

**Brain Injury  
MedTech Co-operative**



**National Institute for  
Health Research**

# **Prevention & Pre-Hospital Care**

## **MIC Theme 1**

***Professor Mark Wilson***

# *Background*

## Prevention and Pre-Hospital

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Most brain injuries are preventable.

The demographics of TBI are changing – whilst TBI from high velocity injuries of young males still occur, the burgeoning elderly population with TBIs from falls from standing are increasing considerably.

TBI causes considerable morbidity and have huge costs to society through failure to return to work, fractured Family relationships, homelessness, imprisonment and requirement for care & support.

The need for guidelines for the prevention, diagnosis and treatment of sports concussion has led to a surge in research activity worldwide that will be helpful to patients with other forms of brain injury.

### **Key Researchers**

# Strategy

## Prevention and Pre-Hospital



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**Year 1**

**Short-term**

The new SBNS Brain Injury Classification System compiled and published.  
Publication and dissemination of the Bristol Paediatric and London TBI epidemiology studies (TriBAL) and of the Pre-Hospital NIRS Infrascanner study  
Network meetings of pre-hospital care organisations  
Ethics and grant applications for prospective collaborative data collection relating to head injury management submitted.  
Biomarker study grants are already submitted. Community response systems are already in place and being evaluated.  
Grant application for development of pre-hospital multichannel NIRS device for imaging.

**Year 2-3**

**Medium -  
term**

Over this time frame we expect to have good pre-hospital data collaboration to enable the subsequent assessment of interventions.  
Multichannel NIRS development and testing of other pre-hospital diagnostic tools underway.  
Biomarker studies nearing completion.  
Lower body negative pressure for ICP pilot complete and if successful developed for further possibly pre-hospital study.  
Completed evaluation of pre-hospital community alerting system and video triage.

**Year 4-5**

**Long-term**

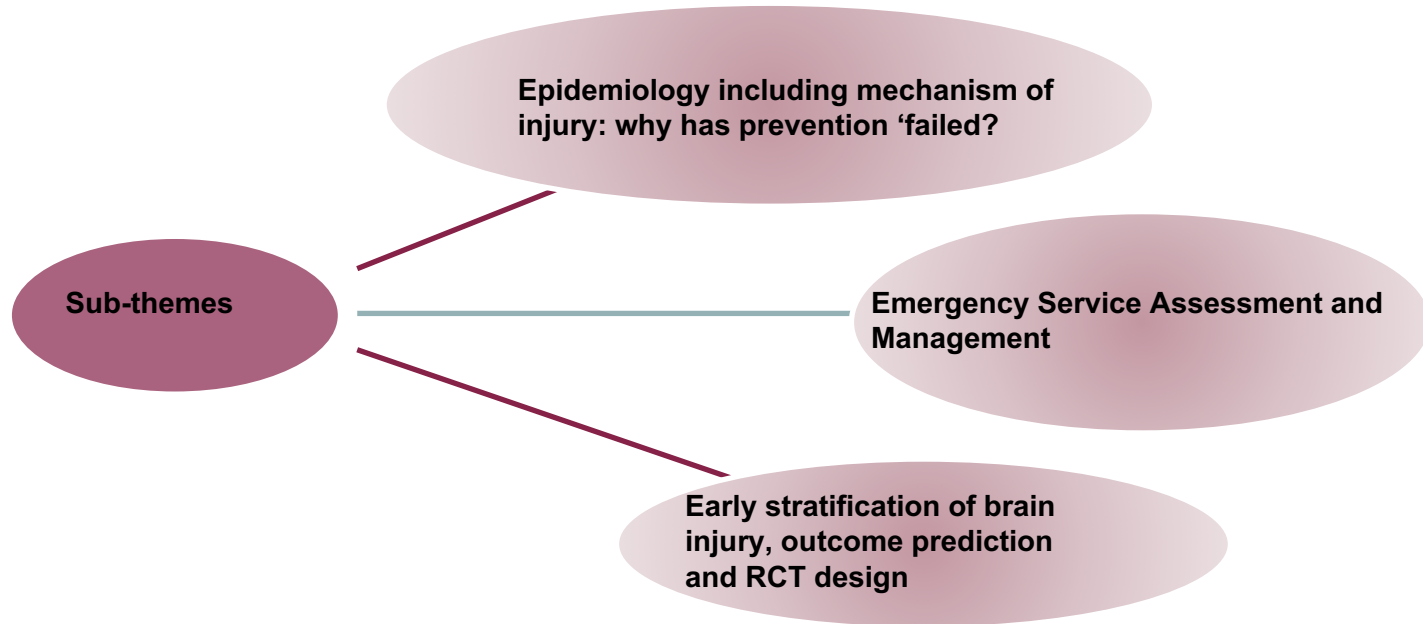
The trial of novel neuroprotectants within 30 minutes of injury  
The implementation of on-scene diagnosis of some forms of brain injury (e.g. extra-axial haematomas) and their targeted management.  
Manipulation of blood pressures for specific injury types.  
A trial of a specific biomarker as a rule out tool conducted in remote areas.

# Sub-themes

## Prevention and Pre-Hospital



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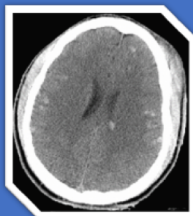


# Examples of work so far...

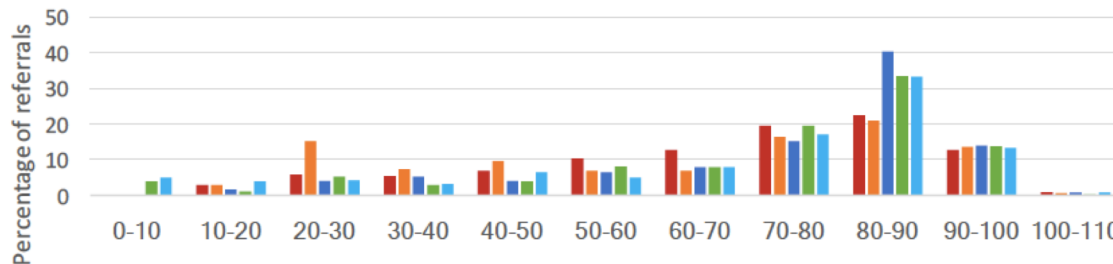


London Clinical Senate

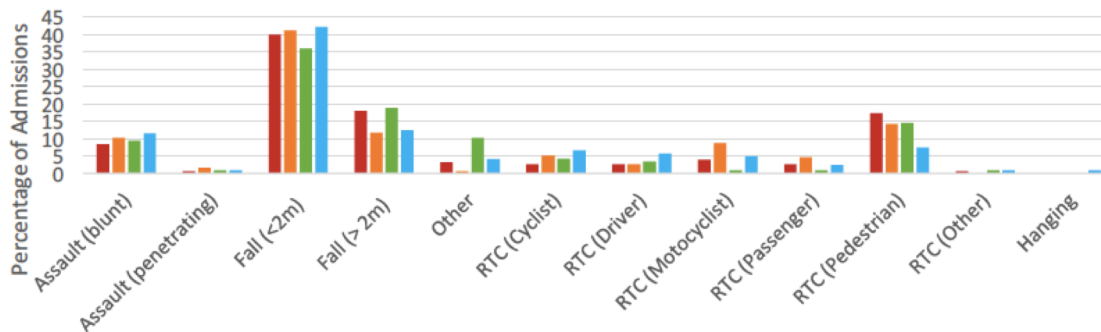
Traumatic Injury to Brain Across London (TRIBAL) Report



Ages of Patients Referred to MTC



Mechanism of Injury in Patients presenting to MTC



# Examples of work so far...

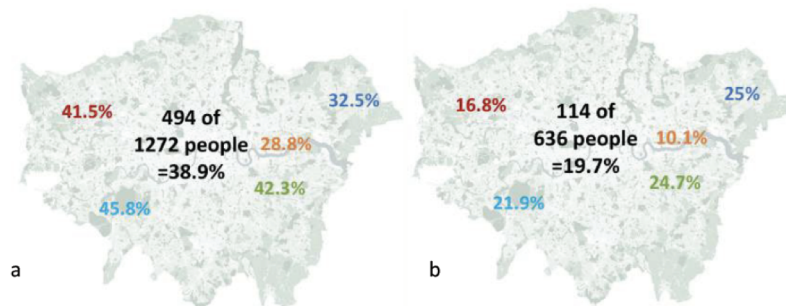
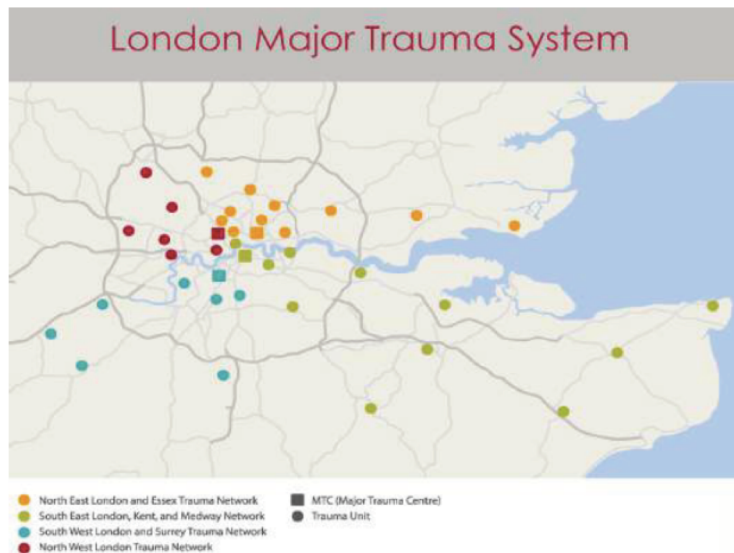
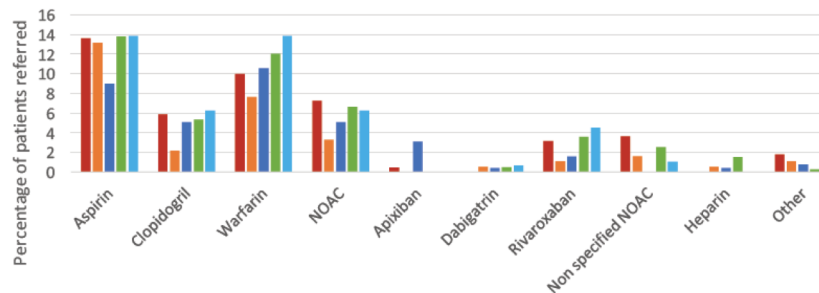
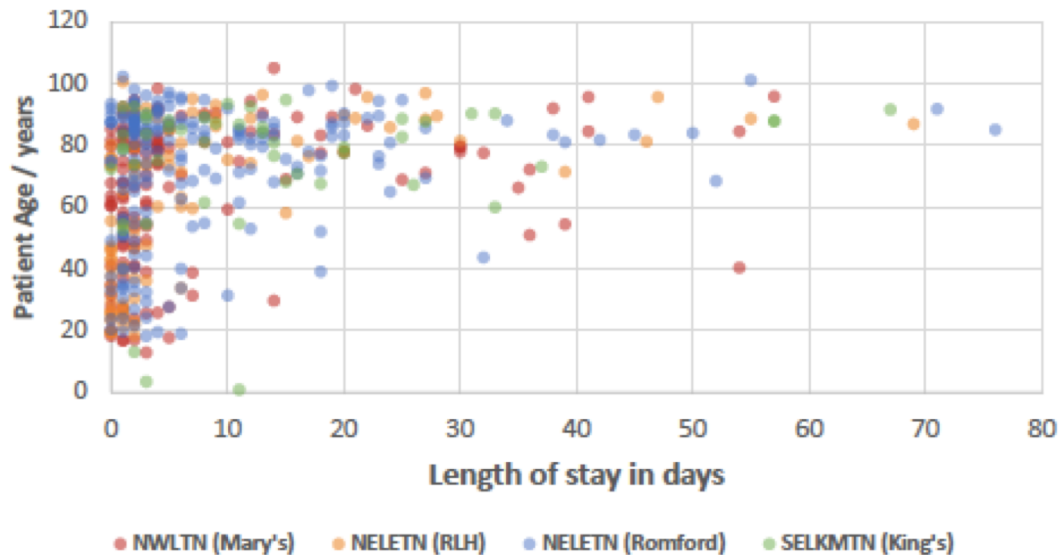


Figure 9) Graphical representation of number of patients a) referred in network on anti-platelet / anticoagulation agents and b) admitted to MTC on anti-platelet / anticoagulation agents.

## Anticoagulation in patients Referred to Neurosurgeons

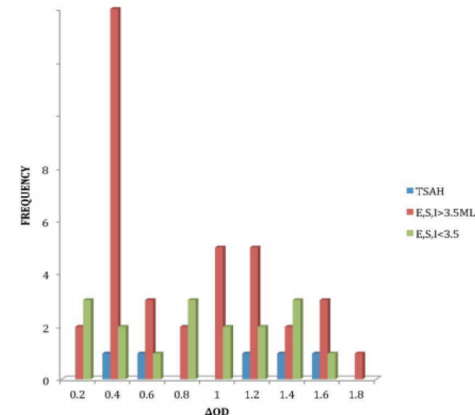
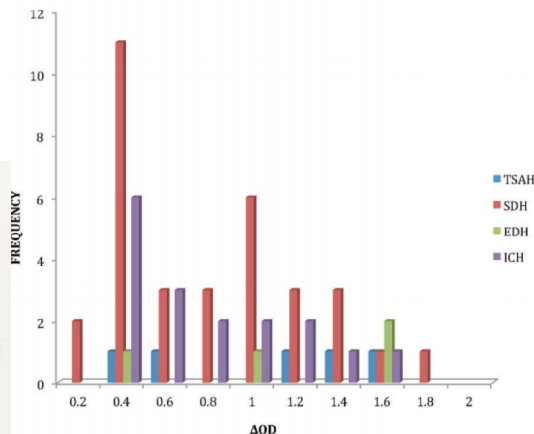


# Examples of work so far...



Recommendations:  
**Prevention**  
**Anticoagulation**  
**Elderly TBI specifics**  
**Primary Admitting Team**  
**Follow Up**

# Examples of work so far...





# Examples of work so far...

## **LBNP for Raised ICP:**

Delays in remanufacture of LBNP chamber – new one created in Sweden and delivered last week.
























# Examples of work so far...

## A simplified Classification System

To enable easier comparison especially where neuroradiologists / surgeons not present

Currently being used to evaluate Civilian Vs Military Injuries

THE SBNS BRAIN INJURY CLASSIFICATION								
Severity	Extradural	Subdural	Subarachnoid	Contusion/ICH	Diffuse Axonal Injury*	HYPOXIA *	TIGHTNESS	Location of injury
0	NORMAL  0 to <10mls	NORMAL  0 to <10mls	NORMAL  <1mm thick	NORMAL  1 small contusion	NORMAL  1-2 microhaemorrhages	NORMAL  Slight loss of grey-white	NORMAL  Mild effacement of sulci	LEFT FRONTAL PARIETAL OCCIPITAL TEMPORAL CEREBELLUM BRAINSTEM RIGHT FRONTAL PARIETAL OCCIPITAL TEMPORAL CEREBELLUM BRAINSTEM
1	 10-25mls (or ventricular effacement)	 10-25mls (or ventricular effacement)	 ≥1mm thick or localised clots	 Medium size or multiple, total volume <25mls	 2-5 microhaemorrhages	 Some sulci effacement	 Severe effacement of sulci	
2	 ≥25mls (or with midline shift)	 ≥25mls (or with midline shift)	 Intra-cerebral or intraventricular clots with diffuse or absent blood in basal cisterns	 Large size or Multiple, total volume ≥25mls	 > 5 microhaemorrhages / Involves brainstem	 Complete loss of grey-white and sulci	 Effacement of Sulci + Basal Cisterns	
3								

\* DAI and Hypoxia brain injury are easier to visualise and grade on MRI

# Examples of work so far...



## BRAIN CAMPAIGN

1.4 million have a Traumatic Brain Injury  
(TBI) each year in UK

TBI is the most common cause of death in under 40s.

Personal &  
Family



TBI destroys people and families. Even minor injuries can prevent return to work.

Society



48% of homeless and 54% of prison population have had significant TBI. TBI more than doubles violent crime.

Elderly TBI



Elderly TBI is an epidemic causing loss of independence. It has increased from 5% to 40% of trauma cases in last 25 years.

**TBI has no specific funding body (unlike Cancer/Heart...)**

9% of UK Research funding is Neuroscience but only a tiny fraction is TBI

The BRAiN Campaign will fund research / innovation in:

PREVENTION



e.g. greater community care. Increased public awareness (switch light on for toilet at night!)

SCIENCE/TECHNOLOGY



e.g. development of tools to enable easier and earlier diagnosis and institution of more rapid management, before neurons die.

MANAGEMENT



Development of new techniques to minimise neuronal loss, enhance rehabilitation and recovery and support care at home.

We plan to raise funding from corporate and charitable sectors. With £5 million, we can deliver within 2 years, innovations in all the above.

## PreHospital Brain Imaging



Prof. Mark Wilson  
Imperial College London

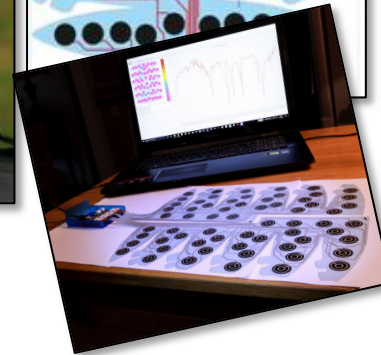
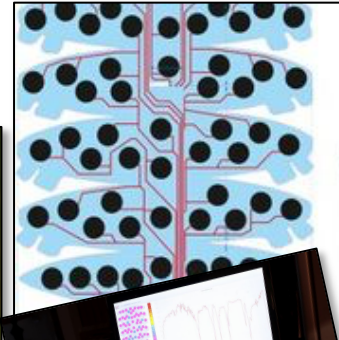


[www.infrascanner.com](http://www.infrascanner.com)

## Helmets by Helpful Innovations Ltd



<http://helpful-innovation.com/>



# Pathway Mapping PreHospital & Prevention



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## Virtual Reality in Sports Concussion

*Dr Michael Grey, University of East Anglia*

[www.abira.ac.uk](http://www.abira.ac.uk)



## Development of a Novel Technology-Based Biomarker for Identification of Mild Brain Injury

*Dr. Magdalena Ietswaart, University of Stirling*



<https://www.stir.ac.uk/news/2017/11/stirling-experts-call-for-more-research-into-heading-footballs/>

## Alan Shearer: Making my documentary Dementia, Football and Me



By Alan Shearer  
Match of the day pundit and former England captain

<http://www.bbc.co.uk/sport/football/41902953>



<http://www.virtualrehab.info>

# Healthcare Technology Co-operative (2013-2017)



National Institute for Health Research

## The NIHR Brain Injury Healthcare Technology Co-operative (HTC) in numbers

UNMET NEEDS

Since 2014, the NIHR Brain Injury HTC ran **8 strategic roadmapping workshops** and **10 patient and carer workshops**

**70 unmet needs** have been prioritised through the various structured initiatives facilitated by the HTC to create an 'Unmet Needs Directory'

PATIENT CENTRED



**7031**

participants recruited to NIHR HTC studies



The Register for Healthcare Involvement and Technology Evaluation (RHITE) has transitioned to an online platform, and has noted a

**100%**

increase since its launch



### FUNDING COMPETITIONS 2013-2017

The NIHR Brain Injury HTC 'Innovations Small Funding Competition 2014-15' and the 'Seedcorn Funding Competition 2016-17' have seed funded 38 national projects that address the unmet needs that have been identified.



**200** expressions of interest

**75** applications

**38** projects have been awarded for a total of **£330,335**



with a return of **£7,890,803**



FIND



External Funding Leveraged with partners  
**£59,562,367**

FACILITATE

FOSTER

### SUPPORTED PROJECTS & BRAIN INJURY DEN

Over 5 years,

**101** peer reviews have been conducted

**30** projects have received feedback from experts and leaders in healthcare innovation as part of the Brain Injury Den



Supported-projects generated **272** publications



### BRAIN INJURY TECHNOLOGIES THINK (BITT) TANK

Over 4 years, the HTC ran 5 BITT tanks, which have been attended by **103** companies

**54** SMEs, start-ups and project teams showcased technological innovations to a panel of patients, carers, clinical and academic experts

**49** new collaborations formed following the BITT tanks



Since 2013, the HTC has worked with **182** SMEs

NIHR Brain Injury MedTech Co-operative

## FIND

Identify areas of unmet need throughout the brain injury pathway that might be amenable to a technology-based innovation.

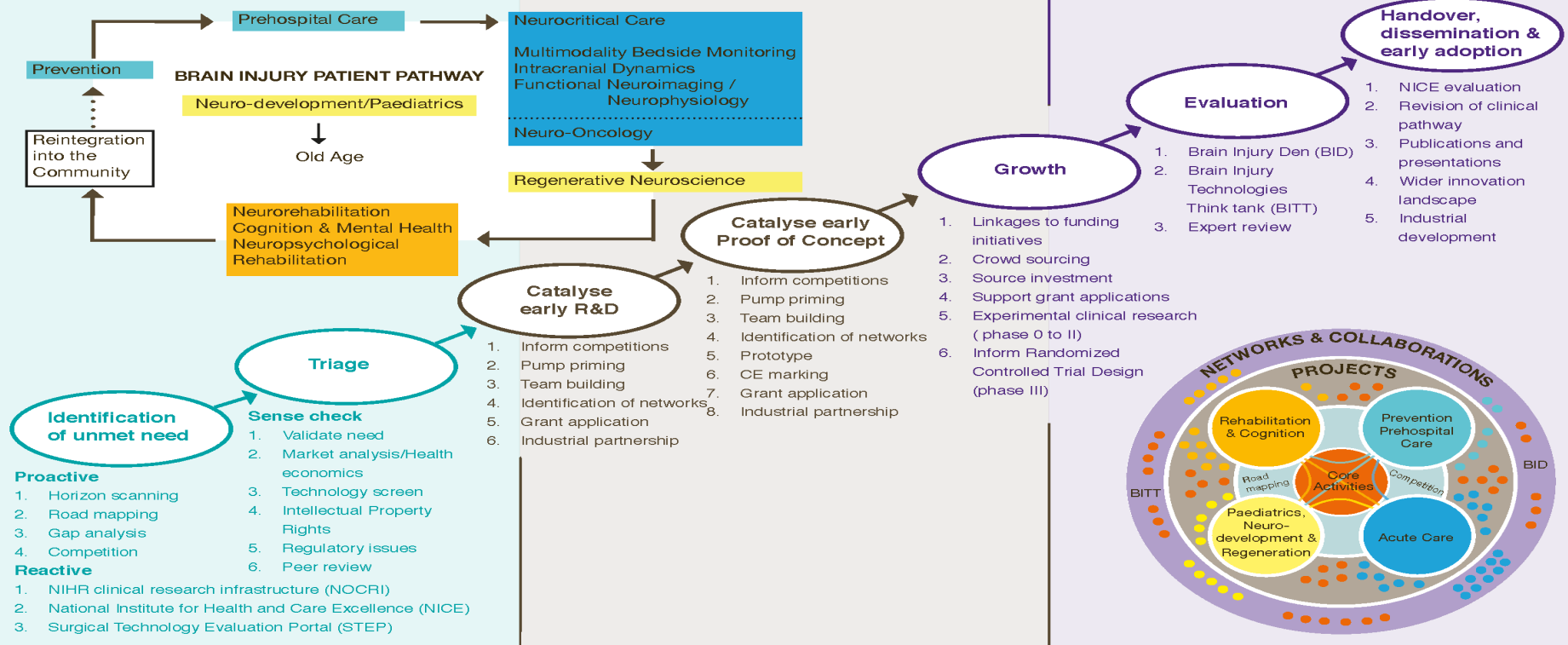
## FACILITATE

Promote the generation of innovative solutions through the facilitation of interdisciplinary communication and collaboration between the NHS, academia, industry and public organisations.

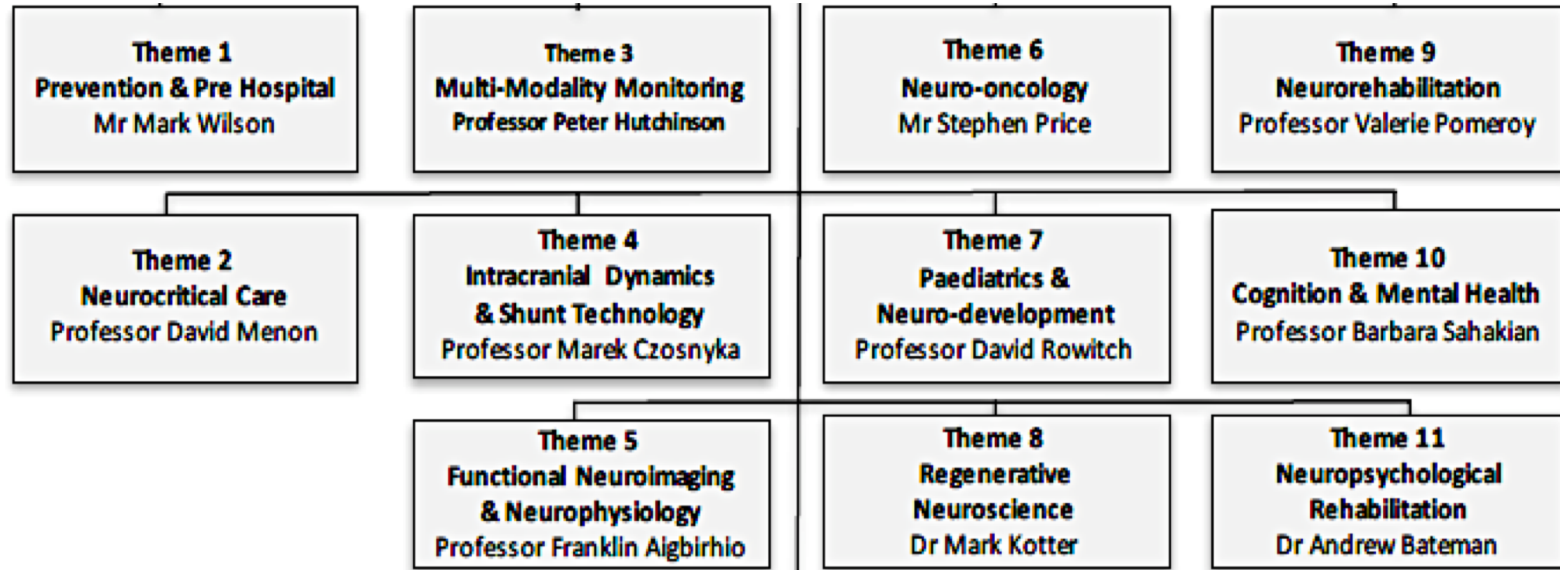
## FOSTER

Support the translational pathway of viable solutions from initial concept to successful market adoption and sustainable clinical impact.

**CORE ACTIVITIES:** Patient & Public Involvement, MedTech Regulation & Developmental Support, Clinical Informatics, Health Economics



# Clinical Themes





**Brain Injury  
MedTech Co-operative**

  
**National Institute for  
Health Research**

# **The Next Generation**

## *Launch Event*

**Wednesday 25 April 2018: Homerton College, CB2**

# Description

## Prevention and Pre-Hospital



National Institute for  
Health Research

Major trauma networks are 'getting the right patient to the right place'. Progress has been made in identifying and treating, in timely fashion, secondary insults to the brain including hypoxia, hypotension, fits and intracranial haematomas. We have developed tools (e.g. [www.goodSAMapp.org](http://www.goodSAMapp.org)) that enable people trained in basic airway management, who happen to be within a few hundred metres of such incidents, to be alerted. The early detection of an intracranial haematoma would allow for focussing of the trauma pathway to the needs of the individual patient. For all these reasons, access to better monitoring at the roadside is required.

If patients survive the first few minutes, there is a therapeutic window of opportunity to intervene and prevent further death of brain cells. However, clinical trials of promising neuroprotective agents have been universally unrewarding apart from Nimodipine for aneurysmal subarachnoid haemorrhage. The therapeutic window of opportunity after subarachnoid haemorrhage is of the order of days whereas it may only be minutes or hours after a head injury. Future drug trials for head injury will require a clinical platform capable of the timely stratification of patients in to homogeneous subgroups at the roadside and the ultra-early administration of safe neuroprotective agents capable of rapidly entering the brain in effective concentrations.