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**Healthcare for Older People Research in Leicestershire**

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East Midlands Research into Ageing Network (EMRAN) is a research collaboration across the East Midlands to facilitate collaborative applied clinical research into ageing and the care of older people. EMRAN was set up with support from NIHR CLAHRC East Midlands.

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## Why Leicester? Who we are and what we do

Well if the [Tigers](#), [the Foxes](#) or [Richard III](#) don't take your fancy, there's the beautiful [countryside](#) with fantastic provision for long walks! We are also only just over an hour from London, with [trains](#) every half hour or so during the day, and a reliable service with space to work or relax. [Leicester is on the up](#), with a VC at the University helm and a Dean for the medical school who have an enthusiasm for high quality translational work.

## Academic geriatric medicine in Leicester

There has never been a better time to consider joining us. We have recently appointed a [Professor in Geriatric Medicine](#), alongside [Tom Robinson](#) in stroke and [Victoria Haunton](#), who has just joined as a Senior Lecturer in Geriatric Medicine. We have fantastic opportunities to support students in their academic pursuits through a well-established intercalated BSc programme, and routes on through such as ACF posts, and a successful track-record in delivering higher degrees leading to ACL post. We collaborate strongly with [Health Sciences](#), including academic primary care. See [below](#) for more detail on our existing academic set-up.

## Leicester Academy for the Study of Ageing

We are also collaborating on a grander scale, through a joint academic venture focusing on ageing, the 'Leicester Academy for the Study of Ageing' (LASA), which involves the local health service providers (acute and community), De Montfort University; University of Leicester; Leicester City Council; Leicestershire County Council and Leicester Age UK. Professors Jayne Brown and Simon Conroy jointly Chair LASA and have recently been joined by two further Chairs, Professors Kay de Vries and Bertha Ochieng. Karen Harrison Denning has also recently been appointed an Honorary Chair.

LASA aims to improve outcomes for older people and those that care for them that takes a person-centred, whole system perspective. Our research will take a global perspective, but will seek to maximise benefits for the people of Leicester, Leicestershire and Rutland, including building capacity. We are undertaking applied, translational, interdisciplinary research, focused on older people, which will deliver research outcomes that address domains from: physical/medical; functional ability, cognitive/psychological; social or environmental factors. LASA also seeks to support commissioners and providers alike for advice on how to improve care for older people, whether by research, education or service delivery. Examples of recent research projects include: 'Local History Café' project specifically undertaking an evaluation on loneliness and social isolation; 'Better

Visits' project focused on improving visiting for family members of people with dementia resident in care homes; and a study on health issues for older LGBT people in Leicester.

### **Clinical Geriatric Medicine in Leicester**

We have developed a service which recognises the complexity of managing frail older people at the interface (acute care, emergency care and links with community services). There are presently 17 consultant geriatricians supported by existing multidisciplinary teams, including the largest complement of Advance Nurse Practitioners in the country. Together we deliver Comprehensive Geriatric Assessment to frail older people with urgent care needs in acute and community settings.

#### *The acute and emergency frailty units – Leicester Royal Infirmary*

This development aims at delivering Comprehensive Geriatric Assessment to frail older people in the acute setting. Patients are screened for frailty in the Emergency Department and then undergo a multidisciplinary assessment including a consultant geriatrician, before being triaged to the most appropriate setting. This might include admission to in-patient care in the acute or community setting, intermediate care (residential or home based), or occasionally other specialist care (e.g. cardio-respiratory).

Our new emergency department is the county's first frail friendly build and includes fantastic facilities aimed at promoting early recovering and reducing the risk of hospital associated harms.

There is also a daily liaison service jointly run with the psychogeriatricians (FOPAL); we have been examining geriatric outreach to oncology and surgery as part of an [NIHR funded study](#).

We are home to the [Acute Frailty Network](#), and those interested in service developments at the national scale would be welcome to get involved.

#### *Orthogeriatrics*

There are now dedicated hip fracture wards and joint care with anaesthetists, orthopaedic surgeons and geriatricians. There are also consultants in metabolic bone disease that run clinics.

### *Community work*

Community work will consist of reviewing patients in clinic who have been triaged to return to the community setting following an acute assessment described above. Additionally, primary care colleagues refer to outpatients for sub-acute reviews. You will work closely with local GPs with support from consultants to deliver post-acute, sub-acute, intermediate and rehabilitation care services.

### *Stroke Medicine*

24/7 thrombolysis and TIA services. The latter is considered one of the best in the UK and along with the high standard of vascular surgery locally means one of the best performances regarding carotid intervention.

### **Academic stroke & geriatric medicine in Leicester**

The Academic Department has strengths in Health Services Research ([Prof Conroy](#)) and stroke medicine ([Prof Robinson](#)) based at the Leicester Royal Infirmary.

The Stroke Medicine Group ([Prof Robinson](#)) has particular expertise in cardiovascular autonomic regulatory mechanisms in acute and sub-acute stroke, and blood pressure management in acute stroke. In addition, the Group led by Professor Robinson, co-hosts the Trent Local Research Network of the United Kingdom Stroke Research Network and undertake collaborative research projects, in a variety of areas including cardiovascular autonomic regulation in other co-morbidities, disability, and ageing.

The Department of Health Sciences (headed by [Prof Conroy](#)) has just moved to the newly built [George Davies Centre](#) on the University campus (2016). The Department is research-led, with external funding that currently stands in excess of £19 million provided by the NIHR, MRC, Wellcome Trust, Leverhulme Trust, Diabetes UK, NICE and other non-profit organisations. We host a wide range of health and health services research encompassing longitudinal studies and international collaborations. We have established strengths across epidemiology, medical statistics, public health, primary care, health services research, and psychiatry. The infrastructure is designed to support innovative multidisciplinary and multi-method solutions to research questions. Our mission is to conduct high quality research that can inform policies and practices aimed at securing people's health and well-being. In 2013, the Department was the first in the University of Leicester to gain an Athena Swan silver award in recognition of its ongoing work to advance the representation of women in medicine.

We regularly support intercalated medical student projects and have Academic Clinical Fellows within the junior doctor rotation, some of whom have gone onto clinical lectureships and senior lectureships.

Academic geriatric medicine plays a central role in teaching the [MBChB Undergraduate course](#) and offers [Postgraduate studies](#) including PhD, MPhil, MRes, as well as one-year and part-time [taught Masters courses](#).

### *Teaching*

Teaching involves students from Leicester University, who receive much of their clinical teaching at University Hospital Leicester (UHL). We plan to map the curriculum for frailty and insert relevant competencies, so that future graduates are well-versed in the needs of older people with frailty.

In addition, there will always opportunities for MRCP teaching and participation in teaching sessions involving physiotherapy, occupational therapy staff and nursing staff (our 'Frailty Flying Squad!').

### *Study and training*

[East Midlands Healthcare workforce Deanery](#) is committed to the development of postgraduate training programmes for both general and higher professional training as laid down by Colleges and Faculties, and by the Postgraduate Deans' network.

There is a newly refurbished postgraduate medical centre at the LRI and library at each of the other Leicester hospitals. Lectures on a wide range of topics are held regularly and all centres are actively concerned in vocational training of general practitioners in the area. There are many weekly postgraduate clinical presentations or lectures as well as academic meetings in the university departments.

### **Where are we heading?**

The focus of the Department of Geriatric Medicine is the collaborative care of frail older people in Leicester, Leicestershire and Rutland. Collaborations are key to the successful care of this vulnerable population and include partnerships with other services within UHL (emergency medicine, orthopaedics medicine), with other providers (e.g. Leicester Partnership Trust (LPT)), with commissioners (local clinical commissioners and national research commissioners such as NIHR), and key partners such as adult social care and the third sector.

### *Development/strategy*

1. Consolidate vertically integrated, seven day delivery of Comprehensive Geriatric Assessment for frail older people with urgent care needs, operationalised by:
  - Developing the Emergency Frailty Unit to a 7/7 service (July 2018)
  - By improving the Acute Frailty Unit
  - By augmenting input to orthopaedic care
  - By maintaining the geriatric bed base at five wards
  - By maintaining community hospital ward cover
  
2. Develop horizontally integrated Frail Older Peoples' Advice and Liaison services as a vehicle for knowledge transfer, to support:
  - UHL inpatient care (medicine, general surgery and oncology)
  - Older peoples mental health (LPT)
  - Community services (e.g. health and social care hubs in community hospitals)
  - And to develop Advance Nurse Practitioners that work across UHL and LPT
  
3. Develop the academic base of geriatric medicine by:
  - Securing additional senior academics in geriatric medicine and old age psychiatry at the University of Leicester
  - Developing the Department as a team of clinical educators in the care of frail older people
  - Appointing an undergraduate lead educator for frail older people (2016)

## Acute and community care (including dementia)

### Identifying models of care to improve outcomes for older people with emergency and urgent care needs

**Investigators:** Professor Simon Conroy, Dr Laia Maynou, Dr Louise Preston, Mr Peter Riley, Mrs Jagruti Lalseta, Professor Andrew Street, Professor Christopher Burton, Professor Graham Martin, Professor Sally Brailsford, Professor Suzanne Mason.

**Funder:** NIHR Health Services and Delivery Research (£931,653)

**Study Dates:** September 2018 – December 2021

**Summary:** Emergency and Urgent care (EUC) is a major international issue. This study will address EUC from the point of an ambulance being called through to admission, and/or transfer out from hospital, focussing upon interventions in the Emergency Department for older people. Older people with EUC needs, in particular those with frailty, are especially vulnerable to harms that can arise in this care pathway. The first hours of an EUC episode can have a powerful influence; for example, the early identification of delirium should lead to more assertive treatment (e.g. intravenous instead of oral therapy), early mobilisation and a review of potentially harmful medication (anticholinergics). Evidence based solutions are required, but it is unlikely that there is one single optimal care model given the various contexts. Rather, there will be a range of possible solutions, with overarching principles that can be specified. We will undertake a series of linked studies, with a focus on implementation, which will provide robust, practical and focussed user-guidance about how best to organise the care pathway in Emergency Departments, so as to improve outcomes for older people with EUC needs. We will conduct an evidence synthesis, in-depth stakeholder interviews, analysis of patient pathways and outcomes, and sophisticated modelling of complex systems.

#### *Methods*

Work Package 1 – identifying best practice

WP1.1 review of reviews of EUC interventions for older people, their outcomes and costs and any implementation factors identified.

WP1.2 interviews of older people and their carers with recent experience of EUC, using the findings to ensure that the patient's voice is at the centre of this study.

WP1.3 clinician interviews about emerging interventions and key elements of high quality care.

Work Package 2 – qualitative study of delivery of exemplar EUC pathways

Qualitative fieldwork (interviews, ethnography, and documentary analysis) in 4-6 sites exemplifying promising pathways, to identify aspects relevant to transfer and adaptation of these models to other settings.

Work Package 3 – routine patient level data analysis to describe EUC pathways, outcomes and costs

Analysis of linked databases to describe EUC pathways experienced by people aged 75+ across the Yorkshire and Humber region, 2010-2017. The aims are to assess which pathways deliver better patient outcomes than others, how pathways have changed over time, and what patient characteristics, demand factors and supply factors explain differences in outcomes and costs between patients, from place to place, and over time.

Work Package 4 – modelling improvements to EUC pathways

We will develop a family of System Dynamics (SD) computer simulation models representing patient flow through the entire care process for different EUC pathways, using evidence from WP1 and WP2 and data from WP3. We will use these models to evaluate EUC interventions in different settings, in terms of their impact on patient outcomes and their knock-on effects in the wider care system.

### *PPI*

PPI input will include high level strategic oversight of the study progress, assured by quarterly briefings to the PPI leads at the Executive Management Team meetings, complimented by 'deep dive' reviews of specific aspects of the project (for example scrutinising recruitment plans and interview schedules); quarterly consultations with the broader Leicester PPI forum to bring wider perspectives to the research; and focussed interaction with the East Midlands Centre for Ethnic Health Research.

### *Dissemination*

We will involve an existing, established national stakeholder group focussing on urgent care of older people with frailty. A comprehensive dissemination strategy (including evidence summaries, high impact papers, national and international conferences, press releases, and national dissemination events) will be developed and targeted to key audiences who will be interested in the findings of this research, informed by the stakeholder group.

### *Impact*

The primary output will be a validated, patient-centred, System Dynamics model(s) adaptable to all health care systems through an easy to use interface, allowing modelling of emergency department interventions on the whole system.

In addition, we will provide outputs relevant to teams planning and delivering EUC for older people, and to academics. These will include a user-friendly classification of the different types of care pathway, summarising the strengths and limitations of different approaches and key points of information about optimising their delivery.

### **How best to deliver Comprehensive Geriatric Assessment (CGA) hospital-wide in a cost-effective way? (HoW CGA)**

**Investigators:** Professor Stuart Parker, University of Newcastle (Principal Investigator). Professor Simon Conroy, Professor Graham Martin (University of Leicester). Dr Martin Bardsley (Nuffield Trust); Dr Helen Roberts (University of Southampton); Dr Sheila Kennedy (University of Sheffield)

**Funder:** NIHR Health Services and Delivery Research

**Study Dates:** Completed 2018

**Summary:** The aim was to provide high quality evidence on delivering hospital-wide Comprehensive Geriatric Assessment (CGA).

#### Objective(s)

- Define CGA, its processes, outcomes and costs in the published literature
- Identify the processes, outcomes and costs of CGA in existing hospital settings in the UK
- Identify the characteristics of the recipients and beneficiaries of CGA in existing hospital settings in the UK

- Develop tools which will assist in the implementation of hospital-wide CGA.

## Design

Mixed methods study combining a mapping review, national survey, large data analysis, and qualitative methods.

## Participants

People aged 65+ in acute hospital settings.

## Data sources

Literature review: Cochrane Database of Systematic Reviews, DARE, MEDLINE and EMBASE.

Survey: Acute hospital Trusts, United Kingdom.

Large data analyses: 1. People aged 75+ in 2008 living in Leicester, Nottingham or Southampton (development cohort, n=22,139). 2. Older people admitted for short-stay (Nottingham/Leicester, n=825), to a geriatric ward (Southampton, n=246) or community dwelling (Newcastle, n=754). 3. People aged 75+ admitted to acute hospitals in England, 2014-15 (validation study, n=1,013,590).

Toolkit development – multidisciplinary national stakeholder group (co-production); field-testing with cancer/surgical teams in Newcastle/Leicester.

## Results

Literature search: common outcomes included clinical, operational and destination but not patient reported outcome measures.

Survey: highly variable provision of multidisciplinary assessment and care across hospitals.

Quantitative analyses: in the development cohort, older people with frailty diagnoses formed a distinct group, and had higher non-elective hospital use. Patients with the highest 20% of hospital frailty risk scores had increased odds of 30-day mortality (OR 1.7), long length of stay (OR 6.0) and 30-day readmission (OR 1.5). The score had moderate agreement with the Fried and Rockwood scales.

Pilot toolkit evaluation: participants across sites were still at the beginning of their work to identify patients and plan change. In particular, the competing definitions of the role of geriatricians were evident.

## Limitations

The survey was limited by an incomplete response rate, yet still provides the largest description of acute hospital care for older people to date.

The risk stratification tool is not contemporaneous, although it remains a powerful predictor of patient harms.

The toolkit evaluation is still rather nascent, and could have meaningfully continued for another year or more.

## Conclusions

Comprehensive Geriatric Assessment remains the gold standard approach to improve a range of outcomes for older people in acute hospitals. Older people at risk can be identified using routine hospital data. Toolkits aimed at enhancing the delivery of CGA by non-specialists can be useful, but require prolonged geriatrician support and implementation phases.

## Future work

Comparing the hospital based frailty index against the electronic Frailty Index; further testing of the clinical toolkits in specialist services.

For more information, please contact Professor Simon Conroy: [spc3@leicester.ac.uk](mailto:spc3@leicester.ac.uk).

**Key words:** Acute Care, Older People, Comprehensive Geriatric Assessment

## **A qualitative study investigating the behavioural and psychological factors contributing to the misdiagnosis of urinary tract infection in adults**

**Investigators:** Professor Simon Conroy; Emma Regen; Kay Phelps: University of Leicester. Dr D Kondova, Dr K O'Kelly: University Hospitals of Leicester NHS Trust

**Funder:** British Geriatric Society, Leicestershire Improvement Innovation and Patient Safety Unit

**Dates of Study:** 01.01.2016 – 31.12.2016

**Summary:** Urine testing should be uncontroversial – urinary problems are common, and their assessment and management are widely taught. There are national guidelines that clarify the approach to testing and there are well-articulated adverse outcomes associated with sub-optimal care, including missed diagnoses, harms from unnecessary antibiotics, antibiotic resistance and added costs. Antibiotic treatment significantly increases the risk of adverse events such as rashes and gastrointestinal symptoms. Despite this there is evidence that urinary tract infection is incorrectly diagnosed in up to 40% of older patients in hospital.

The reasons why clinicians mis-diagnose urinary tract infection (UTI) are complex; clinical assessment can be difficult (especially in frail older people in whom communication may be impaired), teaching and learning vary (for example variable awareness of the prevalence of clinically significant levels of bacteria without the presence of symptoms and associated positive urine dip tests), and human factors play a significant part (e.g. the need to 'do something', the desire for simple explanations for difficult problems).

It is the 'human factors' aspect of this problem that has received the least attention. Yet by understanding why clinicians make the decisions they do regarding the diagnosis of UTI, we hope to make progress towards improving this seemingly complex problem.

A series of interviews with doctors and nurses (senior and junior) from an emergency department were undertaken in order to develop an understanding of the issues leading to what appears to be excessive reliance on urine testing. Results from these interviews have already led to changes in Practice in the ED. Further studies and interventions are underway and being planned to continue this work, including an interdisciplinary programme grant application (2018).

For more information, please contact Professor Simon Conroy ([spc3@le.ac.uk](mailto:spc3@le.ac.uk))

**Key words:** UTI, Older people, Emergency Care, Urine Dip.

## **Investigating the needs and experiences of older carers supporting a spouse or partner with a long-term condition**

**Investigators:** Dr Iain Williamson, Dr Diane Wildbur, Ms Katie Bell

**Funder:** Study A: Macmillan-DMU Partnership. Study B: Seed-corn money has been provided by De Montfort University. External funding to expand this study is currently being sought.

**Dates of Study:** Study A: October 2016 – December 2017. Study B: June 2016 – ongoing.

**Summary:** “Underrepresented Voices in Cancer Caregiving” (Study A) and “Understanding Older Peoples’ Perspectives on Caregiving” (Study B).

Study A is investigating caregivers’ experiences of supporting a partner with any type of cancer. It has a number of components and the ‘older adults’ arm of the study is accompanied by two other separate arms which are looking at ethnicity and sexuality specifically as all three ‘communities’ have typically been under-researched within contemporary research in caregiving. To be eligible for the ‘older adults’ arm participants need to be over the age of 60 years and able to consent to provide a current or recent account of supporting a long-term partner or spouse through cancer and associated treatment and support. Data are being collected through semi-structured interviews (typically around an hour in length), either face to face or, if preferred by the participant, over the telephone or through internet-based software such as Skype or Facetime. Data are being analysed through interpretative phenomenological analysis.

Project B is investigating caregivers’ views and experiences around providing informal care for a partner or spouse with a chronic health condition. Participants need to be over 60 and caring for a partner or spouse with a long-term health condition in their own home. For this study data are being collected through interviews and a technique called Q-methodology where participants sort a series of statements that they feel reflect their caregiving views and experiences. Data need to be collected face-to-face for this study – typically in participants’ homes or at support agencies and groups that they attend. Q-methodology is a technique that combines quantitative and qualitative analyses of data. Duration of participation is typically a little over an hour. This study is being run in collaboration with The Carers’ Centre Leicestershire and Rutland.

For more information, please contact Ms Katie Bell ([katie.bell@dmu.ac.uk](mailto:katie.bell@dmu.ac.uk)) or Dr Iain Williamson ([iwilliamson@dmu.ac.uk](mailto:iwilliamson@dmu.ac.uk)) for project A. Dr Diane Wildbur ([dwildbur@dmu.ac.uk](mailto:dwildbur@dmu.ac.uk)) for project B.

**Key words:** Caregiving; interviews; older adults; cancer; long-term conditions; Q-methodology

### **Behavioural analysis for personalised self-management of chronic diseases**

**Student:** Sarah Fallmann. **Supervisor:** Professor Liming Chen.

**Funder:** EU Horizon 2020, Marie Skłodowska-Curie, ITN, ETN

**Dates of Study:** 2016 - 2020

**Summary:** The work is concentrating on a personalized self-management system for chronic disease patients. This includes the analysing of sleep quality, the building of a behaviour analysis model representing the daily behaviour and the changes occurring after a good and bed night's rest and physical activities including exercises plans. The technology will use the latest wearable sensors and internet of things. The combination of different sensors will make the system adaptable, extendable and flexible to different users and help to meet the demands individually. The model will include vital signs and human behaviour to detect changes concerning chronic disease problems which will help patients to self-manage their wellbeing and health, and access their data anytime. To achieve this goal a sleep quality measurement will be developed and a behaviour data model will be constructed including data mining and pattern recognition algorithms. Later on, the inclusion of physical activity and exercise analyzation will help to improve patient's wellbeing. A decision making support mechanisms will be used to transport personalized important information to the users and care givers.

For more information, please contact Sarah Fallmann ([sarah.fallmann@dmu.ac.uk](mailto:sarah.fallmann@dmu.ac.uk)).

**Key words:** activity monitoring, health monitoring, multi-modal sensing, data collection, smart environment, sleep quality extraction, exercise performance, wellbeing, behaviour analysis, IoT sensors, wearable devices, environmental sensors.

## **Care(ers): An examination of the care and career experiences of mid-life women who combine formal employment and informal caring of a dependent adult**

**Student:** Louise Oldridge. **Supervisors:** Professor Anne-Marie Greene, Dr Mary Larkin, Dr Christine Nightingale

**Funder:** De Montfort University

**Dates of Study:** October 2014 – October 2017

**Summary:** It has been widely reported that the UK is facing a growing 'social care crisis' with an ageing population of people living longer but doing so with health problems. As over 900 paid carers quit their jobs a day, there is an ever increasing reliance on care provided on an informal basis, by friends and family, saving the state £132 billion a year. There are significant implications for those who provide such care, reported to include adverse effects on health and wellbeing, quality of life, maintenance of social networks, income and capacity to remain in employment.

The highest provision of such informal/unpaid care is provided by women between the ages of 50 – 64. According to the last census in 2011, one in nine people combine caring and formal employment. Previous research has demonstrated that those who are carers may find themselves having to reduce the number of hours they work, their levels of responsibility or even leave their jobs entirely. It is therefore important to understand the implications of caring on the careers of women in this age bracket, especially as careers literature sees them as being at their professional peak and the government is keen to encourage older workers to remain active in the labour market.

This PhD project focuses on women between the ages of 45 – 65 across Leicestershire who are currently, or have recently been, combining formal employment and informal caring to understand more about their care and career experiences. Interviews have been conducted with 30 women, starting by plotting their career trajectories, with a focus on how their career has been shaped by the point at which they became a carer (if they were able to identify this) and supplemented by questions around their careers and care.

The data is still being analysed and written up but the following themes have emerged thus far:

- There is much variation around expectations to provide care, but it is often linked to a reported belief in the failure of the adult social care system and the reliance on informal care.
- However, women also place expectations upon themselves to care, alongside family, upbringing, cultural and sometimes religious influences.
- Some women think about their caring as a type of work, in addition to their formal employment, often in the form of both physical and emotional labour. This is important as it means it should be considered when reviewing their career and its development.
- Frequently, women are talking about the additional skills that they have gained from caring but also the skills and experience from their employment history which helps them with caring, even where not directly care-related, such as project management.
- Participants do not always get the opportunity to have career development discussions but do still seek development in many cases.
- In light of their caring, career development becomes subjective rather than necessarily seeking upward progression and they often desire to combine employment and caring effectively.
- Where they are still working sometimes women feel a sense of guilt because they think they should be caring.

The research has implications for adult social care research policy and practice and also how carers are supported where they do continue to work in formal employment and has been presented at a number of national conferences, both academic and practitioner based. Louise will present at the Global Carework Summit in June 2017 at the University of Massachusetts (USA) and the research is generating interest at both a local and national government level.

For more information, please contact Louise Oldridge ([louise.oldridge@dmu.ac.uk](mailto:louise.oldridge@dmu.ac.uk)).

**Key words:** care, caring, career, women, mid-life

## **Diagnosis and management of dementia in primary care in Black Asian and Minority Ethnic (BAME) groups: An exploratory study**

**Investigators:** Professor Andrew Wilson (Principal Investigator), University of Leicester.

**Co-Applicants from the University of Leicester:** Ms Emma Regen, Miss Shona Agarwal, Ms Kay Phelps, Dr John Bankart

**Co-applicant from Leicestershire Partnership Trust:** Dr Hari Subramaniam

**Co-Applicant from De Montfort University:** Professor Raghu Raghavan

**Co-Applicant PPI Representative:** Ms Bina Sitaram

**Funder:** NIHR Research for Patient Benefit

**Dates of Study:** 01/09/2017 – 31/08/2019

**Summary:** In Black Asian and Minority Ethnic (BAME) groups in the UK, the number of cases of dementia is expected to rise seven fold by 2051. As GPs are usually the first professional consulted, their role is pivotal in assessing people who may have this condition. However there is evidence they find this more difficult with patients from some BAME groups because of cultural and language issues.

Our study is based in Leicester, where BAME groups comprise about half the population. Firstly we will assess the extent of the problem by using data from all 59 general practices in the city. We will calculate the proportion of people with dementia recorded and compare this to expected rates in three broad ethnic groups (White, Asian/Asian British and Black/Black British). We will also examine any differences in the use of screening tools for dementia and referral rates to specialists, and examine differences in severity of dementia at presentation and the use of medication to slow the progression of Alzheimer's disease.

To better understand the problem from professional and patient perspectives, we will recruit six practices from ethnically mixed parts of Leicester, with high and low identification and referral rates. In each practice we will conduct focus groups and interviews with practice nurses and GPs to explore barriers and enablers in diagnosing dementia in BAME groups. We will also interview a total of up to 30 patients and their family members/carers in participating practices who have recently been diagnosed with dementia, to understand their perspectives on how the diagnosis was made and their experience of the process.



EMRAN: Leicestershire Older People Research

[www.nottingham.ac.uk/emran](http://www.nottingham.ac.uk/emran)

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With input from PPI colleagues, we will use our findings to produce recommendations for good practice and seek further funding to develop an intervention to improve the primary care diagnosis and management of dementia in BAME groups.

For more information, please contact Professor Andrew Wilson ([aw7@leicester.ac.uk](mailto:aw7@leicester.ac.uk)).

**Key words:** Dementia, ethnicity



## Stroke

### Enhanced Control of Hypertension and Thrombolysis Stroke Study (ENCHANTED and STAY ENCHANTED)

**Investigators:** Professor T.G. Robinson in collaboration with the George Institute for Global Health, University of Sydney.

**Funder:** Stroke Association

**Dates of Study:** 2015-2017

**Summary:** The ENCHANTED study is a global public health study into acute ischaemic stroke aiming to improve the treatment of stroke which affects 15 million people worldwide causing premature death and disability. One in 10 people with stroke die in hospital, with many more suffering ongoing disability, highlighting the need for better treatments. Effective treatment of acute ischemic stroke could potentially improve the chances of survival and living without disability. The four key questions ENCHANTED aims to address are:

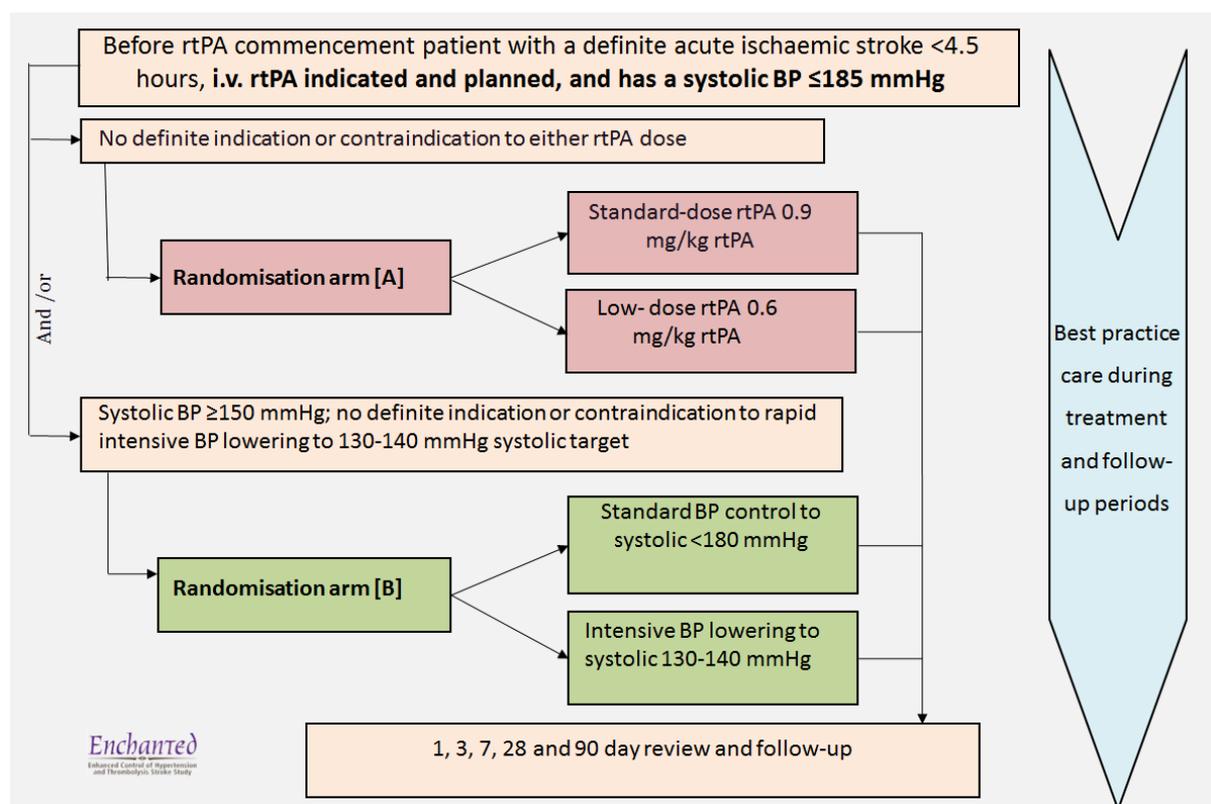
- Does low-dose (0.6 mg/kg) intravenous (i.v.) recombinant tissue plasminogen activator (rtPA) provide equivalent benefits compared to standard-dose (0.9 mg/kg) rtPA?
- Does intensive blood pressure (BP) lowering (130-140 mmHg systolic target) improve outcomes compared to the current guideline recommended level of BP control (180 mmHg systolic target)?
- Does low-dose (0.6 mg/kg) i.v. rtPA reduce the risk of symptomatic intracerebral haemorrhage (sICH)?
- Does the addition of intensive BP lowering to thrombolysis with rtPA reduce the risk of any ICH?

The study was split in to two parts. Part A built on research conducted in Japan, where low-dose rtPA (0.6 mg/kg) is the standard approved treatment for acute ischaemic stroke in that country. One hypothesis is that Japanese people, and possibly other Asian people, are more sensitive to rtPA than Caucasian people, but another explanation is that the dose of rtPA depends on the size of the clot in the brain causing the stroke. Examination of blood vessels in the brain during administration of rtPA has shown that

most clots dissolve quickly after the injection of rtPA, that is before the full dose is given over an hour.

However, as there have been no carefully designed research studies to compare between patients who have received the 0.9 mg/kg and 0.6 mg/kg doses of rtPA, we do not know which of the two doses is the best and safest. Also, given that rtPA is an expensive drug, which costs between \$1000 and \$2000 in most countries around the world, there are significant financial gains for patients, doctors and governments responsible for health care in knowing whether the 0.6 mg/kg dose, which costs less, is 'equally good' or 'better', or possibly 'worse', than the 0.9 mg/kg dose.

Part B concerns appropriate blood pressure management techniques, the control arm being subject to guidelines BP control with the other arm being subject to a more intense BP lowering treatment. The randomisation strategy is outlined in the below schematic.



For more information, please contact Professor Tom Robinson (tgr2@le.ac.uk)

**Key words:** Stroke, hypertension

## **Diversity in blood flow control of the brain: moving from individualized modelling towards personalized treatment of the injured brain**

**Investigators:** Professor TG Robinson, Professor R B Panerai. External collaborators from University of Southampton, University of Oxford, University of Santiago (Chile), University of Sao Paulo, the Cerebral Autoregulation Research Network and University Hospital Southampton NHS Foundation Trust.

**Funder:** EPSRC

**Dates of Study:** March 2014 – September 2017

**Summary:** The brain, more than any other organ in the body, requires a constant supply of blood in order to maintain its function. When blood pressure drops, small arteries dilate to restore flow levels, and when pressure rises, they constrict to protect the most delicate blood vessels and avoid bleeding in the brain. This control system can however become impaired for example following stroke, head trauma, in dementia or following premature birth and this has been associated with worse outcomes for the patient. Failure of the control system also has important implications for the management of patient's blood pressure: changes in blood pressure could be dangerous without the protection of this 'autoregulatory' system.

This project aimed to improve methods for measuring cerebral autoregulation and to gain a deeper understanding of the complex relationship between blood pressure and blood flow in healthy individuals and patients following stroke. While much work has been done in this field, experimental and technical challenges in assessing the control function has so far led to only limited benefit to patients. The control system is highly complex and, typical of such biological systems, there are multiple complementary physiological mechanisms working in parallel. There are indications that even in healthy individuals there are differences in the manner and the extent to which they control the flow. Impairment may also affect different mechanisms to a varying extent in different individuals. This has important implications for grading an individual's autoregulation, as the conventional approach, based on a single number to quantifying the strength of autoregulation, is likely to be inadequate.

This project sets out in a new direction for the field, by focussing on the diversity of ways in which brain blood flow may operate in different individuals, rather than studying average group behaviour, which has so far been the predominant approach. It also

breaks new ground methodologically by integrating the study of blood flow control with that of blood pressure control, based on the complementary roles these have in ensuring that the brain receives sufficient blood.

Patients able to provide consent as soon as possible after stroke onset has six assessments of blood pressure, heart rate and brain blood flow taken when at rest and in response to movement of the arm during breathing a 5% concentration of carbon dioxide. Up to 5 of these assessments were taken in the acute stroke phase, up to 72 hours from stroke onset (at 9, 12, 24 and 48 hours, depending on how soon after stroke the patient was admitted). The last two assessments for each patient were carried out in the subacute phase (within 2 weeks) and in the chronic phase (3 months after stroke).

Building on the differences observed in the healthy subjects, a group of patients were studied during the first days and weeks after they have suffered a stroke. Impairments in blood flow and blood pressure control were quantified, with a view to improving understanding of the evolution of this condition, and how it might impact the management of their blood pressure in the acute and chronic phase. Correct functioning of these control systems is thought to be key in making effective clinical decisions, but currently there are no clear guidelines due to a lack of understanding of the impairments in each individual patient and also the methods for their measurement.

The overarching aim of this multicentre and multidisciplinary project was to lay the foundations for a personalized approach to managing blood pressure control after stroke, based on characterising individuals' blood pressure and flow control, and thus to protect patients' brains from further damage.

For more information, please contact Professor Tom Robinson ([tgr2@le.ac.uk](mailto:tgr2@le.ac.uk))

**Key words:** Stroke, cerebral autoregulation, cerebral blood flow

## **Blood Pressure Variability (BPV) and stroke: its measurement, natural history and prognosis**

**Investigators:** Professor T G Robinson. Collaboration with Norfolk and Norwich University Hospitals, Norwich and John Radcliffe Hospital, Oxford

**Funder:** Stroke Association and British Heart Foundation

**Dates of Study:** July 2013 – June 2016

**Summary:** High blood pressure is a major risk factor for stroke. Recently, variation in blood pressure or blood pressure variability (BPV) has also been reported to be associated with stroke. Commonly used blood pressure lowering drugs have different effects on BPV which may, in part, explain the overall effect on the risk of stroke. However, more research is required to understand fully the natural history of BPV following stroke and how it can be used as an indication of stroke in the future. This study tested if BPV is an indication of risk of stroke and the possibility of future research. The study sought to answer the question: "What is the most appropriate technique to measure and define blood pressure variability in an acute stroke and Transient Ischaemic Attack (TIA) population, including beat-to-beat blood pressure monitoring, the timing and frequency of casual blood pressure measurements and the role of 24-hour and home blood pressure monitoring?" The outcome was death and dependency (Modified Rankin Score >2) at 3 months post-stroke.

All patients with minor stroke, who were managed in an outpatient setting and stroke patients managed in an inpatient setting, were recruited within 24 hours of onset of symptom. For all patients, BPV was measured at several time intervals using different BP recorders. Patients were followed-up over a 12-month period. BPV measurements were repeated at hospital discharge (for admitted patients) and at 1, 3 and 12 months (in all patients). Patients completed a questionnaire about the tolerability of BP measurement devices.

For more information, please contact Professor Tom Robinson ([tgr2@le.ac.uk](mailto:tgr2@le.ac.uk))

**Key words:** Hypertension, stroke, Transient Ischaemic Attack

## **Triple therapy prevention of Recurrent Intracerebral Disease Events Trial (TRIDENT)**

**Investigators:** Professor T G Robinson, in collaboration with Professor Craig Anderson (University of New South Wales) and Professor Clara Chow (University of Sydney)

**Funder:** Australian National Health and Medical Research Council

**Dates of Study:** January 2017 - ongoing

**Summary:** TRIDENT is an international medical research study which aims to determine the effect of more intensive blood pressure control to prevent recurrent stroke in patients who have had an intracerebral haemorrhage (ICH) (a stroke caused by ruptured blood vessel in the brain). The aim of this project is to test the superiority of a fixed low-dose combination blood pressure-lowering pill (Triple Pill) strategy in recurrent stroke in patients with a history of ICH.

Acute ICH accounts for at least 10% of the 20 million new strokes in the world each year. ICH survivors are at high risk of recurrent stroke and other serious cardiovascular events. Numerous studies have proven the benefit of stroke survivors reducing their risk of recurrent stroke through taking blood pressure-lowering medications. However, studies have shown that many ICH survivors are either not receiving any blood pressure-lowering medication or they are receiving inadequate control.

The TRIDENT Study will be conducted in Australia, the UK, The Netherlands, Sri Lanka, Taiwan, Malaysia and Japan, with expansion to other regions imminent. The study aims to recruit 4,200 patients from 150 centres around the world.

For more information, please contact Professor Tom Robinson ([tgr2@le.ac.uk](mailto:tgr2@le.ac.uk))

**Key words:** Stroke, intracerebral haemorrhage, blood pressure

**Rapid Intervention with Glyceryl trinitrate in Hypertensive stroke Trial-2 (RIGHT-2): Assessment of safety and efficacy of transdermal glyceryl trinitrate, a nitric oxide donor, and of the feasibility of a multicentre ambulance-based stroke trial**

**Investigators:** Professor Philp Bath (University of Nottingham), Professor T G Robinson

**Funder:** British Heart Foundation

**Dates of Study:** May 2015 - ongoing

**Summary:** High blood pressure is common in people who have a stroke because of a blood clot or a bleed – called ischaemic or haemorrhagic stroke – and people are more likely to die or become disabled because of it. So far trials to lower blood pressure in people with stroke have taken place but have produced mixed results, partly because blood pressure treatments have been tested too late. Previous trials have suggested that when given very early on after a stroke, a drug called glyceryl trinitrate (GTN), which is currently used to treat angina, can lower blood pressure and improve outcomes.

Professor Philip Bath and colleagues at the University of Nottingham have been awarded a grant from the BHF to carry out a larger clinical trial called RIGHT-2 to confirm if this is true, and if GTN used in these circumstances is safe. 850 patients from five areas around the UK who have had a stroke in the last four hours, and who have high blood pressure, will be recruited to the trial by the paramedics before they are admitted to one of 30 stroke hospitals around the country. Paramedics will take consent from the patient or relative, and then the patient will be allocated to either receive GTN given in a skin patch or a dummy skin patch.

All patients will be treated for four days, and some patients will have their brain blood flow assessed as well. This will help the researchers find out how the drug is working using neuroimaging and blood tests. The patients will be assessed again after ninety days, when the researchers will record the outcome – including whether the patient has died, if they are disabled, and what their quality of life and mood is like. If this trial is successful and finds that GTN can reduce death and dependency, it could reveal a new, simple way for paramedics to routinely treat patients with presumed stroke. This research could change the way we treat people who have had a stroke.

For more information, please contact Professor Tom Robinson ([tgr2@le.ac.uk](mailto:tgr2@le.ac.uk))

**Key words:** Stroke, hypertension, glyceryl trinitrate

## **Prevention of Hypertensive Injury to the Brain by Intensive Treatment after IntraCerebral Haemorrhage: a pilot randomised trial of home telemetry-guided treatment (PROHIBIT-ICH)**

**Investigators:** Professor David Werring (University College London Hospitals), Professor T G Robinson (University of Leicester).

**Funder:** Stroke Association

**Dates of Study:** October 2016 - ongoing

**Summary:** In the UK around 150,000 people have a stroke every year, with up to 23,000 caused by bleeding in the brain, called intracerebral haemorrhage (ICH). ICH is fatal in nearly 50% of cases, and survivors often have physical or memory and thinking (cognitive) problems, with a risk of further ICH and worsening cognition. Effective prevention of recurring ICH is therefore a key research goal.

ICH is usually due to a disease in the small blood vessels damaged by high blood pressure. Lowering blood pressure (BP) is the most promising way to prevent ICH, but many stroke survivors do not achieve good BP control. It is not known how lowering BP protects the brain, how much to lower it by, for how long, or how best to properly control it longer term. 'Telemetric' BP home monitoring looks very promising to control BP in minor stroke or transient ischaemic attack (TIA, "ministroke"), but has not been tested in survivors of ICH, who have more disability, or at multiple hospital centres.

In this study 100 ICH survivors will be randomly allocated to either home BP monitoring using telemetry (sending BP information to a study co-ordinating centre) to allow treatment adjustments to improve BP control; or to standard care. MRI scans of the brain will be taken to see whether intensive BP treatment reduces brain injury over time, assessed by the build-up of new, tiny areas of bleeding (cerebral microbleeds). This study could show whether more intensive lowering of BP in survivors of ICH is possible, safe and effective in reducing brain injury. If successful, a larger definitive trial may be designed. The intervention should allow survivors of ICH to know, understand and manage their own BP to prevent strokes and cognitive impairment and improve outcomes.

For more information, please contact Professor Tom Robinson ([tgr2@le.ac.uk](mailto:tgr2@le.ac.uk))

**Key words:** Intracerebral haemorrhage, transient ischaemic attack, blood pressure

**A feasibility study to identify attitudes, determine outcome measures and develop an intervention to inform a definitive trial that will determine the effectiveness of adapted cardiac rehabilitation for sub-acute stroke patients**

**Investigators:** Nicola Clague-Baker (University of Leicester), Professor T G Robinson

**Funder:** Stroke Association

**Dates of Study:** September 2014 to August 2017

**Summary:** This feasibility study will be undertaken in 4 parts.

Part 1 - participant interviews exploring attitudes to exercise and cardiac rehabilitation before and after stroke.

Part 2 - health professional focus groups discussing cardiac rehabilitation and attitudes to exercise before and after stroke.

Part 3 - a validity study comparing the assessment of cardiovascular fitness of stroke participants using three different measures; the six minute walk test, the shuttle walk test and the VO<sub>2</sub> peak test measured on a static bike.

Part 4 - participants undergo baseline assessments and then attend cardiac rehabilitation programme twice a week for six weeks. At the end of the six weeks baseline measures are repeated and participants are interviewed about their experiences.

As this is a feasibility study the aim is to explore service user and health professionals' attitudes, determine outcome measures and establish an intervention to inform a definitive trial that will determine the effectiveness of adapted CR for sub-acute stroke patients.

For more information, please contact Nicola Clague-Baker ([njc36@le.ac.uk](mailto:njc36@le.ac.uk)).

**Key words:** Feasibility, cardiac rehabilitation, sub-acute stroke

## **Safety and Efficacy of Triple Antiplatelets for Reducing Dependency After Ischaemic Stroke: the TARDIS Randomised Controlled Trial**

**Investigators:** Professor Philip Bath (University of Nottingham), Professor T G Robinson (University of Leicester)

**Funder:** NIHR Health Technology Assessment programme

**Dates of Study:** April 2009 – September 2016

**Summary:** The risk of recurrence is greatest immediately after stroke or Transient Ischaemic Attack (TIA). Existing prevention strategies (antithrombotic, lipid/blood pressure lowering, endarterectomy) reduce, not abolish, further events. Dual antiplatelet therapy - aspirin & clopidogrel (AC) for IHD, aspirin & dipyridamole (AD) for stroke, is superior to aspirin monotherapy. The investigators hypothesise that triple antiplatelet therapy (ACD) will be superior to AD in patients at high-risk of recurrence, providing bleeding does not become excessive.

Design: TARDIS is a multicentre, parallel-group, prospective, randomised, open-label, blinded-endpoint, controlled trial. In the start-up phase, the investigators will assess over 3 years the safety, tolerability and feasibility of intensive therapy (ACD) versus guideline therapy (AD) given for 1 month in 750 patients with acute stroke/TIA. The main phase will then assess the safety and efficacy of ACD in up to 3500 patients. The primary outcome is ordinal stroke (fatal/severe non-fatal/mild/TIA/none) at 90 days. Secondary outcomes include death, MI, vascular events, function, bleeding, serious adverse events; sub-studies will assess cerebral emboli and platelet function.

Detailed Description:

To perform a randomised trial assessing the efficacy, safety and tolerability of intensive antiplatelet therapy (Asp+Dip+Clop) versus guideline antiplatelet therapy (Asp+Dip or Clop) in patients with recent ischaemic stroke or TIA and who are at high risk of recurrence.

Primary Objective: To assess ordinal stroke severity at 90 days after short-term administration (1 month) of intensive antiplatelet therapy versus guideline therapy in patients with very recent ischaemic stroke or TIA.

Secondary Objectives: To assess the safety of short-term administration (1 month) of intensive antiplatelet therapy versus guideline therapy in patients with very recent ischaemic stroke or TIA. To further assess, in high risk patients with stroke/TIA, whether it is feasible to administer intensive therapy acutely and is tolerable to take for 1 month, intensive therapy is superior in respect of surrogate markers such as platelet function and if intensive therapy improves functional outcome.

For more information, please contact Professor Tom Robinson ([tgr2@le.ac.uk](mailto:tgr2@le.ac.uk))

**Key words:** Transient Ischaemic Attack, antiplatelet therapy, short-term administration

### **Tranexamic acid for hyperacute primary Intracerebral Haemorrhage**

**Investigators:** Nikola Sprigg, Katie Robson, Philip Bath, Robert Dineen, Ian Roberts, Tom Robinson, Christine Roffe, David Werring, Rustam Al-Shahi Salman, Stuart Pocock, Lelia Duley, Tim England, David Whynes, Alfonso Ciccone, Ann Charlotte Laska, Hanne Christensen, Serefnur Ozturk, Ronan Collins, Daniel Berezki, Juan Jose Egea-Guerrero, Zhe Kang Law, Anna Czlonkowska, David Seiffge, Maia Beredzie.

**Funder:** NIHR Health Technology Assessment Programme

**Dates of Study:** 2013 - 2017

**Summary:** Tranexamic acid for hyperacute primary intracerebral haemorrhage (TICH-2) aims to test the hypothesis that intravenous tranexamic acid is superior to placebo by reducing death or dependency at day 90 when given within 8 h of SICH.

Intracerebral haemorrhage (ICH) is a devastating form of stroke, with high early mortality; of those who survive, the majority remain disabled. Despite advances in management of ischemic stroke, outcome following ICH has remained static for decades. Around a quarter of ICH are complicated by hematoma expansion (HE); this most often occurs within the first few hours, but can occur up to 24 h from spontaneous ICH (SICH) onset and is associated with poor outcome. Recent evidence has shown that intensive early blood pressure lowering can improve functional outcome, and this has been incorporated into clinical guidelines.

Haemostatic drug therapies aimed at limiting HE have been tested in SICH, with recombinant factor VIIa being the most widely studied. Meta-analysis of these and other haemostatic therapies found no significant benefit on outcome. Tranexamic acid, an antifibrinolytic drug, significantly reduced mortality, with no increase in vascular occlusive events, in patients with major bleeding following trauma. In a subgroup analysis of patients with traumatic ICH, tranexamic acid showed a nonsignificant trend to reduce mortality and death or dependency. A meta-analysis of the only two trials of tranexamic acid in traumatic intracranial hemorrhage showed a significant reduction in posttraumatic intracranial bleeding. However, the confidence interval is wide and a larger trial is ongoing.

Tranexamic acid has also been tested in aneurysmal subarachnoid hemorrhage, where it reduced the risk of re-bleeding at the expense of increased risk of cerebral ischemia. However, prolonged administration of tranexamic acid for seven days, and the known risk of delayed cerebral ischemia without tranexamic acid after aneurysmal subarachnoid hemorrhage, may explain the greater risk of vascular occlusive events. In two small nonrandomized studies, tranexamic acid was reported to restrict HE following ICH. In a subsequent small pilot randomized study, administration of tranexamic acid was feasible and well tolerated after ICH. There have been recent calls for large trials to evaluate tranexamic acid in ICH, and several phase II studies are ongoing.

For more information, please contact Professor Tom Robinson ([tgr2@le.ac.uk](mailto:tgr2@le.ac.uk))

**Key words:** Hyperacute intracerebral hemorrhage, tranexamic acid, randomized trial, placebo controlled

## **Bridging the age gap in breast cancer: Improving outcomes for older women**

**Investigators:** 57 centres across England and Wales, including University Hospitals Leicester.

**Funder:** NIHR Programme Grant for Applied Research

**Dates of Study:** July 2012 – October 2017

**Summary:** Bridging the Age Gap is an NIHR funded study that aims to optimize the management of older women and reduce the age-gap in cancer outcomes between older and younger women with breast cancer by:

- Developing a predictive tool to tailor treatment options for older women according to breast cancer factors and their fitness/frailty
- Developing a Decision Support Instrument (DESI) to assist older women making informed decisions about their preferred treatment

The second phase, which will be embedded within the existing study, will be to evaluate whether use of a package of decision support interventions (DESIs), given to 50% of existing sites and embedded as 'standard of care', helps to improve the quality of life, decision quality, decision regret, satisfaction and treatment understanding of older women entering the Age Gap study. These DESIs will be aimed at women facing a choice of surgery or primary endocrine therapy (PET) or, following surgery, for those with higher risk cancer facing a choice of chemotherapy or no chemotherapy. These are the two areas where clinical practice in older women differs most markedly from that in younger women and where there are high levels of variation between breast units.

A package of decision support interventions (DESIs) have been developed and will form a resource to be implemented in half of the Age Gap recruiting sites as part of standard care. These sites will be trained in their use which will become a routine part of the counselling they are able to offer all women, whether they are in the Age Gap study or not.

The DESIs comprise 2 patient facing booklets designed especially for older women facing these choices and 2 web based algorithms (a bit like PREDICT or adjuvant on line and just as easy to use) which may be used by the clinical team to predict individual risk and benefit information that may be shared with an individual patient. These resources have been carefully developed using the best available evidence and have undergone

extensive user testing. Sites will be allocated at random to have access to use these decision tools as part of routine care or simply continue with normal best practice pre-treatment counselling.

Recruitment, eligibility and data collection for the study will largely be unchanged with all of the current outcomes collected. The only changes are the addition of a few new questionnaires about their pre-treatment counselling and decision making and the ability to use the decision aids if they wish to help patients decide on treatment (optional and only if the patient is facing that particular choice) in half of centres. Staff and patients in a small percentage of selected sites will be asked to give feedback about the resources as part of a formal process evaluation.

We expect that recruitment to the main study will have reached 2000 by the time we introduce the DESIs into 50% of our sites in October 2015 (based on a recruitment rate of about 70 per month and the fact that we are just over 1700 now). The study will continue to run for a further 24 months and recruit a further 1600 cases. Most of the data from these phase 2 patients will be co-analysed with the main cohort, but sub-group analysis will take place to compare outcomes in the intervention sites and non-intervention sites. We expect recruitment rates to be similar in phases 1 and 2 as the study is largely unchanged other than that staff will have access to the DESIs to use alongside their routine counselling resources as part of normal practice.

For more information, please contact Lynda Wyld ([l.wyld@sheffield.ac.uk](mailto:l.wyld@sheffield.ac.uk)) or Malcolm Reed ([m.w.reed@sheffield.ac.uk](mailto:m.w.reed@sheffield.ac.uk))

**Key words:** Breast cancer, older women, decision support intervention

## **Novel ultrasound methods for the detection and deflection of emboli in the bloodstream**

**Investigators:** Dr. Emma Chung (University of Leicester, University Hospitals Leicester NHS Trust)

**Funder:** Engineering and Physical Sciences Research Council

**Dates of Study:** August 2014 – June 2017

**Summary:** Stroke affects approximately 150,000 people each year at a rate of one person every five minutes, and is the leading cause of adult disability, and third leading cause of death, in the UK (Stroke Association, UK). The majority of strokes are caused by pieces of plaque debris and blood-clots (emboli) that detach from the insides of diseased vessels and travel through the bloodstream to become lodged in the brain. Other sources of emboli include air bubbles entering the bloodstream during cardiovascular surgery, or formation of bubbles during sudden decompression (e.g. in Divers or Astronauts).

Since emboli are carried rapidly through the bloodstream at speeds of up to 1 m/s, conventional ultrasound machines, which build up an image line-by-line, are too slow to capture their motion. Emboli are therefore not usually visible on ultrasound images. Currently, emboli are detected using the same 'Doppler principle' as used to detect speeding cars, which is great for detecting emboli speeding through arteries, but is unable to provide information on embolus size or composition. As large pieces of plaque and blood clots are much more hazardous than small bubbles, it is vitally important that clinicians can distinguish between them. Unfortunately, this is not possible using existing Doppler-based techniques. Therefore, we are keen to develop new methods of determining embolus size and composition. This research utilises recent advances in ultrafast ultrasound imaging technology to capture the ultrasonic appearance and motion of emboli at high speed. Since large particles and tiny bubbles are expected to respond differently to the presence of an acoustic radiation force, this could potentially provide a method for distinguishing between them. If a sufficiently large acoustic radiation force can be directed toward the embolus this also has potential for altering the trajectories of emboli at arterial bifurcations to divert emboli away from the brain. Diversion of bubbles and debris may help to reduce the risk of brain injuries during surgical procedures and is not thought to be harmful to other organs. New methods for embolus detection and characterisation could also be useful for monitoring the sizes and compositions of emboli

in patients. At present, many operations involving the heart and arteries carry a high risk of brain injury, which could potentially be avoided using embolus deflection devices. In addition to deflection of emboli away from vital organs, potential applications of our research include 'steering' of ultrasound microbubble contrast agents, or drugs, towards targets of interest.

1. The first part of our study investigates the potential for detecting solid particles and bubbles by relating the Doppler ultrasound scattering properties of emboli to their appearance in the ultrafast ultrasound image. Particular attention will be paid to examining the properties of solid and gas emboli that generate equivalent Doppler signals.
2. The second part of the study directs a focused ultrasound beam toward the moving embolus to slightly alter its trajectory. As bubbles feel the 'push' of the ultrasound beam more strongly than solid particles, we expect that bubbles, thrombus, and plaque will generate differing responses to application of an acoustic radiation force, which will enable us to distinguish between them.
3. Finally, we investigate whether it would be feasible to direct a stronger acoustic radiation force to divert solid and gaseous emboli along one artery rather than another. This will be tested using physiologically realistic laboratory models. The ability to safely direct emboli away from the cerebral arteries, or toward targets of interest, has potential to reduce the number of emboli reaching the brain use during heart surgery, and improve the neurological safety of medical procedures involving the heart and arteries.

For more information, please contact Dr. Emma Chung ([emlc1@le.ac.uk](mailto:emlc1@le.ac.uk))

**Key words:** Stroke, ultrasound imaging, acoustic radiation

## Technology

### **ACROSSING: Advanced TeChnologies and PlatfoRm fOr Smarter ASsisted LivING**

**Investigators:** Professor Liming Chen (Professor of Computer Science, De Montfort University)

**Funder:** EU Horizon 2020, MARIE Skłodowska-CURIE ACTIONS, Innovative Training Networks, €3.88millions, 10 partners from 6 EU countries, 15 researchers

**Dates of Study:** 01 January 2016 – 31 December 2019

**Summary:** Smart Home (SH) provides a promising approach to assisted living for the ageing population. Yet it still remains a challenge to develop and deploy such solutions in a large scale due to the lack of an easy-to-use technology infrastructure and application exemplars. This problem arises from the nature of the SH field: multidisciplinary, diverse in its applications, and with multiple stakeholders. Whilst a one-size-fits-all technology infrastructure seems unlikely, alternatives are still missing. In addition, an effective approach to cross-discipline, cross-sector understanding for best practices has so far not been seen.

ACROSSING addresses this problem by implementing a multidisciplinary cross-sector pan-European training network to knock down barriers between disciplines and sectors and providing the ESRs with a broad training experience. ACROSSING develops 15 topically complementary research projects covering four core research themes, and four main application categories. By multidisciplinary collaborations and cross-sector interactions, the ESRs will develop flexible, interoperable underlying technologies which are then applied to and evaluated in multiple real application scenarios, leading to four specialised technology infrastructures and four best-practice application demonstrators. ACROSSING also deliver comprehensive blended training by combining campus-based and industrial practice training, and perspectives on personal development and social issues by well-established researchers and practitioners from academic, industry and user organisations. Whilst the scientific focus is to challenge the traditional way of SH research to develop advanced technologies and platforms, the training will train ESRs to establish links between research, real-world problems, innovation and personal career. ACROSSING will share software and datasets using open source technologies, and promote findings and impact through a number of measures, e.g. online, outreach events.



More information: ACROSSING website, project leaflet, project poster, project newsletter.

For more information, please contact Professor Liming Chen ([liming.chen@dmu.ac.uk](mailto:liming.chen@dmu.ac.uk)).

**Key words:** Smart homes, assisted living, data analytics, independent living, self-management, early risk detection, healthy ageing

**Responsible-Industry: Responsible Research and Innovation in Business and Industry in the Domain of ICT for Health, Demographic Change and Wellbeing**

**Investigators:** Professor Bernd Carsten Stahl, coordinator. Professor/Director Centre for Computing and Social Responsibility.

**Funder:** European Commission, FP7 Science in Society

**Dates of Study:** January 2013 – July 2017

**Summary:** The *Responsible-Industry* project is designing an Exemplar Implementation Plan of RRI in Industry to demonstrate how industry can work productively together with societal actors and integrate principles and methodologies of RRI into research and innovation processes. To achieve maximum impact where it is most needed, the implementation plan will focus on the grand challenge of health, demographic change and wellbeing. More specifically the project will focus on the role that research and innovation in ICT can play in addressing this challenge.

For more information, please contact Professor Stahl ([bstahl@dmu.ac.uk](mailto:bstahl@dmu.ac.uk)).

**Key words:** Responsible research and innovation, ICT, demographic change



## **Decoding Composite Activities Performed within a Smart Home Environment**

**Student:** Darpan Triboan. **Supervisors:** Professor Liming Chen, Dr Feng Chen.

**Funder:** De Montfort University

**Dates of Study:** 2015 - 2018

**Summary:** As the aging population is rising, ambient assisted living (AAL) systems are being developed as a tool to aid elderly, carers and other stakeholders to improve the quality of life and encourage independent living. There are several challenges in building an AAL systems to support an elderly person to perform their activities of daily living (ADLs). One of the active research challenges in AAL systems is performing accurate human activity recognition (HAR) in a given smart environment. This project seeks to identify and address some of the challenges in performing HAR when performed in simple or composite manner. More specifically, algorithms are being developed to dynamically segment the sensor data stream from the smart environment, perform inferencing and reasoning to recognise complex activities using semantical ADL model and providing just-in-time assistance to the inhabitant. In addition, activity learning and pattern discovery algorithm will be further investigated using data-driven and knowledge-driven approaches to evolve the static ADL models as inhabitant's habit's and personal preferences changes over period of time. Finally, the system prototypes with different algorithms will be synchronised, built and deployed in the real-time wireless sensing network (WSNs) environment in order to test and evaluate the system on its accuracy, scalability and usability.

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**Key words:** Mixed Activity Recognition, Knowledge Modelling, Semantic Reasoning, Smart Environment, Wireless Sensor Networks (WSNs).

## **Privacy preserving, standard based wellness and activity data modelling and management within Smart Homes**

**Student:** Ismini Psychoula. **Supervisors:** Professor Liming Chen, Dr. Feng Chen, Professor Duska Rosenberg.

**Funder:** EU Horizon 2020 Marie Sklodowska-Curie Action, ITN, ETN

**Dates of Study:** 08/09/2016 – 08/09/2019

**Summary:** The management of personal information and user acceptance of smart home systems is a critical factor that hinders the adoption of this promising approach due to severe privacy concerns. Especially in assisted living where large volumes of personal or private data generated by an ample number of applications, sensors and health devices, the study of risk and risk factors related to managing personal information is important. This study investigates effective ways to provide users with a comprehensive and up-to-date view of the entire system in order to support the management of the home. In particular, the management of information generated within the system, without compromising either the system security or the personal privacy of the user, is a major challenge. This leads to a need for privacy tools that provoke awareness of the information security practices of a smart home system and enable users to manage the privacy of their personal information. Current systems do not provide users with mechanisms to control their personal information, to understand the trade-offs between sharing personal information and privacy, or to provide users with intuitive tools that will allow them to understand how their personal information participates and contributes to the flow of information in the smart home system. So, the study aims to create tools that empower privacy in smart home environments and will permit inhabitants to limit the exposure of their personal information. The design of these tools is based on a participatory design approach by incorporating different interest groups such as end-users, service providers, experts, as well as other stakeholders and includes them as active members of technology development to increase user acceptance.

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**Key words:** Smart Homes, Internet of Things, Privacy by Design, Privacy Preservation, Security, Data Management, User-acceptance, Enabling Ambient Assisted Living

## **MemoryCare – Research to improve care for people with dementia in hospitals**

**Investigators:** Katie Featherstone (Cardiff University – PI). Andy Northcott (De Montfort University – Co-Applicant/Researcher)

**Funder:** NIHR Health Services & Delivery Research

**Dates of Study:** 01/11/2017 – 30/05/2018

**Summary:** An ethnography of everyday ward continence and toileting practices for people with dementia in NHS acute hospital settings throughout England and Wales. The study aims to identify challenges, increase knowledge of how to improve patient experiences and outcomes, enhance awareness of toileting strategies and their effects and improve understanding of current service organisation and delivery and its impact on patient care.

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**Key words:** Dementia, Continence, Acute Hospital Settings, Ethnography, Service Delivery.