Traditional surgical scrubs

SPONSORED BY: European Regional Development Funded (ERDF) Health Innovation Exchange Project

SUPPORTED BY: Alder Hey Children’s Hospital Innovation Hub

RARE DISEASES

LEEDS | **40** DELEGATES
06 JUN 2018 | **18** UNMET NEEDS

FOCUS: Remote monitoring, isolation

SPONSORED & SUPPORTED BY: TRANSLATE

EPILEPSY

LONDON | **50** DELEGATES
31 MAR 2019 | **3** UNMET NEEDS

FOCUS: Early seizure detection, communication, interoperability

SPONSORED BY: Aparito, AT&T, and Liva Nova

SUPPORTED BY: Young Epilepsy, Royal College of Paediatrics and Child Health

LONG-TERM VENTILATION

MANCHESTER | **56** DELEGATES
25 JUN 2019 | **22** UNMET NEEDS

FOCUS: Ventilator care and monitoring, airway clearance, networked care and transition, improving pathways

SPONSORED BY: Philips, Fisher and Paykel Healthcare, Breas Medical limited, Resmed, Aerogen Ltd

MUSCLE & MOVEMENT DISORDERS

LONDON | **37** DELEGATES
31 MAY 2019 | **6** UNMET NEEDS

FOCUS: Challenges of measurement, daily life, participation, pain

SPONSORED BY: University College London, Boston Scientific, Merz

SUPPORTED BY: UCL, Evelina London Children’s Hospital

TRANSITION

BIRMINGHAM | **40** DELEGATES
11 JAN 2019 | **29** UNMET NEEDS

FOCUS: Primary care, multi-morbidities, monitoring

SPONSORED BY: NIHR CRN West Midlands

CASE STUDY: TRANSITION WORKSHOP

Most young people with long-term health conditions need to move their healthcare from children's to adult NHS services when they reach 16-19 years old.

However, young people are more likely to stop attending their NHS appointments and taking their medications once they have moved to adult health services. Disengagement with adult health services is associated with an increase in emergency hospital admissions, a higher incidence of mental health problems, poorer physical health, and increased costs for the NHS.

National guidelines recommend that NHS services should prepare and equip young people with developmentally appropriate information and the skills they need for adult NHS services. The process of preparing, planning, and moving from paediatric to adult health services is called transition.

Transition should begin when children are around 11 years old and continue until they are about 25 years old. In reality however, transition is often poorly coordinated by NHS services and poorly experienced by young people. Many NHS services are overburdened and often do not have the capacity to provide developmentally appropriate healthcare. Technology provides novel opportunities to support both young people and healthcare professionals throughout transition. Despite this, technology to support transition is scarce.

We delivered a workshop on 09 January 2019 that aimed to identify unmet needs and potential technology solutions for three challenges surrounding transition:

1. **Transitioning young people with multiple health conditions.**
2. **Transitioning young people to primary care.**
3. **Monitoring young people throughout transition.**

The workshop was funded and supported by the NIHR Clinical Research Network (CRN) West Midlands and took place at The Studio in Birmingham, UK.

Presentations were delivered by leading healthcare professionals, including:

- **Professor Jeremy Kirk** Clinical Director of NIHR CRN West Midlands and Consultant in Paediatric Endocrinology
- **Professor Paul Dimitri** Director of NIHR CYP MedTech and Consultant in Paediatric Endocrinology
- **Dr Priya Narula** Transition Theme Lead and Consultant in Paediatric Gastroenterology
- **Dr Helena Gleeson** Transition Theme Lead and Consultant in Adult Endocrinology
- **Dr Larissa Kerecuk** Rare Diseases Theme Lead and Consultant in Paediatric Nephrology
- **Dr Sarah Mitchell** GP and NIHR Doctoral Research Fellow

Lab4Living from Sheffield Hallam University collaborated with us to lead creative sessions throughout the day.

Twenty-nine unmet needs were identified and ideas for innovation were developed for the top five.

The workshop was attended by experts from healthcare, academia, SMEs, large corporations, NIHR Clinical Research Networks, and Academic Health Science Networks. Young peple and their parents also attended the workshop.

Feedback for the workshop was overwhelmingly positive. Since the workshop, the Transition theme has focused on reviewing the unmet needs and ideas for innovation, establishing project teams with key stakeholders, and applying for national funding to develop and evaluate novel technologies to support transition.

TRANSITION WORKSHOP

TRANSITION WORKSHOP

PATIENT AND PUBLIC INVOLVEMENT

Patient and public involvement (PPI) involves carrying out research 'with' or 'by' patients or members of the public, rather than carrying out research 'about' or 'for' patients or members of the public.

We believe that PPI is fundamental to the successful development and adoption of technologies for child health. The involvement of children, young people, and their families ensures that innovations are: developed for and with the user; adopted more rapidly; and better integrated into health services.

We aim to involve children, young people, families at every stage of the innovation pathway to ensure the voices of children and young people are heard. We work to the principle of 'health technology designed for children, with children'.

We work closely with both local and national patient involvement groups.

Our second short-term objective was to develop a PPI strategy to ensure that children, young people, and families are integrated into NIHR CYP MedTech activity. Our five-year PPI strategy was published in May 2019 and includes the following strategic priorities:

- **Work in partnership** with children, young people, families, and members of the public in the design and delivery of paediatric medical technologies.
- **Continuously improve** through patient experience and public awareness.
- **Widen participation and involvement** of children, young people, families in NIHR CYP MedTech activities.
- **Grow the evidence base** of the impact of child, young people, and family involvement and engagement in the design and delivery of paediatric technologies.

PPI LEAD

Jen Preston leads our PPI work. For 15 years, Jen's main role has been to develop and implement a strategy for involving children, young people, parents, and carers in the design and delivery of paediatric research.

Jen set up the first ever NIHR GenerationR Young Person's Advisory Group (YPAG) in 2006 and currently co-ordinates the GenerationR Alliance, which consists of 17 YPAGs based around the UK. The YPAGs meet regularly to learn about health research and discuss how to make research work better for young people.

TOOKIE PPI FOCUS GROUP

NARCOLEPSY CO-DESIGN WORKSHOP

CASE STUDIES: PPI

GARETH PRESCH

CEO & FOUNDER, WORLD HEALTH INNOVATION SUMMIT

1 What are your experiences as a parent in the NHS?

We've had a good experience with the NHS as parents. It's always important to work together as a team (patients, families, clinicians, managers, etc) when you have to interact with the health system. We fortunately understood how to navigate NHS services and we hope we can share our experiences to help other parents/guardians and families. We will always be grateful to the clinical team led by Dr Quentin Campbell Hewson at the Great North Children's Hospital in Newcastle for their professionalism in treating our daughter.

2 Why is it important to include children, young people, and families when developing medical technology?

It's important everyone has a voice to ensure we develop solutions that enable healthcare professionals time to treat while improving our children's quality of life. Co-designing solutions with patients, clinicians, managers, academics, voluntary sectors, and industry experts brings opportunities to improve patient care while delivering value for money.

3 How have you been involved with NIHR CYP MedTech?

I attended a NIHR CYP MedTech workshop that was focused on finding solutions that improve care for paediatric cancer patients. As part of the workshop, I delivered a talk on unmet needs in children's cancer to raise awareness of the challenges faced by parents/guardians in paediatric cancer services. The session brought together stakeholders to develop solutions that improve children's health and wellbeing through digital technology.

iCAN SUMMIT

iCAN (International Children's Advisory Network) is a worldwide network of YPAGs, dedicated to providing a voice for children, young people, and their families involved in medicine, research, and innovation.

In 2018, NIHR CYP MedTech was invited to the annual iCAN summit to organise and deliver a session about technology in paediatrics. NIHR CYP MedTech's Director, Professor Paul Dimitri, spoke to children and young people about how child health can be improved through technology and the important role children and young people play in developing new technologies. During the session, children and young people were invited to interact with the technologies on display as well as engage with our industry collaborators to further their understanding of how and why health technology is developed.

Our iCAN session led to a collaborative project with a product design university student at the University of Strathclyde, NIHR Devices for Dignity MedTech Co-operative, and NIHR Brain Injury MedTech Co-operative. This collaboration aimed to develop an innovative solution to enable the 14,000 children and young people in the UK with a cochlear implant to play contact sports. During contact sports, cochlear implants can be knocked by the user's helmet or the microphone can become covered which impedes hearing. This collaboration seeks to overcome this unmet need and enable children and young people with cochlear implants to participate in contact sports with their peers.

iCAN SUMMIT SESSION

EVENTS

NIHR CYP MedTech hosts a range of events, including workshops, patient and family focus groups, showcases, and conferences.

Our events are highly interactive and aim to promote the child health technology agenda, identify unmet needs, develop potential technological solutions, facilitate relationships between key stakeholders, and disseminate the latest developments and research findings. Between January 2018 and December 2019, we organised 16 events and presented or showcased at a further 41 events.

Two of the key events we organised during our first two years were the Child Health Technology Conference and the Robotics in Paediatrics and Child Health Showcase.

CHILD HEALTH TECHNOLOGY CONFERENCE

SHEFFIELD, UK

20-21 MAY 2020

NIHR CYP MedTech is organising the UK's first conference dedicated to technology for child health and paediatrics, the Child Health Technology (CHT) Conference.

CHT will include inspirational keynotes from leading experts, interactive seminars, and live demonstrations. Delegates will have opportunities to develop multidisciplinary partnerships to ensure children and young people receive the best and most advanced healthcare.

Delegates will also have the opportunity to tour the Advanced Manufacturing Research Centre (AMRC) in Sheffield. The AMRC is a network of world-leading research and innovation centres.

Due to the COVID-19 pandemic, CHT2020 was postponed. CHT2021 will now take place virtually on 2-5 March 2021. Visit the conference website to find out more: www.childhealthtechnology.com.

ROBOTICS IN PAEDIATRICS AND CHILD HEALTH SHOWCASE

SHEFFIELD, UK

14 FEBRUARY 2020

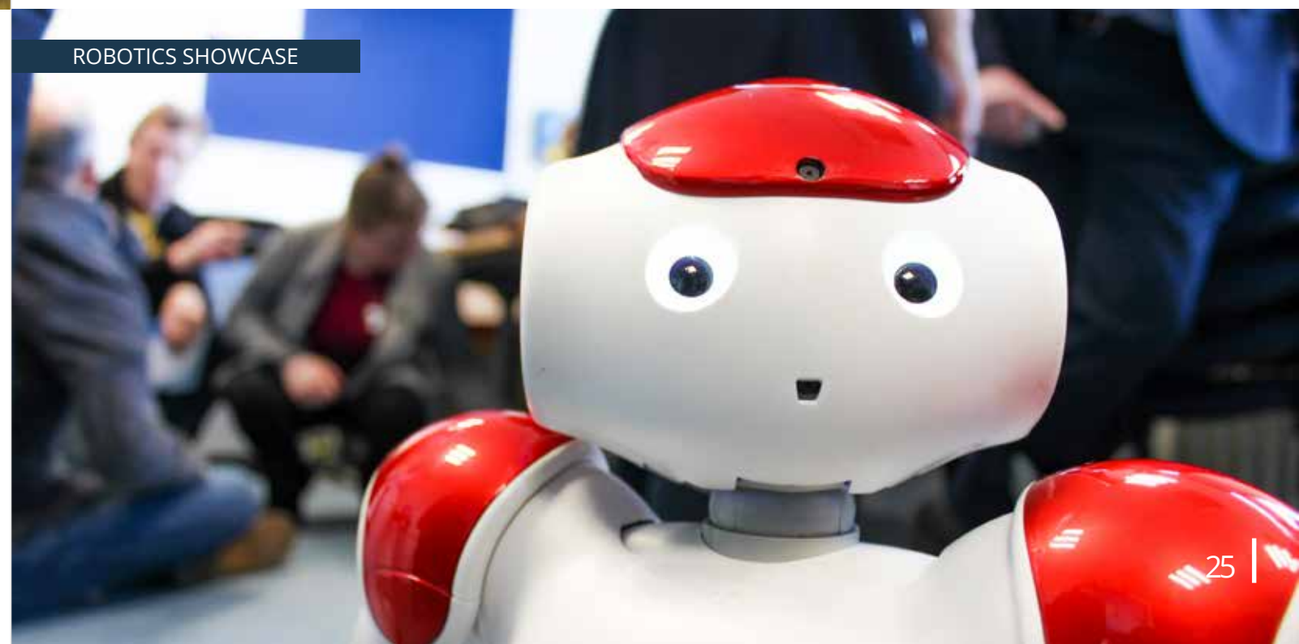
NIHR CYP MedTech partnered with Sheffield Robotics to deliver the UK's first Robotics in Paediatrics and Child Health Showcase.

Sheffield Robotics has one of the largest portfolios of ongoing publicly funded robotics research in the UK, supported by both the UK Research Councils and European Union.

Academic teams from the University of Sheffield, Sheffield Hallam University, and Zuyd University of Applied Sciences (Maastricht, The Netherlands) showcased their innovative work via a series of short talks and interactive demonstrations. The interactive demonstrations enabled attendees to gain hands on experience of social robots, including Pepper, MiRo, ZORA, KASPAR, and Pleo. In-vivo mechatronics for robotic surgical implants, wearable and ingestible robots, and adaptive medical and assistive devices were also demonstrated.

The showcase was very well attended and attracted individuals from a diverse range of backgrounds, including surgery, medicine, clinical psychology, academia, and engineering.

The showcase received outstanding feedback and has led to many new opportunities and collaborations, including further grant applications and a new PhD student in robotics.


ROBOTICS SHOWCASE

PARTNERSHIPS

The market for health technology designed specifically for children and young people is much smaller than the market for adults. This limited market size makes investment in new research and development less attractive to industry. Consequently, technology that has been designed for adults often ends up being repurposed for children and young people, which fails to account for the anatomical, physiological, psychosocial, and developmental changes that occur throughout childhood and adolescence.

There is a growing understanding that children and young people require technology that is designed to give them the best possible medical outcomes.

Despite this, efforts to develop technology specifically for children and young people has often been fragmented across the UK, resulting in many failed ventures or with localised adoption without spread.

Effective partnerships with key stakeholders are essential for the successful development of child health technology. NIHR CYP MedTech therefore specialises in identifying and developing long-term partnerships with diverse stakeholders across academia, healthcare, NIHR infrastructure, SMEs, large multinational corporations, charities, funding bodies, and patient representation.

Ultimately, effective partnerships enable us to achieve our overarching mission of developing safe, evidence-based, and cost-effective technologies that improve the health and wellbeing of children and young people with long-term conditions.

We are the only dedicated paediatric MIC and therefore we recognise the strength of working across the established NIHR infrastructure, including the other NIHR MICs, NIHR Clinical Research Facilities, and NIHR Biomedical Research Centres. Working across NIHR infrastructure ensures expert representation from leading paediatric centres across the UK and helps support the delivery of an innovation pathway across specialist themes. It also enables us to provide a scalable offering to industry through a networked and partnership approach.

Effective partnerships ensure that:

1. Ideas for innovation directly address the needs of children, young people, families, and NHS services.
2. Innovations are developed while considering intellectual property, manufacturing, commercialisation, and NHS adoption.
3. Prototypes can be developed rapidly and evaluated in clinical settings to ensure safety and effectiveness.
4. Funding calls reflect the current priorities in child health and paediatrics and are aligned with the NHS Long-Term Plan.

OUR INNOVATION PATHWAY

Our innovation pathway outlines how we collaborate with stakeholders across academia, healthcare, industry, and patient representation. Following this pathway ensures that the technology we develop has the best possible chance of success for the children and young people we care for.

STAGE ONE: IDENTIFY

UNMET NEED
Observe an unmet need in child health.

INNOVATION
Think of an idea for innovation that addresses an unmet need in child health.

STAGE TWO: SUBMIT

SUBMIT COLLABORATION REQUEST
Complete our collaboration request form to let us know about an unmet need, idea for innovation, or early stage innovation.

STAGE THREE: VALIDATE

OTHER PEOPLE
Speak to other people to find out if they have the same unmet need.

TRENDS
Review and monitor known unmet needs to identify potential trends.

SCOPING
Conduct a scoping exercise to find out if an innovation already exists that addresses the unmet need.

STAKEHOLDERS & END USERS
Engage with stakeholders and end users to find out if they think the innovation is a good idea.

PROTECTION
Conduct preliminary searches to find out if there is any protection that may prevent the innovation from being developed.

STAGE FOUR: OUTCOME

PROJECT
If there is a clear unmet need, we can support the development of an innovation as a project, which includes:

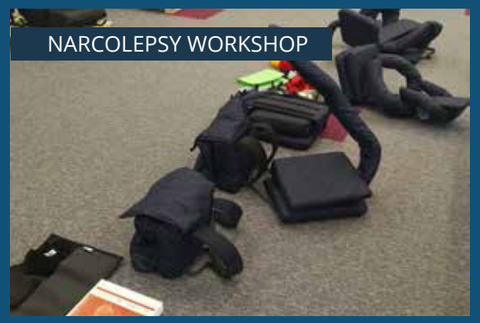
1. Establishing a project team
2. Applying for funding
3. Prototype development
4. Clinical evaluation
5. Health economics
6. Protection

SHARE
In some circumstances, one of our partner organisations may be better equipped to progress the innovation.

PAUSE
If the unmet need cannot be validated or if similar innovations already exist, it may not be appropriate to continue progressing the innovation.

CASE STUDIES: PARTNERSHIP

NARCOLEPSY NECK STABILISING AID


NARCOLEPSY WORKSHOP

UNMET NEED

Narcolepsy is a disabling neurological sleep disorder characterised by excessive daytime sleepiness and sudden muscle weakness triggered by strong emotions. Children with narcolepsy often fall asleep in the car, which can cause pain and injury.

PROJECT

The team secured Medical Research Council Confidence in Concept (MRC CiC) funding to develop a neck stabilising aid for children with narcolepsy to use in the car. Three co-design workshops were delivered to test commercially available products as well as nine new prototypes developed by the project team. Children, young people, families, and healthcare professionals from across the UK attended the workshops. The team are applying for further funding to continue development.

PARTNERS

Sheffield Children's NHS Foundation Trust, University of Sheffield, Sheffield Hallam University, NIHR CYP MedTech

URINE COLLECTION DEVICE FOR YOUNG CHILDREN

CO-DESIGN WORKSHOP

UNMET NEED

Over five million children present to UK Emergency Departments each year with symptoms requiring a urine sample to confirm a diagnosis. However, collecting urine samples from infants and toddlers who are not toilet trained is often difficult and time consuming.

PROJECT

In June 2019, NIHR CYP MedTech and the NIHR Community Healthcare MedTech Co-operative facilitated a co-design workshop with healthcare professionals, engineers, designers, and academics to identify potential technological solutions. A solution proposed by the University of Oxford received pump prime funding and subsequently secured EPSRC Impact Acceleration Account funding to develop the initial concept, optimise the design, and conduct preliminary testing.

PARTNERS

NIHR Community Healthcare MedTech Co-operative, University of Oxford, NIHR CYP MedTech

UPPER LIMB VIRTUAL REALITY REHABILITATION


IMPACT VR LAB

UNMET NEED

Children with upper limb motor impairment and injury need physiotherapy to minimise loss of function. However, these physiotherapy exercises are often painful and repetitive, which often prevents children from completing the necessary rehabilitation.

PROJECT

Sheffield Children's NHS Foundation Trust is pioneering the use of virtual reality (VR) as a therapeutic tool for delivering upper limb physiotherapy. The VR was developed by Sheffield Hallam University's Impact VR Lab and delivers conventional rehabilitation exercises in a fun and immersive way that encourages children to complete their recovery programme. The success of the project has led to further MRC CiC funding for VR lower limb rehabilitation.

PARTNERS

Sheffield Children's NHS Foundation Trust, Sheffield Hallam University, NIHR CYP MedTech

MRI MINI-CAPSULES FOR PAEDIATRIC CONSTIPATION

MAGIC2 PPI FOCUS GROUP

UNMET NEED

Approximately 10% of children suffer with constipation at some point. Abdominal X-rays are often used to find out how long it takes for food to pass through the digestive system. However, x-rays are potentially harmful and are often not very accurate for paediatric constipation.

PROJECT

The project team, led by Nottingham University Hospitals NHS Foundation Trust, has developed easy to swallow mini-capsules that can be detected and analysed using harmless and non-invasive MRI scans. The team are currently evaluating the effectiveness of these mini-capsules after receiving NIHR Invention for Innovation funding.

PARTNERS

Nottingham University Hospitals NHS Foundation Trust, Derby Clinical Trials Support Unit, University College London, University of Amsterdam, University of Lincoln, NIHR CYP MedTech

NATIONAL TITCH NETWORK

The TITCH (Technology Innovation Transforming Child Health) Network is a national network of experts from paediatric and adult surgery and medicine, academia, design engineering, co-design, and patient representation.

The network was established in 2014 to:

1. **Identify unmet needs** in child health that could be solved using technology solutions.
2. **Establish key stakeholder relationships** required to rapidly develop technology at scale.

The TITCH Network is comprised of experts across the UK seeking to support the development, evaluation, and adoption of child health technology.

Members of the TITCH Network have a diverse range of backgrounds, including health, education, academia, industry, patient representation, and NIHR infrastructure.

The TITCH Network is jointly supported by NIHR CYP MedTech and NIHR Devices for Dignity MedTech Co-operative.

TITCH is dedicated to developing child health technology across all clinical specialties and is a route often used by the MICs to find collaborators for projects that fall outside of their own specialist themes.

TITCH
Technology Innovation Transforming Child Health

KEY ACHIEVEMENTS

1. **Leveraged £4.1 million for child health technology** from the Small Business Research Initiative (SBRI) Healthcare funding call in collaboration with the Yorkshire and Humber Academic Health Science Network.
2. **Secured funding from the Department of Health for the Starworks Child Prosthetics Programme** in collaboration with NIHR Devices for Dignity MedTech Co-operative and Sheffield Hallam University.
3. **Supported funding for the development of child health technology** in the NIHR Health Technologies Co-operatives (now called NIHR MICs).
4. Demonstrated the need for **targeted and bespoke child health technology** and for a **funded organisation dedicated to developing child health technology** (NIHR CYP MedTech).

TITCH INDUSTRY AMBASSADOR

Accessing and navigating the NHS' complex infrastructure to develop new products poses many challenges. The TITCH Industry Ambassador initiative has therefore been created to showcase an effective partnership between industry and the NHS.

The role will highlight the value of collaboration and the importance of co-design with children, young people, families, and NHS clinical teams.

This role should enable industry to better understand how to innovate within the field of child health technology for the NHS market.

The TITCH Network is delighted to announce that an Industry Ambassador role has been awarded to long-term collaborator, Tookie Ltd.

Our collaborations with Tookie have so far resulted in four products being listed on the NHS supply chain. These products have been heavily designed, engineered, and developed in collaboration with the NHS through clinical and patient- and carer-centred focus groups supported by the TITCH Network.

Tookie is extremely committed to patient and family involvement, represented by their company ethos of "A life more normal". Their success is a reflection of their attitude towards embedding patient and NHS collaborations in every stage of the innovation pathway.

tookie
#ALifeMoreNormal

TOOKIE FOCUS GROUP

CASE STUDIES: NATIONAL TITCH NETWORK

SBRI HEALTHCARE FUNDING

SBRI Healthcare and the Yorkshire and Humber Academic Health Science Network supported the TITCH Network in developing a funding call for SMEs to stimulate the development of technological solutions to improve self-care and independence in children and young people with long-term conditions.

The following five SMEs received a share of £4.1 million:

1 **ADI Ltd**
Let Me Show U! (LMSU!) is a product developed by ADI Ltd to help physically disabled children and their parents/guardians explain to new carers the best way to address their children's physical challenges. LMSU! uses digital media (video, animation, audio) that is specific to each child. This media is stored within a secure personal health record that is controlled by the child and family.

2 **OPEN BIONICS Ltd**
The provision of prostheses for children and young people is severely limited in the NHS due to their complexity and cost. Open Bionics aims to address these limitations through the provision of affordable, multi-grip, robotic prostheses for children and young people with upper limb deficiencies.

3 **ASEPTIKA Ltd**
Aseptika further developed their Activ8rlives technology in collaboration with Sheffield Children's and Evelina London Children's Hospital to better support children with asthma. Improvements were made to the self-care and remote monitoring capabilities as well as the FingerBandSpO2 miniaturised blood oxygen monitor. This further development work has led to additional funding being secured from Innovate UK.

4 **INNERSTRENGTH Ltd**
Innerstregth evaluated a new model of care that focuses on physical activity and exercise programmes for children and young people with cystic fibrosis. The evaluation focused on improving engagement and self-management and reducing the burden of care. Innerstrength is currently part of the Sheffield Hallam University Advanced Wellbeing Research Centre mentorship programme.

5 **THERAPY BOX Ltd**
Therapy Box Ltd developed a new voice-input communication aid, VocaTempo, that addresses common problems with current communications aids for children and young people with severe speech impairments. VocaTempo recognises words spoken by a child with severely impaired speech and speaks out a clear version of the message, making it easier, faster, and more natural to use than current communication aids.

COMMUNICATION

The success of NIHR CYP MedTech depends on engaging with key stakeholders across multiple sectors to catalyse the development and adoption of novel child health technology in the NHS.

Our third short-term of objective was therefore to develop a Communication and Dissemination Strategy to increase stakeholder engagement. This strategy was published on 28 February 2018 and can be downloaded from our website.

NEWSLETTER

Our monthly newsletter was launched in September 2018. Our newsletter compliments content on our social media channels and website, providing stakeholders with detailed information about our themes, projects, and events. By December 2019, 151 individuals had subscribed to our newsletter.

PUBLICATIONS & CONFERENCES

We publish our work in peer-reviewed journals in collaboration with project teams and present at national and international conferences to ensure that our work is appropriately disseminated among the academic and healthcare communities.

WEBSITE

Our website was launched in July 2018 to provide:

- An overview of the NIHR MICs
- Information about the support we can offer
- A point of access for potential collaborators
- Updates about our projects, events, and achievements
- Case studies demonstrating how we work across sectors
- Relevant funding calls

www.cypmedtech.nihr.ac.uk

SOCIAL MEDIA

We have established a strong social media presence that reaches healthcare, industrial, academic, and patient communities. Our highly active social media presence gives us the opportunity to interact with our stakeholders in an informal way. By December 2019, we had 1083 Twitter followers across our three accounts.

@cypmedtech
@titchinnovate
@chtconference

TEAM

CORE TEAM

PROFESSOR PAUL DIMITRI
Director

DR CLARE BARTLETT
Project Manager

NATHANIEL MILLS
Programme Manager

TOM HODGKINSON
Project Manager

DR PHILIPPA HOWSLEY
Project Manager

ABIGAIL NEEDHAM
Business Development and Project Manager

STEERING GROUP

PROFESSOR NICK BISHOP
Vice President for Science and Research, Royal College of Paediatrics and Child Health

DAVID COLE
Head of Business Development and Innovation Europe, Middle East, and Africa, IBM Watson Health

PROFESSOR PAUL DIMITRI
Director, NIHR CYP MedTech

PROFESSOR JEREMY KIRK
Clinical Director, NIHR Clinical Research Network West Midlands

KAREN LIVINGSTONE (CHAIR)
Chief Executive Officer, Bedfordshire and Hertfordshire Local Medical Committee

NICOLE MCGLENNON
Managing Director, East Midlands Academic Health Science Network

DR LIZ MEAR
Chief Executive Officer, Innovation Agency, the Academic Health Science Network for the North West Coast

NATHANIEL MILLS
Programme Manager, NIHR CYP MedTech

JEN PRESTON
Patient and Public Involvement Lead, NIHR CYP MedTech

PROFESSOR MEHDI TAVAKOLI
Knowledge Transfer Manager for Infrastructure, Medical Technology, and Therapies, Knowledge Transfer Network

PROFESSOR WENDY TINDALE
Clinical Director, NIHR Devices for Dignity MedTech Co-operative

NIHR | Children and Young People MedTech Co-operative

www.cypmedtech.nihr.ac.uk
cypmedtech@nihr.ac.uk
@cypmedtech