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child health technology
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BUILDING A GLOBAL CHILD HEALTH
TECHNOLOGY COMMUNITY



ABSTRACT BOOKLET

NIHR | Children and Young People
MedTech Co-operative

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01 PAEDIATRIC SURGERY: WHAT CHALLENGES DO FAMILIES FACE, AND HOW THE LITTLE JOURNEY APP ADDRESSES THEM

Phoebe Chatfield

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BACKGROUND

Previous research on families' experiences of paediatric surgery has identified practical challenges that families face. However, a deeper conceptual understanding is lacking. Nonetheless, these findings highlight key areas for quality improvement of care. To improve families' care, various health apps have been designed and developed to prepare and support families. Research into how such apps can be used to meet families' needs is crucial to ensure high-quality patient-centred care.

AIMS

This study aimed to explore the challenges experienced by families in paediatric surgery and to examine how the Little Journey (LJ) app can help families address these challenges.

METHODS

Qualitative semi-structured interviews were conducted via online video calls with nine parents (N=9 female). All parents had a child who underwent surgery and were recommended to use the LJ app. Eight parents used the LJ app and one did not.

RESULTS

Inductive reflexive thematic analysis revealed three main themes on challenges parents faced: negotiating suitable support, managing unfamiliarity, and coping with uncertainty. Each main theme contained two sub-themes on how families used the LJ app to address these challenges. These sub-themes identified LJ as a personalisable source of information that shows potential in setting families' expectations and adding to their support by empowering families throughout the paediatric surgery process.

DISCUSSION

Insights from parents' experiences revealed key aspects of the paediatric surgical process that families find challenging. This furthers our understanding of how provision of care can be improved. Firstly, the importance for healthcare services, including LJ, to collect and understand families' experiences to provide high-quality patient-centred care is discussed. Furthermore, evaluation of family-centred care models is discussed based on our findings. This includes the importance of children's involvement and LJ's potential in solidifying children's role in paediatric surgery and helping children develop positive schemas for future healthcare.

BACKGROUND

Over recent decades, technology has become more and more intrinsic within daily life, with advancements in wearable, sensor, and assistive technology (amongst others) leading to an increased use within healthcare, particularly in aiding self-management. Juvenile idiopathic arthritis (JIA) is the most frequently occurring rheumatic disease of childhood, causing ongoing joint inflammation, pain, and stiffness. Studies have highlighted the negative impacts of these symptoms in all areas of life, therefore self-management is crucial. The benefits of using technology for self-management are vast, however barriers and concerns remain, particularly for the younger population around embarrassment, stigma, over-reliance, privacy, or impact on relationships.

AIMS

To investigate the notion of assistive technological innovations as a 'helping hand' to enable improved self-management in children and young people (CYP) with JIA.

METHODS

A co-designed suite of three prototype innovations was tested over a 9-week period with 10 CYP with JIA (7-16yrs), their parents and teachers. The prototypes consisted of:

- P1: A wearable pain management device
- P2: A motivational physiotherapy tool
- P3: A communication aid for use in school

Baseline, intervention, and post-intervention data sets were collected using quantitative usage data, self-reported diaries, and interviews.

RESULTS

88% of participants found one or more of the devices beneficial for condition management. Highlighted benefits included increased independence, improved communication between CYP and their teacher, improved motivation, and reduced social embarrassment and stigma.

DISCUSSION

Initially, the technological device benefits had been assumed to focus on addressing JIA symptoms. The results instead indicate that the benefits went beyond the physical aspects of the condition towards the more intangible aspects such as independence, stakeholder communication, motivation, and social embarrassment. This highlights both the underlying importance of these hidden aspects to successful condition management as well as the huge potential for technological devices to act as a helping hand, empowering CYP to self-manage confidently.

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BACKGROUND

In the past decade, research across different disciplines has demonstrated the potential benefits of social assistive robots (SARs) in providing care for individuals with autism spectrum disorder (ASD). While the integration of SARs into clinical practice has garnered increasing interest, their effectiveness in diagnosing ASD remains limited.

AIMS

The aim of this study is to present a preliminary critical analysis of the clinical validity of using SARs to detect the risk or diagnose individuals with ASD.

METHODS

Following the PRISMA guidelines, a systematic review was conducted, including studies that met specific criteria: a) focusing on autism, b) evaluating the effectiveness of one or more social robots for diagnosing or assessing the risk of autism, c) using a sample consisting exclusively of individuals with ASD, and d) employing physically present and actively utilized robots.

RESULTS

The review identified a total of 7 studies where SAR was employed to detect ASD using data gathered during the interaction with the robots. ASD was identified through various indicators, including participants' engagement, facial expressions, movement patterns, spatial positioning, experts' observation of typical symptoms, joint attention, eye contact, and adult seeking behaviour. No standardised or validated assessment supported by SAR was identified.

DISCUSSION

Despite the promise of using SARs in the clinical context of individuals with ASD, more clinical evidence is needed to validate and confirm the applicability of SARs for diagnosing and assessing the risk of ASD. Overall, this preliminary analysis emphasises the potential of SARs in contributing to the detection and understanding of ASD. However, further research is necessary to establish the effectiveness and reliability of SARs as a diagnostic tool in clinical settings. The development of standardised and validated assessment protocols involving SARs could greatly enhance their utility in diagnosing ASD and evaluating the associated risk.

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BACKGROUND

The neonatal heart rate immediately after birth is a major measure of health determining if assistance or resuscitation is required. The heart rate is required to provide the one minute APGAR score. The current recommendation is to use auscultation which can only be heard by one person, is not accurate, and is not documented in real time. Recent guidelines recommend that the umbilical cord remains unclamped for at least one minute after birth in neonates not requiring resuscitation. Determining the heart rate is not achieved at many births, especially while the neonate remains within the sterile surgical field at caesarean section.

AIMS

To provide a low cost, accurate and documented heart rate immediately after birth at all high risk births, including caesarean section.

METHODS

A fetal doppler device has been modified to sit hands free on the neonatal chest. An initial feasibility study of the heart rate determined by the doppler is underway. Neonates under one year of age undergoing sleep studies have been recruited. The heart rate, as determined over a few minutes by the doppler is compared with the ECG heart rate. A parental survey is completed.

RESULTS

The doppler heart rate closely correlates with the ECG heart rate. It is highly acceptable by the parents and remains unattended on the chest.

DISCUSSION

The doppler heart sounds are heard by all the team and the parents immediately after the transducer is applied to the chest, and similar to the doppler sounds heard during labour. The standard low cost device is readily available throughout the world. By separating the transducer connected by a soft flexible wire to the ultrasound device the transducer sits on the neonatal chest without attention. At caesarean section the transducer can be placed inside a sterile polythene tube and used by the obstetrician.

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BACKGROUND

Newborn screening (NBS) aims to identify babies affected by rare but serious genetic conditions. As technology advances, there is the potential to expand the NBS programme following evaluation of the likely benefits and disbenefits. It is important to consider the family experience of screening, and the views of the public. To engage in public dialogue can be difficult; the conditions, screening processes, and associated moral and ethical considerations are complex. We consider a new approach to engage, and consult on the implementation of extended genetic testing in NBS for Cystic Fibrosis.

AIMS

The aim was to develop a stand-alone resource to enable a range of stakeholders to understand and consider the question: How should extended genetic testing be used when screening babies for Cystic Fibrosis?

METHODS

Four co-design workshops with policy makers, parents, and stakeholders informed the design of an interactive activity, including the structure, content, and questions posed. Vignettes constructed using interview data, and translated into scripts were recorded to provide short films to represent, and provoke consideration of families experiences.

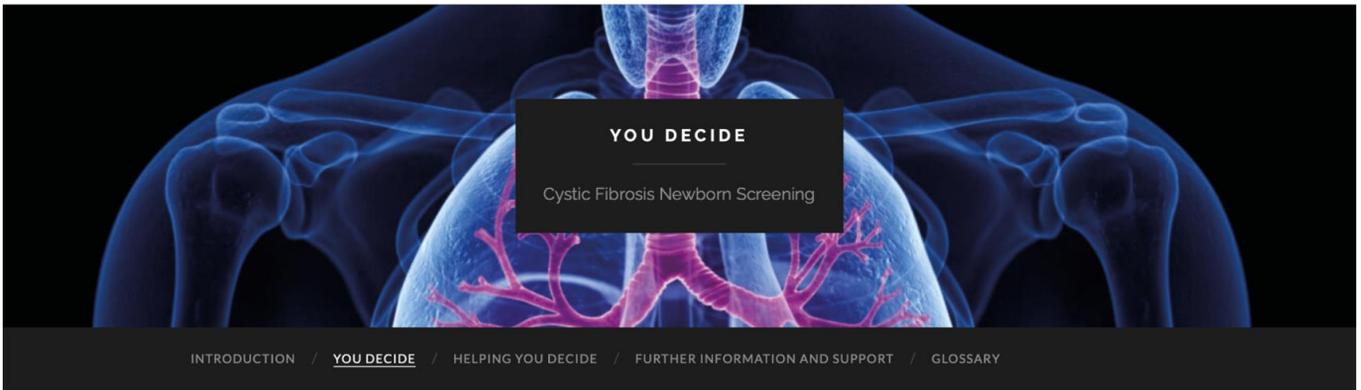
RESULTS

An open access online resource, ‘Cystic Fibrosis Newborn Screening: You Decide’, provides the ‘user’ (e.g. a parent, the general public, a healthcare professional) with an interactive presentation of the potential outcomes of extended genetic testing allowing them to visualise the impact upon families. A learning workbook explains key concepts and processes. The user is then presented with questions to collect their views on potential approaches to implementing extended genetic testing.

DISCUSSION

The resulting tool facilitates public engagement and understanding of complex healthcare concepts in child health. It intends to help people form considered views, and facilitate access to the perspectives of parents and the wider public on genetic testing that are otherwise difficult to obtain but are of importance to healthcare professionals and policy makers.

Continued



A Normal Newborn Screening R...
Experience 1

< Back

Proceed >

0:44 2:52

Watch this film to understand the experience of receiving a normal newborn screening result (cystic fibrosis not suspected).

2: Receiving a 'Cystic Fibrosis screen positive, inconclusive diagnosis' (CFSPID) designation.

Receiving a Cystic Fibrosis Scre...
Experience 2

< Back

Proceed >

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BACKGROUND

Childhood brain tumours are currently diagnosed using magnetic resonance imaging (MRI) followed by histopathological and molecular analysis of tumour specimens, often combining artificial intelligence (AI) based classification of methylation profiling, which may take several weeks in clinical practice. Advanced MRI combined with AI can help achieve an accurate molecular diagnosis, prior to tissue analysis, supporting early clinical decision making, but the quantitative tools are not available to radiologists.

AIMS

To develop a clinical decision support system with machine learning that can support clinicians/radiologists interpret advanced MRI and provide accurate rapid diagnosis of tumours.

METHODS

The Medical Image Region Of interest analysis tool and Repository (MIROR) tool builds data from the CCLG Functional Imaging of Tumours database, to create a reference repository of conventional MR imaging, perfusion weighted MR imaging, diffusion weighted MR imaging and single-voxel MR spectroscopy of the main paediatric brain tumour types and subtypes. A graphic user interface has been developed to allow viewing and analysis of advanced imaging, including a range of semi-automated classification tools to generate a final report.

RESULTS

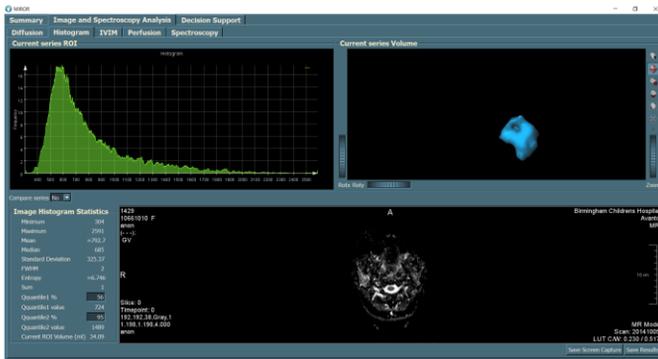
The available features of MIROR have included data importing, visualisation and image analysis, spectroscopy quantification, and brain tumour type identification through machine learning. The repository of MIROR has included 377 childhood brain tumour cases which have at least one functional imaging modality available currently. MIROR has been developed into a fully independent software package that can run on hospital computers (Figure 1).

DISCUSSION

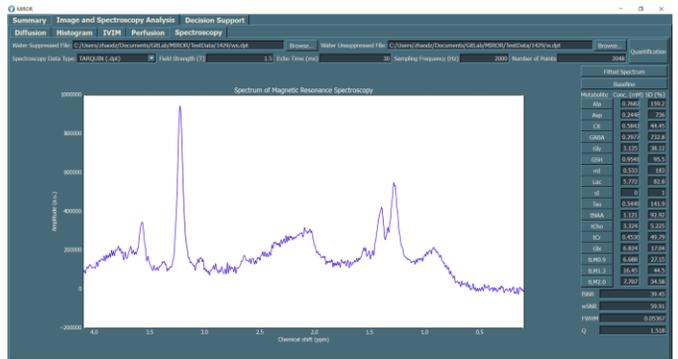
MIROR has initially been developed as a practical decision support system in clinical scenarios for brain tumour diagnosis with key features of image analysis and classification. Future work includes completing the features to all advanced MRI modalities, further expanding the repository and designing prospective clinical studies to assess the accuracy and added clinical value of MIROR for brain tumour diagnosis.

Continued

A. Diffusion Weighted MR Imaging



B. MR Spectroscopy



C. Visualisation



D. Semi-Automatic Classification



MIROR performing multi-modal MR imaging and spectroscopy analysis

07 JAMES LIND ALLIANCE PRIORITY SETTING PARTNERSHIP: DIGITAL TECHNOLOGY FOR ADOLESCENTS AND YOUNG PERSONS WITH IBD

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BACKGROUND

Researchers may not be fully aware of the issues and uncertainties that matter most to patients and their families. Priority Setting Partnerships (PSP) using the James Lind Alliance (JLA) methodology, bring together health professionals, patients, and parents/carers to identify and prioritise unanswered questions that can be addressed by future research projects.

AIMS

Identify and prioritise the top 10 unanswered research questions in digital technology for adolescents and young people (AYP) with inflammatory bowel disease (IBD).

METHODS

A steering group (SG) consisting of AYP with IBD, their parents/carers, representatives from Chron's and Colitis UK and Crohn's in Childhood Research Association charities and patient information forum, and paediatric and adult and primary care healthcare professionals was established in 2021 to oversee all aspects of the PSP, and establish the protocol and scope of the PSP. All SG meetings were chaired by a JLA advisor and followed the established JLA methodology.

RESULTS

413 in scope questions were gathered on the initial survey and later thematically categorised into 10 themes and consolidated into 92 summary questions by the SG. A comprehensive review of the literature and further SG deliberation narrowed the unanswered summary questions to 45, which then went on to the interim prioritising survey. 102 respondents were asked to rank their top 10 research questions, and the results gathered were used to identify the top 18 research priorities to be taken on to the final prioritisation workshop. The virtual workshop, facilitated by the JLA advisors and attended by key stakeholders, resulted in the determination of the top 10 research priorities.

DISCUSSION

The top 10 research priorities will encourage interested researchers to undertake research that addresses these areas of unmet need for AYP living with IBD, their parents/carers and their healthcare professionals, thereby facilitating improved patient care and outcomes in the longer term.

SOUNDFIELDS : A VIRTUAL REALITY HOME-BASED INTERVENTION FOR AUDITORY HYPERSENSITIVITY EXPERIENCED BY AUTISTIC CHILDREN

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BACKGROUND

Many autistic children experience sound hypersensitivity, meaning they may find ordinary everyday sounds distressing. This could lead to them avoiding specific places or situations and may result in them displaying what appears to be aggressive or self-harming behaviours.

AIMS

This study aimed to develop a possible solution to help autistic children with sound hypersensitivity become more accustomed to those sounds they otherwise find distressing. 'SoundFields' plays a range of sounds that would usually cause distress, while pairing them with reward during a fun, virtual reality (VR) game. It has previously been used by autistic children and was found to be helpful in reducing sound-associated anxieties.

METHODS

We worked with autistic children, their parents, and professionals to select the sounds and make improvements. Additionally, seven children took part in our 10-week feasibility study, during which they played the SoundFields game weekly for 30 minutes each time. Participants completed a questionnaire rating how they felt about specific sounds using emojis at the start and end of the 10 weeks. We also spoke to the children and parents about how they felt about the games and whether it helped reduce their sound hypersensitivity.

RESULTS

Based on the questionnaire, five children stated that they felt better about the sounds they heard during the game. However, two children reported that they felt worse about the sounds. We also discovered that the children taking part in our study preferred to listen to the sounds for longer, but at a quieter level. They reported to us that overall, they enjoyed playing the games but there were some technical issues that need fixing and that playing for a shorter time would be better.

DISCUSSION

VR is a new approach to delivering therapy targeting sound hypersensitivity and these results provide initial support for SoundFields as a home-based intervention.

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Non-invasive ventilation (NIV) is assisted respiratory support delivered via facemask for people with chronic respiratory failure. Commercial NIV masks are available but masks that fit well are difficult to find for children who have small or asymmetrical facial features. Compromised ventilation can have significant health and quality of life impacts for patients and their families.

Previous development of 3D printed custom-made masks to improve comfort, fit and performance of NIV for children revealed that in 45% mask-fit was compromised by poorly-fitting headgear (Willox 2020). Parents report that headgear is of “paramount” importance for mask-fit.

Design concepts and materials for a custom-made modular headgear were refined using patient and parent/carer feedback until a final prototype was reached. The custom-made headgear was evaluated against a comparator mass manufactured stock headgear using adult volunteers using pre-set levels of headgear strap tension (100g, 200g and 300g). Air leak was demonstrated using leak data from a Nippy Junior Plus ventilator and pressure was measured using a Tekscan F-Socket 9811 pressure sensor array.

Air leak measurements at medium tension (200g) were 82 l/min for custom mask/custom headgear, 69 l/min for stock mask/custom headgear and 79 l/min for stock mask/stock headgear. Pressure readings at the nasal bridge at medium load (200g) were 86 g/cm² for custom mask/custom headgear, 53g/cm² for stock mask/custom headgear and 123 g/cm² for stock mask/stock headgear.

At medium tension, a stock mask with customised headgear was the optimum combination. 3D printing of silicon is in its infancy therefore 3D custom-made mask technology is evolving; however implementation of custom-made headgear may result in significant patient benefit.

Willox M, Elphick HE et al. Custom-made 3D printed masks for children using non-invasive ventilation: a feasibility study of production method and testing of outcomes in adult volunteers. *J Med Eng Technol.* 2020 Jul;44(5):213-223.

BACKGROUND

In response to market failure in child prosthetics, the NIHR formed Starworks. Starworks ran multi-stakeholder events across the UK and identified the following R&D priorities: Adaptive, flexible, and self-tuning prostheses that respond to growth. Improved articulating joints and new material technologies. Age, weight, and gender matched prostheses of appropriate weights.

AIMS

The aim of the Rebel hand project is to deliver a small, lightweight multi-functional prosthesis that can adapt to children's growth via modular componentry. The project aims to introduce a new levels of personalisation of function, by creating a hand that can use any number of muscle sites for control.

METHODS

We have conducted early PPI work to obtain information on optimal chassis and finger sizes. Novel motor systems have been designed to reduce weight while retaining almost all the functionality of an adult device. A new digital electrode system has been developed enabling low-cost AI enabled control.

RESULTS

We have developed a chassis, a novel two speed motor for finger actuation, and prototyped fingers with novel joints that minimise any possibility of any unintended pinching. Our current design is very low weight and we are actively working with children to ensure this requirement is met. All our components are modular and allow for periodic resizing as the child grows.

DISCUSSION

The Rebel hand is a commercial product which aims to deliver state-of-the-art prosthetic hands to children at a very early age. Our goal is to create a hand equal to, and where possible better, than adult devices. We believe this approach will raise standards across upper-limb prosthetics as new users come to expect higher standards earlier in life.



L to R: a hand chassis prototype from early PPI work, chassis relative to a bionic small, current Rebel hand design.

BACKGROUND

Patient and public involvement and engagement (PPIE) in healthcare-related design projects is a critical component of developing effective, appropriate and desirable outcomes, but in many cases involving children and their families in the design process is far from inclusive, equitable, creative or responsible.

AIMS

Four research questions are explored before unveiling a framework to propel Inclusive, Creative, Equitable, and Responsible (ICER) participation in child health technology design: (RQ1) Who is included in 'patients and the public' in healthcare projects? (RQ2) What are the best interdisciplinary practices and state-of-the-art knowledge for involving them in MedTech design? (RQ3) What existing tools and frameworks support equality, diversity, and inclusion in MedTech research, and what are their limitations and benefits? (RQ4) What are the current strengths, weaknesses, opportunities, and threats in inclusion and involvement of patients and families, and equality, diversity, and inclusion practices?

METHODS

A literature review investigated RQ1-4, covering methodologies and frameworks from diverse disciplines to uncover cutting-edge practices and knowledge. A case study of MedTech device design for CYP provided real-world context.

RESULTS

The review emphasised the importance of defining 'patients and the public' broadly, ensuring diverse representation and avoiding inappropriate or tokenistic involvement; each has distinct knowledge, experiences, needs, and desires, requiring different approaches. The catch-all term PPI/PPIE should be differentiated based on carefully considered purposes and objectives for meaningful involvement with the stakeholders separately. Best practices highlight child-centred approaches, safeguarding rights, and design justice principles. Existing tools and frameworks show progress but have limitations: limited access to participation and the need for inclusive environments. Findings from the review and case study were synthesised into an ICER Participant Recruitment and Engagement Framework.

DISCUSSION

The proposed framework advances inclusive, equitable, and creative participation in child health technology design by addressing limitations, emphasising diverse representation, and incorporating child-centred approaches and design justice principles.

12

PROGRESSING DYNAMIC DIAGNOSIS OF INDUCIBLE LARYNGEAL OBSTRUCTION IN CHILDREN

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BACKGROUND

Inducible laryngeal obstruction (ILO) causes severe breathlessness affecting a child's quality of life, social functioning, and educational achievement.

ILO is ideally diagnosed through continuous laryngoscopy with exercise (CLE) but there is currently no paediatric specific equipment available to do this.

AIMS

To develop an effective and acceptable method for holding a laryngoscope in the nose of a child whilst exercising, plus the refinement of a vest design for mounting the laryngoscope securely on the body.

METHODS

A collaboration of clinicians, young people, designers, and engineers from 3 leading NHS and HEE institutions engaged in a co-design process to progress early design concepts for a device to hold a laryngoscopy in place in the nose whilst exercising into a working prototype that could be tested.

RESULTS

A number of design iterations took place following input from patients, and clinicians locally, nationally and internationally. Additional design developments to the vest garment enabled both elements of the CLEKit system to be successfully tested with an adult volunteer.

DISCUSSION

CLEKit was able to hold a laryngoscope in place during running on a tread mill and the view of the upper airway was maintained at all times. The equipment is reported to have been comfortable and secure. Future design iterations were identified to enable CLEKit to better accommodate laryngoscopes with a Bluetooth module which will enable patient testing to be performed outside of the laboratory environment.

Accurate diagnosis using the new device will enable rapid access to treatment, remove the risk of unnecessary and harmful medications and improve quality of life.



Figure 1 - Device testing with an adult volunteer

Gopala Krishnan

Inditech Technology Services Pvt Ltd, Navi Mumbai, India

The pediatric healthcare landscape in India suffers from poor early detection rates and inadequate timely referrals for both rare and common ailments among children. Addressing this problem requires a patient-centric and doctor-facilitated approach.

Inditech has innovatively leveraged the reach and marketing resources of pharma brands to deploy a localized solution tailored to enhance early detection capabilities in pediatric clinics.

Inditech's system introduces trackers, administered by doctors to their patients, which are in local language. When any unusual symptoms are reported, red flag alerts are generated and sent in a report to the doctor.

To tackle technology adoption challenges, the system is WhatsApp-based, thus simplifying workflows for both the doctor and the patient. Moreover, the system enhances the relevance of professional education by offering practical, at-a-glance education for the doctor on the significance of the red flag and the differentiated diagnosis approach, along with patient education videos in local language, to ensure compliance and timely intervention.

Since launch in early 2023, several leading pharma brands have partnered with Inditech, which will ensure the system's distribution to thousands of doctors by the pharma field teams.

The solution's potential is underscored by Inditech's position as the exclusive digital professional education partner of the Indian Academy of Pediatrics, thereby ensuring toptier, academy compliant education.

14 CREATION OF A PATIENT ADVISORY BOARD TO CO-DESIGN A DTx FOR PAIN IN PEDIATRIC ONCOLOGY

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BACKGROUND

NEN has been founded to help kids with cancer, their families and HCPs with pain management. NEN is a Digital Therapeutics (DTx) solution based on gamified cognitive behavioral therapy (CBT). It offers a novel mission-driven approach to address pain management through play to modulate pain and improve their overall wellbeing.

AIMS

We are taking an evidence-based approach to bring patient-centric care to the pediatric oncology population that is designed and clinically validated especially for children.

METHODS

In order to design and develop a patient/parents centric digital health tool a kids/parent's advisory board has been established as part of a research collaboration with Sant Joan de Deu to involve the parents and kids in the co-design process of NEN. These provide feedback along the different stages of the development phases and final clinical ready platform.

RESULTS

We have analyzed the feedback from 21 parents and 30 children from 7-12 years old to inform our design and functionalities. The parents overwhelmingly appreciated the functionalities presented and suggested including more PROs with both parent and patient applications to vet that their assessment and their child's assessment of mood and pain are aligned.

DISCUSSION

Almost 500,000 children will be diagnosed with cancer this year and nearly all of them will experience pain. Pain management in children remains an enormous unmet medical need that is not currently served by current practices. Despite the significant burden of pediatric pain, very few digital solutions are built specifically for kids. Novel approaches to manage and modulate pain designed for kids are required to address the psychological aspects of pain. This exercise validated the need for a DTx that delivers CBT for children in pain and will serve to democratize access to much needed psychological interventions around pain and mood management.

15 STAKEHOLDERS' PERSPECTIVES ON ROBOTS FOR SAFEGUARDING

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BACKGROUND

Children may consider socially assistive robots as social peers, sometimes disclosing sensitive information that they might not be comfortable sharing with someone else.

AIMS

This project aims to investigate subject matter experts' (SMEs) perspectives on robots as part of the safeguarding team for proactive reporting about instances relating to children's wellbeing. The objective of this research is to explore the robot's responsibility when the child discloses information that potentially puts the child's wellbeing at risk.

METHODS

We interviewed SMEs based in the United States or the United Kingdom who have extensive experience with children, robots and/or child-related technology. These include (i) academics working in child-robot interaction, (ii) academics working in child psychology, and (iii) industry experts working with child technology.

RESULTS

The SMEs explored a range of specific examples and broader themes concerning their prior experiences and research with children, especially from the standpoint of safeguarding. The experts acknowledge that robots could serve as great recording devices; however, they do not believe that the task of reporting child abuse is one that can be parsed by a robot today. Experts also explored the possibility of using robots to alert trained humans by identifying potential "red flags".

DISCUSSION

The experts believe that the task of reporting child abuse by robots is not just restricted due to the technical abilities of the robot but also the legislation and guidelines concerning child abuse and the use of technology. We have also observed that there was a perceptible mismatch of morals among the different SMEs (corporations developing commercial products, law enforcement, and roboticists). Overall, they recognize that the task of recognizing child abuse is community-specific and contextual. We further detail the moral and logistical questions raised by SMEs as these technologies continue to be used in children's spaces.

16 USING SOCIAL ROBOTS TO PROMOTE THE AUTONOMY OF ADOLESCENTS WITH AUTISTIC SPECTRUM DISORDER

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BACKGROUND

Developing self-care capabilities is essential for becoming autonomous in other areas of life, so this should be a communitarian goal. It follows that autonomy is fostered in caring relationships where adolescents develop capabilities by exerting them, and therefore technological artifacts are embedded in a net of relationships constituted by the adolescent, his family, professionals, legislation, personal interests, values and meanings.

AIMS

Provided that existent social robots have been mainly developed for adolescents diagnosed with ASD up to 11 years old, the main aim was to analyze if and how social robots can also be a suitable tool for promoting autonomy after 11 years old.

METHODS

After developing the theoretical framework from Latour's ANT, the fieldwork comprised a PPIE process including 2 workshops with 6 autistic adolescents from 14 to 17 years old from a Special Education School in Barcelona, and 9 semi-structured interviews with engineers, computer scientists, research nurses, child psychologists, psych-pedagogues and design researchers & product designers from Barcelona and Sheffield.

RESULTS

1) Autonomy and wellbeing are both defined in terms of emotions management and social relationships fostering, 2) the process of robot design should be interdisciplinary and adolescents should have a say, 3) social robots should only be used as a transition tool to improve human interaction, because otherwise they could create dependency and 4) the adolescent-robot interaction for autonomy promotion can be defined as a 4-phase process including: engagement, interaction, skills achievement and extrapolation.

DISCUSSION

Social robots have benefits and potential in the field of autonomy development of autistic adolescents up to 15 years-old, but more research is needed to ensure that both human emotions and traits of autistic adolescents are not too simplified in the robot design, which could lead to either the robot being counterproductive or to the adolescent being stigmatized.

Richard Moore

Sheffield Hallam University, Sheffield, UK

BACKGROUND

This project employed a theory-based approach to co-design a conversational agent aimed at supporting adolescents in overcoming barriers to physical activity and fostering the development of healthy behaviours.

AIMS

The main objectives of the project were to develop a prototype conversational agent that was evidence-based and theory-informed. The chatbot aimed to identify barriers to physical activity through natural language input, provide evidence-based solutions, and incorporate a persona that could establish a relational and persuasive connection with adolescents.

METHODS

The project followed a systematic approach that involved identifying barriers to physical activity by gathering input from over 100,000 adolescents. A Natural Language Understanding model was developed based on this input. Additionally, a Theoretical Framework was created to guide the design and development of the chatbot. The framework integrated existing theories, including the COM-B model, Theoretical Domains Framework, and Behaviour Change Taxonomy, to map barriers and evidence-based solutions. The prototype chatbot was co-designed with the input of 9 young people. Subsequently, the chatbot was developed and evaluated with a sample of 50 adolescents.

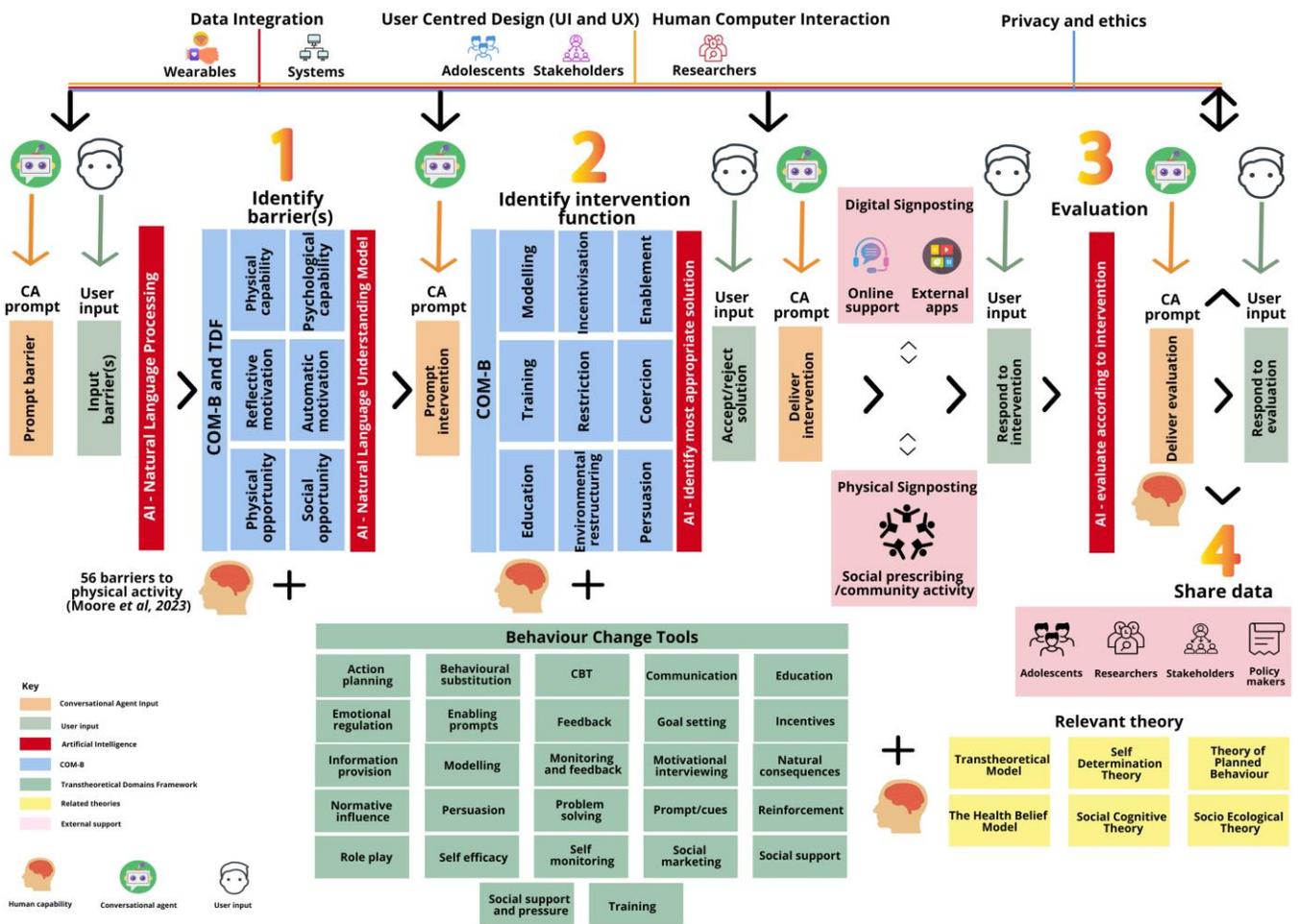
RESULTS

The results showed positive outcomes in terms of the chatbot's acceptability, usability, and its impact on adolescents' confidence and motivation to participate in physical activity.

DISCUSSION

The findings from the prototype demonstrate the promising potential of conversational AI in understanding relevant barriers and providing solutions to health-related concerns. The method and Theoretical Framework holds promise for guiding the development of future health-related conversational AI solutions.

Continued



BACKGROUND

Children and young people (C&YP), families and professionals fed back that mental health services and resources were not accessible, it felt confusing and when in the system it was hard to navigate and get support.

AIMS

Our vision was to provide children and young people's mental health services via an integrated web-based platform, which would digitally innovate and transform the services offered across the 3 clinical commissioning groups.

METHODS

We wanted to streamline the process and make the user journey as easy as possible. We utilised an open-innovation framework and user-centred design processes. A web-based platform (www.seftonliverpoolcamhs.com) has been created bringing together a single point of access utilising one digital referral form, which supports the C&YP to the right service at the right time, as well as providing a friendly user interface that provides support and resources, for C&YP families and professionals.

RESULTS

Automation of the processing of referrals received reduces the number of referrals processed manually. We have estimated that this process can release 1,638 hours per year of admin time. In 2022, around 400 referrals were redirected to a 3rd sector partner. Reducing the time, it takes for a patient to be seen by the service that is right for them and decreasing the time it takes for them to get the proper treatment. The platform led to an increase of 7.48% in patients receiving treatment within two weeks of referral, exceeding the government's goal of a four-week waiting time for treatment. The platform has seen a 79% increase across self and parent referrals.

DISCUSSION

This platform has digitally innovated and transformed how children and young people's mental health services are offered across our region. It has allowed a single point of access with a consistent sole digital referral form for referees.

Table 1: Web-based platform iterations defined by user research types

Paper prototype v1 (Focus Group)				
	Participant	User type	Number	Date
	AH CAMHS	Professional	5	13/03/2020
	Bemando's	Professional	4	19/03/2020
NHS Prototyping Kit v2 (1-1 Interviews)				
	Participant	User type	Prof subset	Date
	a	Professional	YPAS	08/04/2020
	b	Professional	YPAS	14/04/2020
	c	Professional	GP	15/04/2020
	d	Professional	GP	15/04/2020
NHS Prototyping Kit v3 (1-1 Interviews)				
	Participant	User type	Prof subset	Date
	e	Professional	AH CAMHS	12/05/2020
	f	Professional	AH CAMHS	12/05/2020
	g	CYP	NA	28/05/2020
	h	Parent	NA	30/06/2020
	i	CYP	NA	30/06/2020
	j	Parent	NA	01/07/2020
	k	Parent	NA	01/07/2020
	l	Parent	NA	03/07/2020
	m	Parent	NA	07/07/2020
	n	Parent	NA	07/07/2020
Mindwave 1 v4 (workshop)				
	Participant	User type	Number	Date
	YPAS Sky Group	CYP	5	01/11/2020
	YPAS Parent Coffee	Parents	6	11/11/2020
	Fresh Plus Group	parents	7	17/11/2020
	YP Forum	CYP	6	18/11/2020
Mindwave 2 v5 (focus groups)				
	Participant	User type	Number	Date
	Professionals drop in	Professionals	12	16/02/2021
	YPAS Ambassador	CYP	6	17/02/2021
	Professionals drop in	Professionals	9	17/02/2021
	Fresh Plus Group	Parents	5	22/02/2021
	Camhelions workshop	CYP	5	22/02/2021
	Sefton Parent Care Forum	Parents	7	24/02/2021
	Fresh CAMHS	CYP	2	24/02/2021

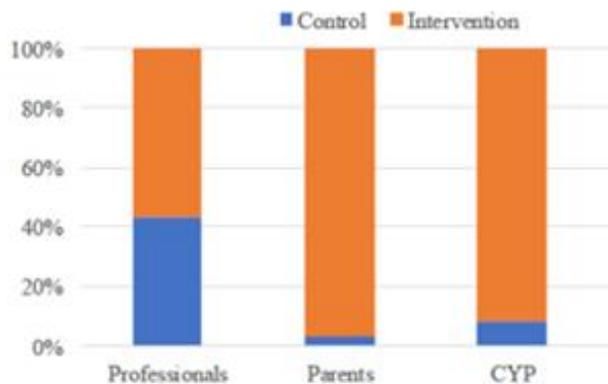


Figure 1 – Referral to CAMHS by referee between Control (pre platform) and Intervention (post platform)

19 CO-DESIGNING THE IMAGINATION: EXPLORING CULTURAL IMAGINARIES OF ROBOTS WITH CHILDREN WITH BRITTLE BONES

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BACKGROUND

This empirical study addresses the gap of including children with brittle bones in the Participatory Design (the active involvement of end users in the design of products/services they use ('PD')) of robots and assistive technology. It will deploy a range of creative methods to produce better outcomes for all stakeholders, using storytelling to foster children's inclusion in the development of, and engagement with, healthcare technologies.

AIMS

The study will address the following research questions:

How can PD be leveraged for future development of robots and assistive technology, with focus on children's empowerment?

How can the symbiotic relationship between popular culture and real-life technology advancements be acknowledged within the Participatory Design process?

METHODS

Over several PD workshops, families will interact with robots often used to alleviate anxiety during hospital stays and co-write stories to share how they imagine such technology could play a role in their future. A "robot home visit" will enable families to consider how robots might fit into their daily lives. The stories will undergo reflexive Thematic Analysis to interpret their meanings. Sliding scales will be used to evaluate families' responses to the robots and to the PD process itself as it unfolds.

RESULTS

The study has recently obtained full NHS ethics approval. Workshops are planned for Autumn 2023 and initial results will be available at the time of presentation.

DISCUSSION

It is expected that the co-produced PD methodology will support increased adoption of and successful outcomes arising from future child healthcare technology. Children are underrepresented in PD, and children with brittle bones particularly stand to benefit from robotic interventions, which currently underserve children regardless of dis/ability. This inclusion not only grounds developed products in the real-life needs and desires of its potential end users, but also centres children throughout the process..

BACKGROUND

Healthcare globally is looking to digitisation to help tackle quadruple priorities: improving patient experience, improving overall population health, reducing costs, and improving the experience for health workers. Progress is inevitably restricted by limitations in resources and funding. Therefore, Alder Hey Innovation in collaboration with Alder Hey Heart Centre have developed a clinically validated paediatric RPM (remote patient monitoring) platform, Little Hearts at Home®™.

AIMS

LHAH transforms existing post-operative pathways from a reactive approach to a proactive and preventative model. The platform aims to facilitate a safe early discharge, reduce emergency admissions, and reduce unnecessary readmissions.

METHODS

LHAH provides babies born with severe heart defects, such as single ventricle anatomy, with cross-organisational RPM, connecting patient, parents, community care providers, and clinical teams. Funded by NHS England, over the last 12 months, a team of paediatric cardiac specialists supported by an innovation team embedded within an NHS organisation, have used agile methodology and iterative testing to develop and implement LHAH successfully across the Northwest Congenital Heart Disease Network.

RESULTS

We have successfully onboarded >200 community nurses across the NW CHDN and currently monitoring 31 active patients on the platform. e.g., following a 6- months stay from birth at AH, patient X was able to go home to the Lake District (160-mile round trip) six weeks earlier than normal, in time for Christmas, with clinicians confident in monitoring their condition through LHAH platform. The early discharge has been estimated to have saved the Trust £101,000 in resources and allowed for another critically ill infant to utilise the bed space and clinical capacity reducing the waiting list.

DISCUSSION

The intent is using agile project management approach to establish LHAH, a paediatric focused RPM AH hosted platform, further developing and extending functionality into other specialities for AH and expanding into other health care providers.

BACKGROUND

Eczema affects 1 in 5 children in the United Kingdom. While there is no cure, certain licensed treatments act on underlying inflammation. Some of these treatments are administered by injection, and routine tests, including blood monitoring, also involve a needle. However, procedures involving a needle are among children's most feared, which may increase movement during administration. Redirecting attention away from the needle, through distraction, is widely documented to alleviate these problems.

AIMS

This project pilots the feasibility of a novel digital intervention, an augmented reality (AR) game, that promotes stillness during injection and provides positive reinforcement following successful administration.

METHODS

The game comprises a breathing exercise to calm the child prior to injection, a 'stay-still game' using in-built smartphone gyroscopes, and positive reinforcement for stillness in the form of unlocking additional gameplay. Fewer than 2 registered movements during the stillness activity is deemed a successful administration. The game is part of a wider patient support programme, and AR technology integrates into complementary educational materials including a printed comic book – telling a treatment-related story using the same characters, covering topics including treatment administration, presenting the injection as a treatment not a cure, and preparing the child for self-administration at the suitable age. Children (aged 6-17) prescribed the injectable after March 2021 were also provided with the complementary support materials.

RESULTS

Since initial dissemination, 176 unique users engaged in 422 separate gaming sessions. Average session duration was 7 minutes and 44 seconds, and >50% of sessions resulted in successful administration.

DISCUSSION

Anecdotal feedback and engagement data suggest that gamification is a feasible way to promote stillness during injections. Whilst this pilot demonstrates the potential to transform childhood injections into positive learning experiences, further evaluation is underway.

22 INNOVATION TO IMPACT: CATALYSTS, CHECKPOINTS, AND CHALLENGES IN DESIGNING MEDTECH FOR CHILDREN AND YOUNG PEOPLE

Cara Shaw, Farnaz Nickpour

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BACKGROUND

The design and commercialisation of MedTech, involves numerous drivers, motivators, requirements, and challenges. Understanding these aspects is crucial for developing effective and impactful solutions.

AIMS

This study explores the drivers and motivators for MedTech design and commercialisation, with a specific focus on AssistiveTech for Children and Young People (CYP). It also interrogates requirements and key milestones in the design and commercialisation process and addresses barriers and challenges faced in this domain.

METHODS

A comprehensive analysis was conducted, incorporating literature reviews, insights from a live real-world case study of MedTech design for CYP, case study reviews of MedTech design for CYP, and expert opinions. The research encompassed multiple disciplines, including healthcare, technology, and business, to gain a holistic understanding of the MedTech innovation landscape for CYP.

RESULTS

Key drivers for MedTech innovation and design include improving healthcare outcomes, enhancing quality of life, addressing specific unmet needs of CYP and leveraging technological advancements, all of which contribute to creating value in MedTech solutions. Key milestones in MedTech design and commercialisation encompass user-centred design, regulatory compliance, clinical validation, manufacturing scalability, market access, support infrastructure, and post-market surveillance. Successfully navigating these milestones facilitates the development of high-quality, safe, and commercially viable MedTech solutions. However, several challenges exist, including complex regulatory landscapes, complications around clinical validation, limited resources for R&D, market access barriers, and the incorporation of CYP-specific considerations in governance.

DISCUSSION

This paper highlights the importance of understanding the requirements and challenges in MedTech design regulatory processes and commercialisation. By addressing these aspects, stakeholders can more effectively foster innovation, overcome obstacles, and deliver impactful solutions that improve the lives of CYP and their families. Collaboration among healthcare professionals, researchers, regulators, industry partners, and end-users is essential to drive the successful design and development and adoption of MedTech for CYP

23 HYPERPOLARIZED XENON LUNG MRI IMPROVING CARE OF CHILDREN WITH RESPIRATORY DISEASE

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BACKGROUND

Hyperpolarized (HP) gas lung MRI (HPG-MRI) has increasingly been used in respiratory services in Sheffield to improve the care of paediatric patients.

AIMS

This presentation will aim to describe the multiple advantages HPG-MRI has over traditional methods of respiratory imaging, that have meant it has revolutionised and improved care of paediatric respiratory conditions.

METHODS

Patients are referred on the NHS pathway. HP 129Xe is manufactured via spin exchange optical pumping using a custom-built polariser under a MHRA specials licence. Patients are scanned using a 1.5T GE whole-body system and 129Xe transmit-receive RF coil. HP 129Xe ventilation images are acquired during a short breath-hold, analysed to calculate quantitative metrics and reported by a paediatric chest radiologist.

RESULTS

The figure shows HPG-MR images of a child with DNA fragility where detection of lung disease led to a significant change in her care.

HPG-MRI can detect early lung disease in chronic respiratory conditions where traditional methods like spirometry and Lung Clearance Index remain normal. This can lead to early intervention and improved outcomes.

Because of its lack radiation MRI can be used to diagnose lung conditions in patients with DNA fragility like Fanconi's anaemia and DNA ligase deficiency where ionising radiation is relatively contraindicated.

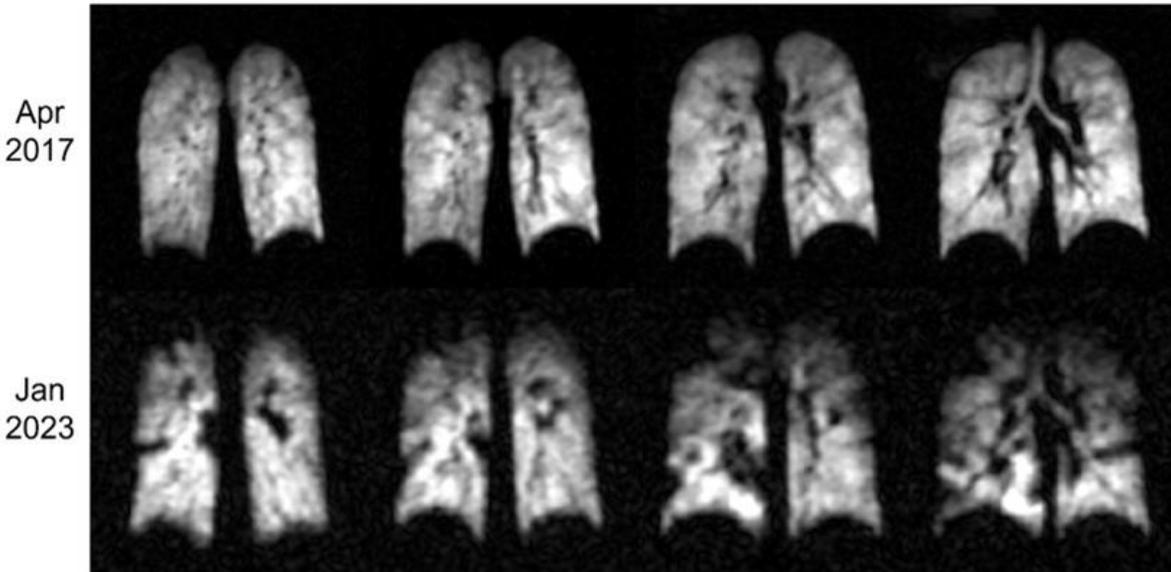
MRI can be used rapidly and because of lack of radiation can be used multiple times. This makes it ideal to track changes in lung ventilation with therapeutic interventions like intravenous antibiotics, inhaled treatments, respiratory physiotherapy, exercise therapy and to monitor lung health over time.

DISCUSSION

MRI is an evolving lung imaging modality, combining functional and morphological information in three dimensions.

Presented case series and vignettes will demonstrate that HPG-MRI detects disease early, is sensitive to disease progression and improvement and provides safe sensitive monitoring of response to therapy and interventions.

Continued



Figure; HPG-MR images acquired in (top) April 2017 with ventilation defect percent = 0.3% and (bottom) in January 2023 with ventilation defect percent = 8.4% in a child with a condition with DNA fragility who has been monitored with HPG-MRI. Detection of lung disease in her 2023 images has led to a significant change in her care. This diagnosis would have been difficult in the past due to CT scan being relatively contraindicated in her underlying condition due to risks associated with ionising radiation

24 THE I-FACTOR PROGRAMME, A PRACTICAL IMPLEMENTATION OF NHS INNOVATION WITHIN A TERTIARY CHILDREN'S HOSPITAL

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BACKGROUND

In 2023, Alder Hey Children's Hospital launched I-Factor programme, an initiative to encourage staff members to contribute creative solutions to local healthcare challenges, with a focus on early-stage innovations and employing a unique framework that blends design thinking with traditional MedTech methodology.

AIMS

I-Factor aims to encourage intrapreneurship to improve care and well-being for children and young people. Its primary goal is to empower staff to transform ideas into tangible solutions, targeting disease prevention, reducing healthcare inequalities, and fostering an innovation culture to enrich staff experience and optimise resources.

METHODS

Staff engagement used posters, screen savers, interactions, and emails. An open workshop introduced the departmental framework and innovation pipeline. Ideas were sent to a specialised triage team through an online portal. During triage, projects were evaluated on originality, impact, feasibility, and presentation.

RESULTS

Engagement across 4 departments and 30 sub-specialties led to a threefold increase in idea submissions in Q4 compared to Q1 2022. The projects include AI solutions, medical devices, and digital biomarkers. A pre-programme survey highlighted the need for healthcare innovation and staff readiness, despite limited innovation opportunities. A post-programme evaluation will be performed to measure changes in staff confidence. Several high-impact projects stood out (Fig. 1), with three selected for internal funding. At the time of writing, these are in development, with a demo to regional investors scheduled after six months.

DISCUSSION

The I-Factor programme offers an implementable service to empower local healthcare staff to drive improvements in underserved patient groups. Further work is being undertaken to evaluate the impact on staff confidence and commercial viability.

Continued

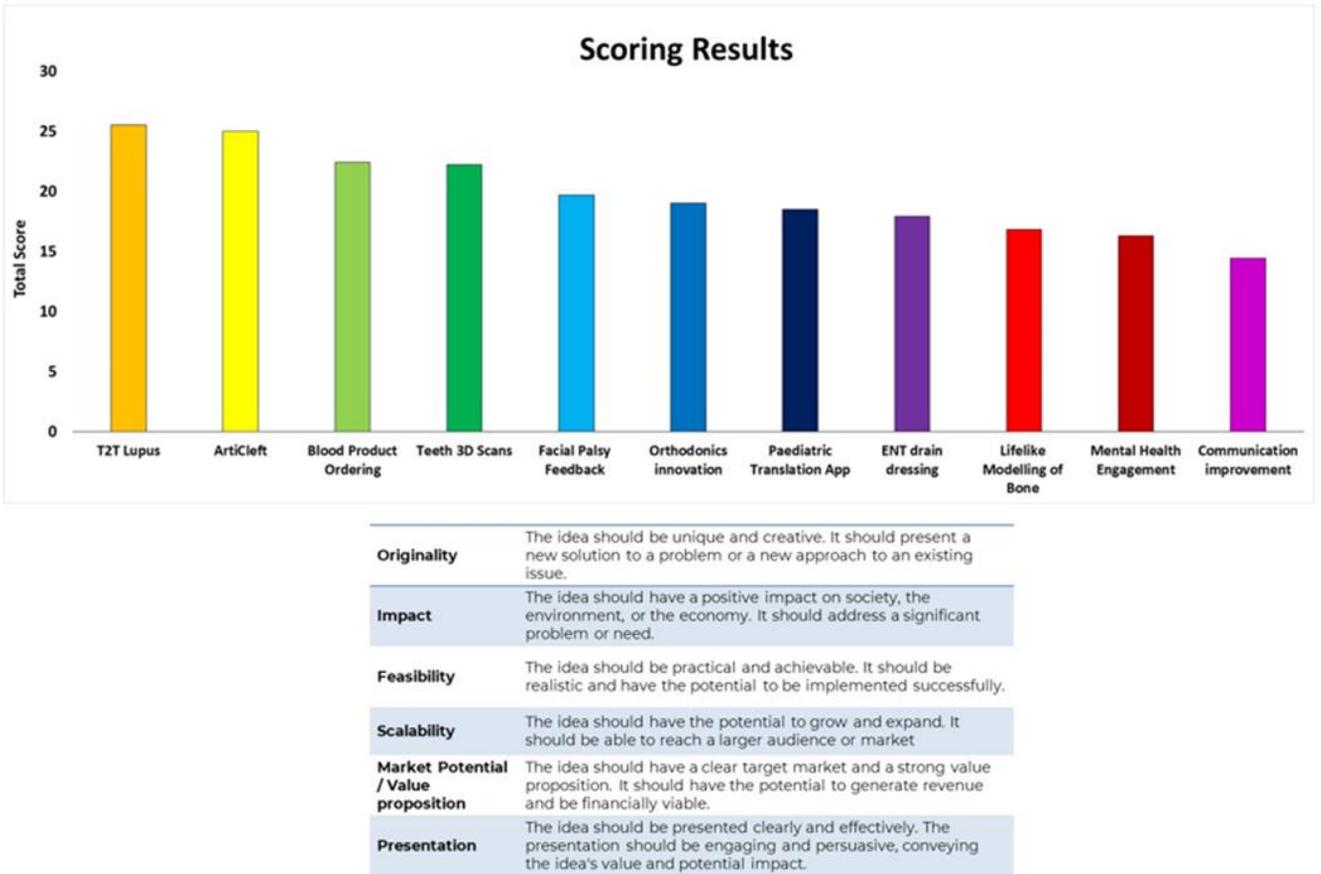


Figure 1: Submissions were scored on originality, impact, feasibility, scalability, market potential, and presentation quality. The top 3 were prioritised for the next stage.



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