

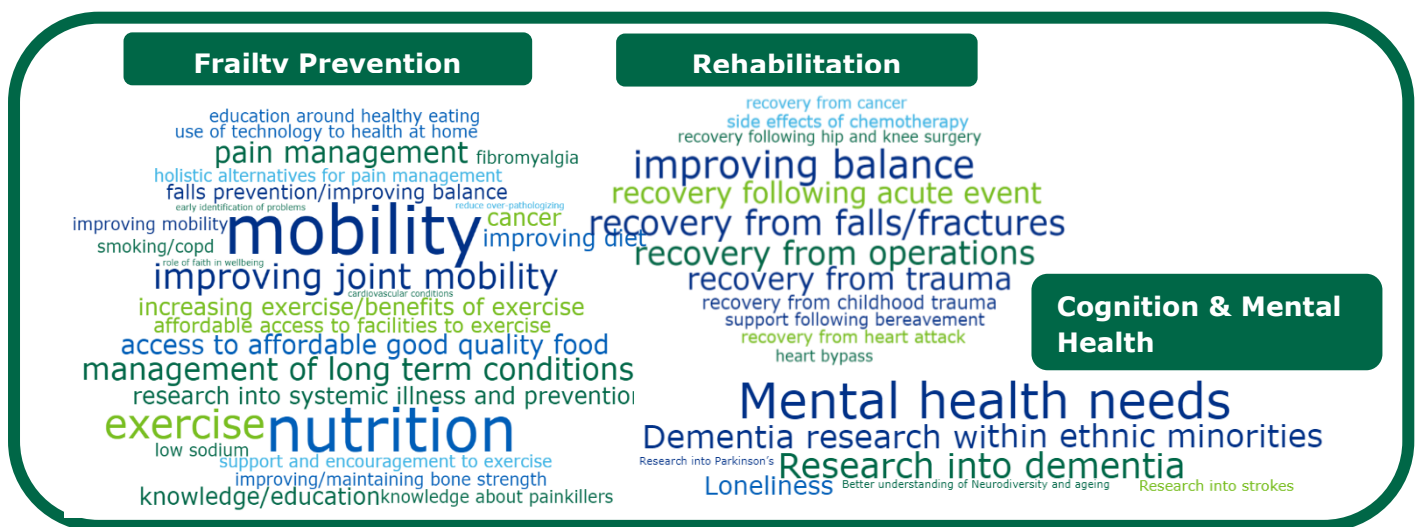
Background:

FAIRER-DTP will focus, like the ACHA, on applied health research, responding to the needs of our local population and health and care system and seeking implementable solutions.

In line with the principles of ACHA, we intend to embed three non-clinical PhD studentships in a vibrant community of applied health researchers, clinicians and health professionals and local people.

The six potential doctoral research projects were developed in line with the community priorities identified during ACHA’s recent engagement work. Through a series of events and surveys, we asked local people and hospital patients about their concerns, priorities, and pressing clinical questions regarding healthy ageing. This approach ensures our research listens to, involves, and addresses the needs of our local community.

The following word clouds summarise the responses (sized according to prevalence).



Research Projects detailed in this document:

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2. Designing an inequalities focussed digital health intervention for healthy ageing. Page 4
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3. Development of a rehabilitation intervention to reduce concerns about falls among carers of older adults with cognitive impairment and fracture. Page 6
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PROJECT 1: Understanding inequalities in delirium identification to improve care and patient outcomes

Background: Delirium is an acute neuropsychiatric syndrome affecting over 40% of general hospital patients over 65 years old. It is characterised by acute onset and fluctuating course of disturbed attention, consciousness, orientation, memory, behaviour, perception and sleep cycle. It is associated with many poor outcomes; distress to patients, carers and staff, longer admissions, falls, pneumonia, pressures sores, future dementia, death, and significant increased costs for hospitals and social care¹.

Rationale: Delirium detection is essential to improve outcomes. Diagnosis gives access to specialist care, supporting communication with patients and relatives. Delirium screening using the 4-AT (a three minute verbal bedside test)² is mandated for all those 75 years and above admitted to English hospitals, but implementation is patchy². There is limited USA evidence that people from ethnic minorities or deprived areas are less likely to have delirium screening or receive proper treatment¹.

Aims: We will use Barts health data to examine the impact of inequalities, particularly ethnicity and deprivation on delirium screening across the trust. We will use qualitative techniques to explore the understanding of delirium in patients and staff and develop pragmatic actions to improve care³.

Objectives

- 1) Conduct a scoping review of any literature around delirium and inequalities and how these impact on patient, carer and service-level outcomes.
- 2) Explore delirium detection and coding prevalence and the impact of inequalities across Barts Health
- 3) Understand barriers and facilitators to delirium screening in disadvantaged groups and how this could be improved in practice across Barts Health.

PPIE: This submission has developed from our DeNPRU-QM PPIE group. The student will work with two PPIE members from project initiation. They will advise the student on all aspects of their research, comment on patient facing materials, interpret findings through their lived experience and inform intervention development. The student will learn to reflect on and evaluate PPIE input into their work.

Potential methods: These are flexible and the student will be supported to adapt study questions as knowledge and their thinking develops. ***The student could focus on a Barts Health specialist area, for example, renal care, trauma, fragility fracture pathway with supervision from an expert in the chosen field.***

Scoping review: guided by Preferred Reporting Items for Systematic Reviews and Meta-Analyses (PRISMA) guidelines for scoping reviews, will inform the data analysis plan and qualitative work.

Data study: Clinical and demographic data, from Barts Health Cerner Millennium Electronic Medical Record (EMR) data warehouse. Main outcome will be completion of the 4-AT delirium screening tool: a mandatory pop-up window when an older person is admitted to hospital. Data suggest over 1000 patients should be screened/month. Exposures of interest informed by the scoping review include ethnicity, defined using NHS ethnic category codes and relative measures of socioeconomic deprivation using national Index of Multiple Deprivation (IMD) quintiles. Initial analyses will describe and explore 4-AT data, including prevalence of missing items and then the documentation of a correct Barts Trust delirium code. Potential hypotheses that could be modelled and tested include whether particular 4-AT items are more commonly missed, and delirium under-coded in people from ethnic minorities and if there is an interaction between ethnicity and socioeconomic status driving lower levels of delirium screening.

Qualitative interviews: Semi-structured interviews (topic guide developed from scoping review) with purposive sample of people from groups identified in the health data study (interpreters used where necessary). Staff will be purposively sampled for a range of roles, i.e. junior doctors, nursing staff. This gives contextual understanding of key barriers and facilities to delirium screening. There is potential for the student to explore understanding of delirium in our local ethnic minority groups.

Key deliverables

- 1) Academic papers from scoping, health data and qualitative interviews.
- 2) Understanding of inequalities in delirium across Barts Health, first European study of this issue.
- 3) Practical and measurable methods to improve delirium screening across Bart Health.
- 4) Capacity building- ACHA PhD student with experience of embedded PPIE, skilled in mixed methods health service research, ready for competitive post-doctoral fellowship bid.

Supervisory team: highly experienced supervisory team (>15 completed PhD students). Delirium health data research, links to international networks i.e. European Delirium Association (Sampson)⁴. Mixed method research, health inequalities (Rawle). Understanding ethnicity, geography, place, leadership in PPIE (Kenten). Qualitative research and pragmatic intervention development (Davies).

References: ¹Wilson et al. 2020, doi: [10.1038/s41572-020-00223-4](https://doi.org/10.1038/s41572-020-00223-4), ²Penfold et al. 2024, doi.org/10.1111/jgs.18751, ³Bauernfreund et al. 2018, [10.1136/bmjog-2017-000200](https://doi.org/10.1136/bmjog-2017-000200), ⁴Bauernfreund et al. 2023 doi: [10.1111/acps.13480](https://doi.org/10.1111/acps.13480)

PROJECT 2: Designing an inequalities focussed digital health intervention for healthy ageing

The world's population is aging rapidly, with the number of people aged 60 and older expected to double by 2050 (1). This demographic shift brings both challenges and opportunities for supporting the health and well-being of older adults. . As lifespans increase, older adults face higher risks of conditions like heart disease, cancer, diabetes, arthritis, dementia and loss of functional independence (2). Digital health interventions (DHIs) like telemedicine, remote patient monitoring, and mobile health apps could help address aging challenges if designed accessibly and widely adopted (3). Studies show DHIs can improve chronic disease management, facilitate preventive care, promote aging in place and support older adults' mental health (4-7). However, disparities in technology adoption among older populations persist, influenced by racial, socioeconomic, and geographical factors (8, 9). Digital inequalities and health have been highlighted in recent government publications, including a plan for digital health and social care in England (10), guidance to commissioners and health care providers on digital inclusion (11) and recommendations on how future digital health approaches can address ethnic inequalities in healthcare (12) as well as by other high profile organisations (13, 14). Evidence suggests that early consideration of inequalities in the development of DHIs, and a focus on implementation is important. For example, early and meaningful engagement of Public and Patient Involvement, using co-production approaches (15) and culturally competent user-centred design can promote the uptake, use, and benefit of digital health approaches (15, 16).

The overall aim of the PhD will be to design a prototype intervention (or make an appropriate adaptation to an existing intervention) designed to support healthy ageing and engage users at risk of digital and health inequalities. A Core20plus approach (17) focusing the intervention design on populations living with social deprivation and an intersectional lens to include other identities that may contribute to inequalities including age, ethnicity and gender will be taken.

Specific objectives and methods include: 1) Scoping review of the the current evidence base on DHIs for healthy ageing and to understand how inequalities might be addressed. This review may also lead to the identification of existing interventions that could be adapted 2) Qualitative interview study with underserved groups and key NHS and social care stakeholders to understand the wants and needs of a healthy aging DHI and how it might be used and implemented in practice 3) Development of a programme theory for a healthy aging DHI, specifying what works, for whom and in what context, using principles of co-design and combining findings from studies 1&2. 4) Co-design a prototype intervention with service users.

PPI: JR is the SPCR PPI lead and will identify members from underserved groups to shape the PhD and be involved from beginning to dissemination. PPI members will meet regularly with the student and receive relevant training and reimbursement to enable them to be involved in each phase of the research. PPI members will be offered authorship opportunities.

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PROJECT 3: Development of a rehabilitation intervention to reduce concerns about falls among carers of older adults with cognitive impairment and fracture

Background: In the UK, 549,000 fragility fractures occur annually. Many fail to recover mobility to return to community activities and life roles. This may be due to a focus on physical recovery during rehabilitation with limited regard for the psychosocial consequences of fracture.¹ Indeed, concerns about falls are common among patients² and carers following fracture.³ Concerns may reflect a realistic risk appraisal after fracture and lead to protective behaviour e.g. removing trip hazards.⁴ However, for some, concerns lead to 'maladaptive' behaviours such as activity restrictions that increase risk.² Addressing these concerns has become an emphasis of rehabilitation research. Interventions developed targeting these concerns after fracture have focused on community-dwelling older adults without cognitive impairment. There is a need to determine how to address carer concerns to optimise rehabilitation for older adults with cognitive impairment and fracture.

Aims and objectives: The aim is to develop a rehabilitation intervention to reduce concerns about falls among carers of older adults with cognitive impairment and fragility fracture. The objectives are to: 1) Synthesise evidence for support interventions for carers of older adults with cognitive impairment and a recent fragility fracture undergoing rehabilitation; 2) Conduct interviews with carers to explore their specific concerns, how they address them, and what support they would like to overcome them; 3) Conduct focus groups with professionals to determine the extent they experience carer-concerns about falls, how they address concerns, or would like to address them; 4) Develop a rehabilitation intervention targeting a reduction in carer-concerns about falls using consensus methods.

Methods: Objective 1: A scoping review to identify published and grey literature of support interventions for carers of older adults with cognitive impairment and a recent fragility fracture undergoing rehabilitation. Data will be synthesised using SWiM methodology with interventions mapped to the Rehabilitation Treatment Specification System, target outcomes identified categorised according to the International Classification of Functioning, Disability and Health framework, and evidence of effectiveness reported by intervention type.

Objective 2: A qualitative semi-structured interview study. Purposive sampling will be used to recruit up to 20 carers based on underserved characteristics which may influence help seeking behaviour e.g. deprivation, gender, ethnicity. Inductive thematic analysis will be informed by the theory of biographical disruption. Communities whose first language is not English will be supported to take part. **Objective 3:** A focus group study. Professionals will be purposively sampled based on professional background, experience, work location and to ensure ethnic and gender diversity to four focus groups from NHS sites (hospital and community). Thematic analysis informed by the Theoretical Domains Framework will explore barriers and facilitators to future intervention implementation. **Objective 4:** Carers, professionals, and researchers will support intervention development with Nominal Group Technique in two workshops with a survey between. Translation will be supported.

PPI: PPI activity will inform design, delivery, and interpretation at each step. The Fellow will be supported to bring together a PPI group of carers from across North East London through infrastructure at ACHA, the BRC, and the Bone & Joint Health Public Advisory Group. PPI members will be reimbursed in line with best practice.

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PROJECT 4: The Influence of Multigenerational Housing on Healthcare Use for Persons Living with Dementia

BACKGROUND: Health and social care services often struggle to identify how best to optimise limited resources to improve care for growing numbers of PLwD [1]. Growing numbers of people, including PLwD, are now living in multigenerational homes [2]. Social contact has been established as a protective factor for cognitive decline, and older adults may display mental health benefits with MGL [3]. For PLwD housing arrangements may also impact access to care. Deteriorations in the health of PLwD may be noticed earlier by younger relatives [4], and younger individuals may be better able to navigate complex health-service structures and digital technology, enabling PLwD to access elective services and remain at home for longer. Conversely, carer-burden can also generate negative health outcomes for both PLwD and their carers [5]. Currently little is understood on the impact of the increasing trend for MGL on access to healthcare and subsequent outcomes for PLwD. We hypothesise MGL will increase attendance of PLwD at planned healthcare services, and reduce unplanned healthcare presentations and social care service use.

OBJECTIVES: 1. Quantify whether, for PLwD, MGL is associated with changes in the use of emergency and non-emergency health and social care, and time to residential placement. 2. Determine whether relationships between care use and MGL (identified in objective one) are altered when stratifying for ethnicity. 3. Qualitatively explore how PLwD access services while in MGL households.

METHODOLOGY: Mixed methods study; (1) retrospective cohort study utilising health and social care data from the Care City dataset, (2) qualitative analysis of semi-structured PLwD/carer interviews.

Population: Individuals enrolled in the Care City Cohort. Any household with at least one resident age ≥ 65 with a diagnosis of dementia and at least three years of follow up data available between 2010-2018 (pre-pandemic). Entry into study at point of dementia diagnosis. Individuals in nursing/residential care for duration of study excluded. We estimate there are currently over 7000 PLwD in this dataset.

Quantitative analysis plan: Retrospective cohort analysis using multivariable regression models with time-varying covariates. Primary analysis of a single exposure measure, and multiple service use outcomes (for health and social care). Secondary analysis will stratify by major ethnic groups, to determine if ethnicity impacts associations with service use. Sensitivity analyses performed to omit PLwD whose MGL exposure alters during the study period. Finally, time to placement used as outcome metric on subgroup of PLwD who move into residential/nursing care during the study period.

Exposure: Living in a multigenerational household, defined as two or more individuals with an age gap of ≥ 20 years within the same residential address during the studied period.

Outcomes: We will analyse associations with the following outcomes; contacts with general practitioner, contacts with mental health service providers, contacts with emergency services including unplanned admission (HES), and overall contact with healthcare providers (a sum measure of the preceding components). We will also analyse social care including use of home care packages, receipt of carers allowance, and use of residential or nursing care (as an endpoint).

Covariables: Adjustments for age, sex, index of multiple deprivation (individual and practice level), ethnicity, number of residents per household, frailty (using electronic frailty index), polypharmacy, comorbidity count, and receipt of social services at baseline.

Qualitative analysis plan: Purposive recruitment of 10-15 multigenerational East London families with PLwD in household, focusing on minoritised groups. Semi-structured interviews on rationale for care choices conducted with both PLwD (able to provide informed consent) and their carers. Translation services utilised to maximise inclusion. Reflexive thematic analytic methods to analyse qualitative data. Data from quant and qual phases integrated at interpretation stage using mixed methods approaches.

Consent: Consent for patient data stored in the Care City Data set has already been obtained. PLwD and carers involved in our qualitative study will be independently consented prior to interview.

Patient and Public Involvement and Engagement (PPIE): Utilising ACHA's integrated working PPIE group, we have access to diverse representative sample of adults living within North East London. The panel will be actively involved in appraising the lay summary of all protocols, and amendments to study design will be made according to feedback. A lay summary of all results will be produced and presented to the panel, who will be actively involved in the dissemination strategy.

Additional Funding: NHS costs will be supported via Barts Health and/or the Local Clinical Research Network. Data access and management costs will be supported by Care City Innovation C.I.C.

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PROJECT 5: Monitoring of fracture repair in older people to optimise recovery

Immobility has been shown to be an independent risk factor for patient morbidity (including impaired fracture healing), health-care utilisation, disability, and mortality. The primary aim of treatment lower limb fragility fractures is to facilitate early mobilisation and rehabilitation in order to avoid these undesired sequelae. There are currently no reliable methods for monitoring fracture healing until the fracture non-union has "declared" itself. This "forgotten phase" of fracture healing is detrimental in the elderly in whom ongoing immobility is associated with significant morbidity and even mortality. The ability to identify impaired fracture healing at an early stage would allow timely intervention using current treatment strategies to rescue fracture healing, reducing this lost period of impaired mobility and its associated sequelae. This project proposes using a multimodal approach to monitor fracture healing in a cohort of patients undergoing treatment for lower limb fragility fractures.

Whole blood transcriptomic profiling. Serum biomarkers in the monitoring of fracture healing remain elusive. Candidate serum biomarkers such as collagen X² and microRNA³ have shown promise in early pre-clinical studies. Fracture healing is a complex inflammatory-mediated cellular process. Whole blood gene expression analysis has been used to identify gene expression signatures of similarly complex inflammatory and immune-mediated cellular processes such as sepsis⁴. It is plausible that there is a whole blood signature in fracture healing that could be utilised as molecular biomarkers for monitoring its progression. There have been no studies investigating the circulating transcriptomic profiles of patients undergoing fracture healing. This proposed study hypothesises that whole blood gene expression profiling can be used to identify those patients experiencing impaired fracture healing.

Quantitative ultrasound. Although the use of ultrasound is widely used in the diagnosis of musculoskeletal conditions, it has not been widely adopted in fracture care. However its ability to detect early radiologically-covert callus holds great promise for monitoring fracture healing. Its diagnostic value in the prediction of fracture non-unions has been demonstrated in small clinical pilot studies in the upper limb but not in lower limb injuries⁵.

Implantable strain gauge. Measurement of fracture stiffness has been demonstrated as a valid outcome measure for the maturity of the repair tissue but such monitoring has been restricted to pre-clinical applications. However recently, a novel implantable fracture monitoring device has been designed and is currently undergoing phase I evaluation. It consists of an implantable sensor that is attached to conventional fracture fixation plates and continuously measures implant load during physiological weight bearing. Data is recorded and processed in real-time on the implant, from where it is wirelessly transmitted to a cloud application via a smartphone⁶. This study will seek to continue its evaluation as a clinical adjunct in the monitoring of fracture healing.

Wearable activity trackers. The use of wearable sensors to track activity is growing in popularity. A recent survey of orthopaedic surgeons found that 20% respondents already use wearable technology in their clinical practice to assess patient activity levels⁷. However there have been no studies validating their use in the monitoring of fracture healing and patient recovery. This proposed study aims to validate the use of an in-house research-specific proprietary activity-monitoring smartphone application in lower limb trauma patients. It is hypothesised that phenotyping of functional activity will permit the early identification of patients experiencing impaired fracture healing. In addition, validation of this smartphone application in the assessment of post-traumatic rehabilitation creates a research model for future evaluations of interventions aimed at improving mobility in the frail and elderly.

Impact and next steps This proposed PhD project aims to identify molecular, radiological, mechanical, and functional phenotypes at risk of impaired fracture healing following lower limb fragility fractures to optimise mobility. Furthermore, qualitative assessments will be made on the impact these prospective investigational modalities have on patient and carer experiences during their treatment journey. The information generated from this project will be used to inform on the suitability and/or design of a phase III clinical trial to compare their potential efficacy against current practice. These technologies have the potential to improve patient experiences by reducing the "forgotten phase" of fracture healing and expediting recovery; not only following lower limb fragility

fractures but all extremity trauma.

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