Public Empowerment through Patient Inspired Innovation

The NIHR Brain Injury Healthcare Technology Co-operative is delivered in partnership between Cambridge University Hospitals NHS Foundation Trust and University of Cambridge
What is the NIHR Brain Injury Healthcare Technology Co-operative (HTC)?

The NIHR Brain Injury HTC (www.brainhtc.org) is dedicated to identifying areas of unmet need susceptible to a technology-based solution amongst patients of all ages with Traumatic (TBI), Acquired (ABI) or Developed (DBI) Brain Injury. Essentially, the NIHR Brain Injury HTC provides a ‘go-to’ centre of expertise for understanding care pathways including:

- Acute Care
- Multimodality bedside monitoring
- Intracranial dynamics
- Functional Neuroimaging
- Neuro-oncology
- Neurorehabilitation
- Cognition
- Neural Engineering, stem cells and Neurodegeneration
- Neurodevelopmental and neuropsychiatry
- Clinical informatics
- Paediatrics

The HTC works with patients, carers, NHS, charities, academia, inventors, SME’s and business angels to support the development of new medical devices and healthcare technologies improving the effectiveness and quality of healthcare services encompassing:

- Market evaluation
- Clinical research networks
- Innovation pathways
- Funding landscape
- Regulatory frameworks
- Public and patient involvement
- Patient-centred design
- Early phase evaluation

Care pathway
The NIHR Brain Injury HTC ‘Innovations Small Funding Competition 2014-15’ has seed funded 9 national projects. Each of these projects addresses the unmet needs that have been identified through the various methodologies with a ‘Strategic Roadmapping’ programme explored by the Brain Injury HTC.
Clinical Director (Honorary)
Professor John Pickard FRCS FMedSci is Professor (Emeritus) of Neurosurgery in the Department of Clinical Neurosciences of University of Cambridge. He is the honorary director of the National Institute for Health Research’s Healthcare Technology Cooperative (HTC) for brain injury. His research focuses on advancing the care of patients with acute brain injury, hydrocephalus and prolonged disorders of consciousness through functional brain imaging, studies of pathophysiology and new treatments as well as focusing on health, economic and ethical aspects.

John has championed the growth of the HTC portfolio by working with patients and their carers to identify unmet needs in the brain injury pathway, catalyzing NHS pull by targeting industry engagement, and building collaborations that utilise expert networks and world leading clinical communities.

NEUROREHABILITATION & MEDICAL DEVICE DEVELOPMENT WORKSTREAM

Neurorehabilitation Lead
Professor Val Pomeroy is a Professor of Neurorehabilitation and Associate Director of Research for the School of Health Sciences, University of East Anglia. Her portfolio of research in stroke rehabilitation focuses translating the underlying mechanisms of movement control recovery to inform the content of rehabilitation interventions in clinical trials.

Medical Device Development Lead
Dr. Peter Jarritt is the Deputy Director of the Brain Injury HTC. He is currently undertaking projects with Health Education East of England and The Academy for Healthcare Science. He previously held appointments as: Clinical Director of Medical Physics and Clinical Engineering at Addenbrooke’s Hospital; Lead Scientist for the EoE Strategic Health Authority; Chief Executive, Northern Ireland Regional Medical Physics Agency; Honorary Professor, Queen’s University Belfast; Scientific Director, Northern Ireland PET Institute. Lecturer and Senior Lecturer at the Institute of Nuclear Medicine, UCL.
Clinical Director (Honorary)

Professor John Pickard FRCS FMedSci is Professor (Emeritus) of Neurosurgery in the Department of Clinical Neurosciences of University of Cambridge. He is the honorary director of the National Institute for Health Research's Healthcare Technology Cooperative (HTC) for brain injury. His research focuses on advancing the care of patients with acute brain injury, hydrocephalus and prolonged disorders of consciousness through functional brain imaging, studies of pathophysiology and new treatments as well as focusing on health, economic and ethical aspects. John has championed the growth of the HTC portfolio by working with patients and their carers to identify unmet needs in the brain injury pathway, catalyzing NHS pull by targeting industry engagement, and building collaborations that utilise expert networks and world leading clinical communities.

NEUROREHABILITATION & MEDICAL DEVICE DEVELOPMENT WORKSTREAM

Neurorehabilitation Lead

Professor Val Pomeroy is a Professor of Neurorehabilitation and Associate Director of Research for the School of Health Sciences, University of East Anglia. Her portfolio of research in stroke rehabilitation focuses translating the underlying mechanisms of movement control recovery to inform the content of rehabilitation interventions in clinical trials.

Medical Device Development Lead

Dr. Peter Jarritt is the Deputy Director of the Brain Injury HTC. He is currently undertaking projects with Health Education East of England and The Academy for Healthcare Science. He previously held appointments as: Clinical Director of Medical Physics and Clinical Engineering at Addenbrooke's Hospital; Lead Scientist for the EoE Strategic Health Authority; Chief Executive, Northern Ireland Regional Medical Physics Agency; Honorary Professor, Queen's University Belfast; Scientific Director, Northern Ireland PET Institute. Lecturer and Senior Lecturer at the Institute of Nuclear Medicine, UCL.

SUPPORTED PROJECTS

Contracture and Spasticity Management using ORLAU Standing Frame

Mr. Andrew Roberts, Mr. Keith Miller, Professor Anand Pandyan and Mr. William Bromwich

Brain Injury is frequently accompanied by the development of lower joint limb deformities as a result of weakness and spasticity (muscle over activity). As a result of weakness patients are often unable to move and the excessive muscle activity leads to joints locking in a fixed position causing joint deformities called contractures.

Contractures frequently occur in the lower-limbs. Standing frames are commonly used to prevent contractures and reduce their magnitude once developed. The efficacy of short-term vibratory stimuli has been demonstrated in treating contractures and spasticity in cerebral palsy, stroke and spinal cord injury. This study aims to study the effects of integrating vibratory stimulus into the commonly used ORLAU standing frame stimulating the lower limb skeleton and muscles.

Multidisciplinary Computer-Based Motor and Language Therapy for Acquired Brain Injury

Dr. Holly Robson

A stroke or a brain injury can damage any part of the brain, leading to a wide range of different possible symptoms. When the damage affects parts of the left frontal and parietal lobes people can experience problems with moving their arms and hands as well as finding their words. Although these difficulties often co-occur, they are treated separately by physiotherapists, occupational therapists and speech and language therapists. This NIHR HTC project aims to create a new therapy which combines aspects of physiotherapy and speech and language therapy. The Motor and Language Training programme uses motion sensor technology to help individuals with brain injury and stroke practice their arm and hand movement at the same time as practicing their language skills. Those who have tried the programme describe it as fun and motivating and it is hoped it will increase the amount of rehabilitation therapy that patients receive.
Tablet-based App Development for Upper-Limb Stroke Rehabilitation
Dr. Sheree McCormick
Mental training techniques such as action observation and motor imagery have the potential to improve stroke recovery when combined with physical therapies. Action Therapy is a self-directed, iPad-based application that provides stroke survivors with the opportunity to mentally and physically practice upper-limb movements of daily living in a structured manner. Using evolving technology, the therapy promotes motor function, supports independence, expands rehabilitation and improves quality of life. A recent feasibility study found that Action Therapy was acceptable to community dwelling stroke survivors, highly usable, and feasible to deliver. Future studies will determine the clinical and cost effectiveness of Action Therapy.

Tele-Rehabilitation Device to Enhance Walking Following Traumatic Brain Injury
Dr. Celia Clarke
After a brain injury some people may experience difficulty moving their legs and have problems with walking. The ability to control ankle movement has been shown to be an important feature of walking recovery following a brain injury. The aim of this study is to work in collaboration with patients to develop a device that can be used at home for independent rehabilitation. The device, named the ALLEX board (Ankle Lower Limb Exercise) provides visual and audial feedback through their TV screen to motivate and guide to promote recovery. ALLEX will provide ‘remote’ feedback of the user’s performance to a therapist.

Virtual Learning Environment (VLE)
Dr. Andrew Bateman
This research utilises an innovative computerised cognitive behavioural therapy platform delivering a range of self-help materials and providing expert guidance remotely to patients whilst collating routine clinical data. The developed packages are designed to target depression and anxiety. Early work has developed mood management materials, including remote access to high quality guidance aiding individuals to overcome some of the emotional problems associated with traumatic brain injury.
Tablet-based App Development for Upper-Limb Stroke Rehabilitation

Dr. Sheree McCormick

Mental training techniques such as action observation and motor imagery have the potential to improve stroke recovery when combined with physical therapies. Action Therapy is a self-directed, iPad-based application that provides stroke survivors with the opportunity to mentally and physically practice upper-limb movements of daily living in a structured manner. Using evolving technology, the therapy promotes motor function, supports independence, expands rehabilitation and improves quality of life. A recent feasibility study found that Action Therapy was acceptable to community dwelling stroke survivors, highly usable, and feasible to deliver. Future studies will determine the clinical and cost effectiveness of Action Therapy.

Tele-Rehabilitation Device to Enhance Walking Following Traumatic Brain Injury

Dr. Celia Clarke

After a brain injury some people may experience difficulty moving their legs and have problems with walking. The ability to control ankle movement has been shown to be an important feature of walking recovery following a brain injury. The aim of this study is to work in collaboration with patients to develop a device that can be used at home for independent rehabilitation. The device, named the ALLEX board (Ankle Lower Limb Exercise) provides visual and auditory feedback through their TV screen to motivate and guide to promote recovery. ALLEX will provide 'remote' feedback of the user’s performance to a therapist.

Virtual Learning Environment (VLE)

Dr. Andrew Bateman

This research utilises an innovative computerised cognitive behavioural therapy platform delivering a range of self-help materials and providing expert guidance remotely to patients whilst collating routine clinical data. The developed packages are designed to target depression and anxiety. Early work has developed mood management materials, including remote access to high quality guidance aiding individuals to overcome some of the emotional problems associated with traumatic brain injury.

Multimodal monitoring Lead

Professor Peter Hutchinson is an NIHR Researcher at the Department of Clinical Neurosciences, University of Cambridge and Honorary Consultant Neurosurgeon at Addenbrooke’s Hospital, Cambridge. His research interests include multimodality monitoring in traumatic brain injury and he has projects in 3D cranioplasty printing, clinical utility of microdialysis and the ICP monitoring in paediatrics (ICM+).

Intracranial dynamics Lead

Professor Marek Czosnyka and Peter Smielewski study the physical interactions between volumes, flows and pressures in the brain. Their on-going research collectively investigates the intracranial dynamics of TBI informing the continuous development of ICM+. ICM+ is a software package enabling the collection and analysis of bedside monitoring data capable of alerting medical staff to the development of brain pathological.

Neuro-oncology Lead

Dr. Stephen Price is an NIHR Clinician Scientist and Honorary Consultant Neurosurgeon with Cambridge University Hospitals. His research interests include refining imaging software to improve tumour excision, neuoinformatics (DAMSEL) and improving diagnosis of brain tumour through raising awareness and rehabilitation.
SUPPORTED PROJECTS

Development of Microdialysis Online Sensor Technology for use in Critical Care of Acute Brain Trauma Patients
Prof. Peter Hutchinson, Prof. Stephen Elliott, Dr. Tanya Hutter, Dr. Keri Carpenter, Dr. Susan van der Heide and Mr. Adam Young

Head injury is the largest single cause of death in those aged under 40 in developed nations. After the initial trauma, the greatest clinical challenge is limiting secondary insults to the brain, when complex, dynamic changes occur in the brain’s chemistry. Managing these can improve patient outcome. We already monitor in “real-time” pressure in the brain and its oxygen levels, enabling rapid response to dangerous changes. Brain chemistry monitoring uses microdialysis, by inserting fine semi-permeable tubes to collect small samples of brain fluid, with hourly manual transfer to a bedside analyser.

They have established proof-of-concept in the laboratory for a novel sensor for glucose, lactate and pyruvate, the three most important substances. The sensor will work continuously online, neither requiring manual transfer nor the expensive consumables of existing bedside microdialysis analysers. After further laboratory optimisation, the sensor will be trialled online with patients. This has potential for better patient management and therapy, and deployment of microdialysis monitoring to many more hospitals’ critical-care units.
**non-Invasive ICP monitoring (nICP)**  
Prof. Marek Czosnyka  
Mild to moderate head injury seldom presents as severe and patients are regularly sent home following assessment. However, following release, unmonitored intracranial pressure can cause rapid decline resulting in re-admittance to secondary care too late, if at all. It is therefore key to introduce a non-invasive means of directly monitoring intracranial pressure. 
A trolley is being developed that will provide a combination of estimation tools and specialist software capable of delivering care at clinicians’ will. A wider clinical feasibility study is currently underway assessing the trolley’s efficacy in an unmet area of the acute brain injury pathway. The ‘Trans-cranial Doppler System’ will provide the estimation tool for the non-invasive assessment of intracranial pressure, a key component to the trolley combination.

**Advanced Neuro-Monitoring in Paediatric Neurosurgery**  
Prof. Peter Hutchinson  
The majority of brain damage is avoidable and is caused by factors such as brain swelling and poor oxygen delivery occurring in the hours and days after the initial injury. Treatment of children with severe head injuries is currently guided by monitoring pressure within the head. However, this does not detect the other, arguably more important factors, which cause continuing brain damage. This project assess the use of monitors sensitive to oxygen and chemical changes in the brain which are used safely in adult patients but have not been widely employed in children despite their potential benefit.

**3D Cranioplasty Printing**  
Prof. Peter Hutchinson & Mr. Adel Helmy  
3D Printing has the potential to provide medical grade prostheses rapidly, cost effectively and with high fidelity. We propose producing cranioplasty plates for skull reconstruction in collaboration with the University of Cambridge Department of Engineering. The patients’ existing imaging (CT scans) pre- and post-operation can be used to provide a digital model of the bone that has been removed. Rapid prototyping can then be used to rapidly synthesise replacement prosthesis for the patient that accurately matches the contours of the skull. We will trial the use of these cranioplasties in 30 patients. Outcome measures will include patient satisfaction, rate of infection, cost effectiveness and the time delay to successful production and insertion of the plates.
**ACUTE CARE AND FUNCTIONAL NEUROIMAGING WORKSTREAM**

**Acute Care Lead**
Professor David Menon is Head of the Division of Anaesthesia and Co-Chair of the Acute Brain Injury program at Cambridge University. Professor Menon’s research interests include neurocritical care, secondary TBI, metabolic imaging of brain injury, and the physiology of anaesthesia, coma and the vegetative state. Professor Menon’s research interests include neurocritical care, secondary brain injury, metabolic imaging of brain injury and the physiology of anaesthesia, coma and the vegetative state.

**Functional Neuroimaging Lead**
Professor Franklin Aigbirhio is the Director of PET (Radiochemistry) Sciences at the University of Cambridge Department of Clinical Neurosciences, with a research focus on the development and application of neuroscience PET radiotracers.

**SUPPORTED PROJECTS**

**Bedside Assessment in Disorders of Consciousness (DoC)**
Dr. Srivas Chennu
Over the past decades, effectiveness of neurointensive care for sustaining life in the vegetative and minimally conscious states has significantly improved. However, relatively little is understood about the cognitive underpinnings of these profound neurological disorders. Accurate behavioural diagnosis and prognosis have been challenging, and the likelihood of misdiagnosis is estimated to be as high as 40%. This project aims to help improve accuracy of assessments by developing and validating a suite of EEG-based tests of brain function that can be deployed at the patient’s bedside.
Development of a Novel Technology-Based Biomarker for Identification of Mild Brain Injury
Dr. Magdalena Ietswaart
Mild traumatic brain injury is common and difficult to diagnose, as such, it is important that sensitive, objective, and reliable diagnostic tools are developed to aid diagnosis. This project aims to establish a neural biomarker by measuring the ease with which a neural impulse travels from the brain to the muscle it controls. This measure is called cortico-spinal excitability and is established by applying an electromagnetic pulse to the brain and measuring the size of the effect in a lower limb muscle. There is evidence that (amateur) football/soccer players may induce a form of mild brain injury through their ball heading practice with effects that can persist for a day or more. Volunteers in this project will do ball heading in our lab by returning a ball projected at approximately 67 miles per hour. This speed is entirely in keeping with what players routinely do as part of their football practice and competition, reflecting our aim to examine the consequence of real-world behaviour. We predict that heading will temporarily induce (mild) traumatic brain injury thus reducing the conductivity of the brain-to-muscle pathway as evidenced by 1) changes in postural balance (the ability to stand on one leg) which is also affected by ball heading, and 2) changes to cognitive performance. If successful, our novel approach to the diagnosis of mild traumatic brain injury will significantly increase our ability to identify which routine behaviours are most damaging, and in turn, what can be done to reduce the impact of such damage.

Pre Hospital Brain Imaging
Dr. Mark Wilson
There are many forms of brain injury that individually have optimal specific treatments. The problem is that pre-hospital imaging is not always possible and hence pre-hospital specific diagnosis and treatments has not occurred. This study aims to take diagnosis closer to the point of injury, in the “Pre-Hospital” arena, by investigating the accuracy of near infrared spectrometry in detecting blood clots on the outside of the brain (extradural or subdural haematoma). Two protocols will run concurrently, one investigating the use of near infrared in the pre-hospital environment (with London’s Air Ambulance) and another, on a separate group of patients, studying its use in the resuscitation department of St Mary’s Hospital Major Trauma Centre. The results of the near infrared assessment will then be compared with the CT scans assessing need for surgical intervention with the sensitivity and specificity for the technique calculated.
COGNITION AND NEURODEVELOPMENTAL DISORDERS WORKSTREAM

Cognition Lead
Professor Barbara Sahakian is Professor of Clinical Neuropsychology at the University of Cambridge. She is also an Honorary Clinical Psychologist at Addenbrooke’s Hospital, Cambridge and has an international reputation in psychopharmacology, neuropsychology and neuropsychiatry.

Neurodevelopmental Disorders Lead
Dr. Howard Ring is a clinical academic consultant psychiatrist working in the University of Cambridge and the Cambridgeshire and Peterborough Foundation Trust. His current research initiatives include the study of non-pharmacological approaches to epilepsy management in adults with ID and the application of EEG and psychophysiological measures to investigate biological associations of behavioural symptoms in people with neurodevelopmental disorders.

SUPPORTED PROJECTS

Extra-cranial Seizure Detection
Dr. Howard Ring
Faster detection of seizures may reduce the severity and mortality risk of epilepsy. The proposed research will determine whether home-based monitoring and detection of seizures is possible and clinically useful. If so, then home-based monitoring may improve accuracy, understanding of seizures and clinical responses to treatments.

Cognitive Training in Traumatic Brain Injury (TBI)
Prof. Barbara Sahakian
Cognitive training is an important and powerful technique that is an effective and safe method for boosting cognition (i.e. the mental actions of processing information). These techniques often use computers to train participants to respond to mental exercises that can enhance different aspects of cognition. TBI patients are good candidates for cognitive training as they typically experience loss or damage to several cognitive functions following injury, e.g. memory, language and attention dysfunction. The project aims to develop and implement a new computer game (i.e. an App) to train patients with TBI to maintain their attention and improve reasoning and problem.
Clinical Informatics Lead
Dr. Alexis Joannides is the brain injury HTCs programme advisor. He is also a clinical lecturer in neurosurgery at the Department of Clinical Neurosciences, University of Cambridge. He is currently the programme director of the Outcome Registry Intervention and Operation Network (ORION), a national informatics platform for collecting and analysing health outcome data following neurosurgery and other neuroscience-related procedures.

SUPPORTED PROJECTS

Using Social Media to Elucidate the Unmet Needs and Support Networks of People with Brain Injury
Dr. Aaron Lawson McLean
We aim to address several key questions about how users of social media discuss brain injury online. Patients increasingly turn to the internet for information on medical conditions pertinent to them, often researching clinical developments and treatment options. In recent years, an online patient community has arisen alongside the rapidly expanding world of social media. One social media platform, called Twitter, has become an important online tool for patients. Twitter is now considered to play an important role in the modern social community of online patients. These online patients are likely to include those with Acquired Brain Injury (ABI) from both traumatic causes (such as falls and road traffic accidents) and non-traumatic causes (such as lack of oxygen and brain tumours). Online discussion about ABI may reveal patient insights, perspectives and experiences that the doctors who care for these patients and researchers are not aware of.
Neurosurgery Task List
Mrs. Nicola Owen
The success of treatment relies on continuity in patient care, a challenge given medical and nursing working patterns, resource limitation and employment legislation. This is particularly marked in junior medical staff, where short specialty rotations do not allow for sufficient experience to be acquired as a mitigating factor. Thus, a robust means of communicating and handing over inpatient tasks in a user-independent and intuitive manner is required. This project proposes to implement an electronic task list for improving inpatient care for neuroscience patients.
Implementation of a secure web application for managing neuroscience emergency referrals has been successfully implemented in the east of England. This application provides a means of transparently recording specialist advice, whilst also providing real-time data analytics for service evaluation and audit. The project proposes to develop a novel module - xTask - within the national cloud based ‘ORION’ database recording and improving task requests and handover between junior medical and nursing staff.

Electronic Rehabilitation Prescription (eRP) and Integrated Rehabilitation Management and Assessment (IRMA)
Dr. Alexis Joannides
The efficacy and continuity of patient care is dependent upon the accuracy, detail and accessibility of clinical information, this is epitomised in neurological patients. The eRP has been designed for use across all trauma patients including those with neurological and non-neurological trauma. It is a composite document made up of multiple forms capturing discrete categories of clinical information. The rehabilitation form portfolio has been separated into logical divisions in order to facilitate ongoing assessment and revision, whilst maintaining a transparent audit trail. It consists of 6 purpose-built data capture forms and 9 standardised outcome measures. The content of the entire dataset has been developed in line with the latest national guidelines. The recent launch of IRMA takes eRP into the wider rehabilitation context.
Workstream Lead
Professor James Fawcett is Chairman of the John van Geest Centre for Brain Repair, University of Cambridge. His main interest is the repair of Central nervous system damage. Plasticity is the ability of the brain to bypass damage by creating new circuits. His work has shown how plasticity can be activated in the damaged adult nervous system, and how this can restore motor and sensory function and memory. He also works on axons and how their function can be restored after damage.

SUPPORTED PROJECTS

Cellular Protection Strategies in Diffuse Axonal Injury (DAI)
Dr. Alexis Joannides
Diffuse axonal injury (DAI) is recognised as a key feature of traumatic brain injury. Research has demonstrated that mechanical trauma can lead to axonal damage in the absence of direct tearing of neuron axons. The recognition of secondary axonal injury over a period of hours and its potential evolution into a chronic neurodegenerative process creates a window of opportunity for disease-modifying therapies aimed at axonal protection and preservation. Investigating the molecular basis of axonal degeneration and protection in the context of traumatic brain injury is dependent on the presence of appropriate cellular models. In vitro models of axonal stretch have been shown to replicate many of the structural consequences of DAI, and both organotypic and single cell-based models have been developed. Recent reports utilising such models are beginning to provide insight into potential disease mechanisms. This project proposes to develop a human stem cell-based axonal stretch model to investigate the role of injury-induced axonal degeneration, and explore its modulation by both genetic and environmental means. The program of work will potentially provide a platform for the development of novel disease-modifying and neuroprotective therapies in brain injury.
Workstream Lead
Dr. Topun Austin is an academic neonatologist leading a research team undertaking original research into brain injury in newborn infants. This research encompasses critical care, the link between brain function and behaviour as well as the relationship between the heart and brain in response to stimuli. Topun leads the Cambridge Centre of Perinatal Neuroscience including the Evelyn Perinatal Imaging Centre.

Project Lead
Dr. Richard Iles is a Paediatric Consultant and joint clinical lead for the Paediatric HTC work stream. This work stream has a number of projects, with an emphasis on non-invasive, non-contact monitoring and the interpretation of complex physiological data sets, rehabilitation, neonatal brain injury, and epilepsy. The Brain Injury HTC’s paediatric and adult workstreams have significant overlap and work in close collaboration with TITCH maximising access to national and international paediatric expertise.

In February 2015, additional funding was awarded to the Brain Injury HTC along with four other existing NIHR Healthcare Technology Cooperatives (HTCs) in order to stimulate research activity in paediatric healthcare technologies.

SUPPORTED PROJECTS

Novel Proteomic Biomarkers of Brain injury in New-Borns
Dr. Divyen Shah
After brain injury, whether traumatic or due to conditions such as stroke, further deprivation of blood or oxygen to the brain tissue may worsen brain injury in all age groups. The neonatal brain is particularly vulnerable and deprivation of blood or oxygen to a baby through the placenta often occurs unexpectedly prior to or at the time of delivery having catastrophic consequences, often
leading to disability or even death. Innovative cooling treatment is routinely used in full term newborn babies at risk of brain injury which, when commenced within the first six hours following birth, has been shown to reduce death and disability in survivors.

At present there are no objective tests informing our selection of babies for cooling, meaning that the benefit from treatment may get missed and other babies who may not benefit are treated unnecessarily.

The present study addresses this unmet need by using proteomics to develop a blood test enabling better selection of babies for brain saving treatments, and also allow us to determine the long-term outcomes for individual babies who have suffered from lack of blood or oxygen. The success of this study will assist paediatricians to refine selection for brain saving treatments as well as allowing prediction of outcomes.

**Non-invasive Non-contact Measurement of Heart Rate and Movement using Ballistocardiography (Bcg)**

Dr. Richard Iles, Dr. Joan Lasenby and Dr. Joachim Steiner

Reliable long term non-contact monitoring of apnoeic seizures in childhood is very difficult, particularly at night, causing much family disruption and distress. If these seizures remain unnoticed this may result in sudden unexpected death. In nocturnal epilepsy, including post traumatic and chronic refractory epilepsy, the identification of patients at risk of sudden death is critical.

NoctuSense Ltd has developed non-invasive, non-contact monitoring algorithms, which can be connected to a set of force transducers placed under the mattress. The system is capable of monitoring and analysing seizures as well as disturbances in respiration, heart rate and sleep. This non-contact methodology requires no active participation by the patient, enabling data collection in a cable- and probe-free environment. The resulting data is immediately relevant to paediatric patients and clinicians.

This HTC supported project to validate this valuable tool for non-contact monitoring is being developed by Dr Joachim Steiner, CEO, NoctuSense Ltd, with the aim of undertaking pre-clinical trials, hosted by the Department of Respiratory Paediatrics.

Pre-clinical trials are expected to commence during the first half of 2016, with approval for the trial protocol obtained from the Addenbrookes R&D Department as well as approvals for the prototype device obtained from the Addenbrookes Clinical Engineering Department and Infection Control.
Technology and Innovation Transforming Child Health (TITCH)

TITCH is a national healthcare technology network that is dedicated to the development of technology solutions to help improve children’s healthcare. This is achieved by focusing on the identification of areas of unmet need where new technology could have an impact for child health. TITCH also identifies where innovative technologies can lead to best clinical practice and stimulates the adoption of these across the TITCH network.

TITCH focuses on 4 key areas:

• Evaluation - to facilitate the evaluation of a device or technology through the expert network.

• Collaboration - offers the opportunity for network collaboration in the development of new technologies from validation of need to active collaboration on projects.

• Early adopter - TITCH can facilitate the identification of early adopter sites that may have an interest in a specific new technology.

• Market ready - showcases devices that have gone through the process and are now commercially available.

For more information please visit www.titch.org.uk.
Patient and Public Involvement (PPI) Lead
Mrs Helen Balsdon leads the Patient and Public Involvement workstream for the NIHR Brain Injury HTC. As the Assistant Director of Nursing at Cambridge university hospital foundation trust, she manages patient experience across the University teaching hospital on behalf of the Chief Nurse. Helen is in contact with patients and their carers keeping the PPI theme current and relevant.

The NIHR Brain Injury HTC has initiated implementation of the ‘Public Empowerment through Patient Inspired Innovation’ vision and is committed to engaging patients and carers throughout its work programme.

We strongly believe that research should focus on questions that are important to people with brain injuries, and those who care for them. To ensure that patients and carers have a voice we invite people whose lives have been affected by a brain injury to get involved in our work. Key enablers for this are the development of the HTC patient register and running of themed patient workshops.

Get involved in the work of the Brain Injury HealthCare Technology Co-operative!

If you are interested in the work of the NIHR Brain Injury HTC, we invite you to join our Patient and Carer Register. Joining the register does not commit you to do anything. It means that periodically we shall send you our patient newsletter with information about our activities. We shall also send you details of any opportunities there may be to take part in Brain Injury HTC activities. These may include:

• taking part in surveys
• taking part in workshops
• getting involved in other NIHR Brain Injury HTC activities and events
Patient & Carer Register
The NIHR Brain Injury HTC has developed a volunteer register for patients and carers to assist in the advance of healthcare technologies and is inviting patients and carers to register their interest in getting involved in the work of the HTC. By signing up to the register you give us permission to invite you to take part in surveys, focus groups, workshops or other events, but being on the register does not commit you to anything.

How to join the Patient & Carer Register
Are you interested in getting involved in the work of the HTC? You can volunteer by joining our register of interested people. You may have experienced a brain injury yourself, or may be a relative or carer of a patient.
People with experience of a brain injury and their carers can join the register by contacting us for a leaflet about the registry, or by downloading a form from our website and posting a printed copy or emailing an electronic copy to us.
For more information and frequently asked questions about joining our register please visit: https://brainhtc.org/patient-and-carer-register

GET INVOLVED!
**Themed patient workshops**
Our patient workshops offer an opportunity for patients, carers and families to feedback their invaluable expertise and unmet needs from their experiences. The identification of these requirements relating to brain injury will ultimately inform clinicians, academics and industry to innovate new technologies. Each workshop will focus on part of the brain injury patient pathway to elicit unmet needs.

**The Mind Your Head (MYH) Challenge**
In collaboration with Headway Cambridgeshire, MYH was a crowd sourcing initiative to generate ideas for products and services that will help improve the quality of life of people with acquired brain injury, or to prevent brain injury. 10 Headway Cambridgeshire clients set out their ‘challenges’ and 150 members of the public took part in a 2-part ‘Apprentice meets Dragon’s Den’ style event in 2014. Find out more at [www.mindyourhead.brainhtc.org](http://www.mindyourhead.brainhtc.org)
Patient and Public Involvement in HTC Events

Patients are involved in all HTC events. These include:

• **Brain Injury Technologies Think (BITT) Tank**: This series of events offers the opportunity for small to medium enterprises to gain an insight into research and clinical requirements and receive feedback from a panel of expert clinicians, academics, patients and carers. The NIHR Brain Injury HTC will be running focussed BITT tanks to showcase technologies in our 4 priority areas: primary Prevention, acute monitoring and treatment, co-ordinated Care and technologies for Independent Living.

• **Brain Injury Den (BID)**: A series of event similar to the premise of ‘Dragon’s Den’ - Clinicians and academics present their medical devices to a panel of experts including wider industry and angel investors.

• **Patient Benefit Review (PBR)**: PBR workshops provide research projects with structured feedback and direction shaping project plans, grant applications and publications.
Submit an unmet need
We invite anyone affected by a brain injury to submit their unmet needs to us. We want to know what is important to patients, carers and relatives as well as what is important to academics researchers and clinicians.

We shall collate all the unmet needs submitted and, with the help of patients and carers, put them in priority order. We shall use this information when we are talking to technologists. We shall ask the questions. Can you fulfil this unmet need? Does your new technology solve any of these problems?

To submit an unmet need, please fill the form on our website: https://brainhtc.org/surveys/ or contact us by email, phone or post.

Contact us
NIHR Brain Injury HTC
Dept. of Clinical Neurosciences
University of Cambridge
Box 167 - Cambridge Biomedical Campus
CB2 0QQ

Tel: +44 (0)1223 336 936
Email: info@brainhtc.org

Director: Prof. John Pickard
Deputy Director: Dr. Peter Jarritt
Programme Manager: Ms. Mita Brahmbhatt
Programme Co-ordinator: Ms. Talissa Gasser
Contact
NIHR Brain Injury HTC
Dept. of Clinical Neurosciences
University of Cambridge
Box 167 - Cambridge Biomedical Campus
CB2 0QQ

Tel: +44 (0)1223 336 936
Email: info@brainhtc.org
Website: www.brainhtc.org
Twitter: @NIHRBrainHTC