National Institute for Health Research

NIHR Maudsley Biomedical Research Centre

PhD Studentships

Project Catalogue

Mobile Health

Studentships to commence October 2017

Contents

NIHR Maudsley Biomedical Research Centre (BRC)

NIHR Biomedical Research Centres are funded to support people- and/or patient-focused early translational (experimental medicine) research, the aim of which is to translate discoveries from basic/discovery science into clinical research, and through to benefits for patients, the health system and for broader economic gain.

On September 16 2016 the Secretary of State for Health announced that the Department of Health has awarded £66 million funding over the next five years to the National Institute for Health Research (NIHR) Biomedical Research Centre (BRC) at South London and Maudsley NHS Foundation Trust and the Institute of Psychiatry, Psychology & Neuroscience at King's College London.

The award represents a substantial uplift in funding compared to the previous BRC funding round, and demonstrates the government's continued commitment to the current NIHR Maudsley BRC, allowing the research centre both to build on its current work and expand into new areas including substance use, obesity, pain and mobile health technology.

The expanded NIHR Maudsley BRC will bring together scientists, clinicians, mental health professionals, service users and carers, to improve clinical care and services across the field of mental health. The investment in the NIHR Maudsley BRC will allow research into ground-breaking treatments and care for mental health and dementia.

NIHR Maudsley BRC Strategy

There are four major elements to the NIHR Maudsley BRC strategy for the coming 5 years, reflected in aims of the 17 themes:

- **Precision psychiatry**: Bringing together insights from cognition, behaviour, genomics and brain imaging, we will develop biologically-informed strata of psychiatric syndromes, with the ambition to develop and provide more individually tailored treatment
- **Novel therapeutics**: Using the access to our large databases, electronic consent for contact procedures, and our dedicated experimental medicine Clinical Research Facility (CRF), we will undertake trials of new pharmacological, neuromodulation and psychological treatments
- **Translational informatics**: By using our bespoke natural language processing algorithms and 'smart agents', we will use informatics to influence treatment choice, increase adherence, improve health behaviours and increase patient empowerment, all of which will benefit patient outcomes and service delivery
- **Mental/physical interface**: We will decrease the 15 years of life lost to serious mental illness by using informatics to identify, prioritise and track the treatment of those with comorbid mental and physical disorders

Clinical disorder focused research themes

Seven clinical disorder focused research themes cover mental health and dementia from cradle to grave:

- Affective Disorders and Interface with Medicine
- Child and Neurodevelopmental Disorders
- Dementia and Related Disorders
- Lifestyle Substance Use & Harms (Substance Use)
- Obesity, Lifestyle and Learning from Extreme Populations (Obesity)
- Pain and headache
- Psychosis and Neuropsychiatry

Technology and methodology focused research themes

Seven technology and methodology focused research themes develop and deploy new approaches to clinical problems:

- Bioinformatics and Statistics
- Biomarkers and Genomics
- Clinical and Population Informatics
- Mobile Health
- Neuroimaging
- Patient and Carer Involvement and Engagement
- Translational Therapeutics

Cross cutting themes

Three cross cutting themes provide enabling infrastructure:

- BioResource
- Clinical Research Facility
- Training and Capacity Development

Mobile Health

Lead: Professor Richard Dobson

This theme exploits novel mobile health and remote sensing technology to enable nuanced, deep and continuous clinical phenotyping, by providing data on the patient experience throughout the disease continuum. Complementary to our other Informatics themes, it supplies the specific expertise and collaborations required in this emerging field to develop user experience, apply methodology for real-time streaming and predictive analytics, and platform development for data management.

Aims

1. Exploit mobile health (mHealth) and remote sensing technology, enabling a shift from sporadic clinical data capture, to a nuanced, deep and continuous clinical phenotype, allowing us to harness patient experience throughout the disease continuum – from at risk, through early diagnosis, to post-diagnosis
2. Establish mobile and remote sensing technology as essential translational informatics infrastructure for precision psychiatry, developing novel interventions including early diagnosis and anomaly detection, disease stage monitoring, therapeutic adherence, and treatment response
3. Explore the interface between physical and mental health (e.g. nutrition, exercise), linking with the electronic health record, –omics, and imaging to provide a more complete picture of health and a more objective phenotype

Projects

When applying for the NIHR Maudsley Biomedical Research Centre PhD studentship in the **Mobile Health** theme, please ensure you state your two preferred PhD projects from those listed in this catalogue only. These should be listed in order of preference and include the number that is assigned to the project and the project title.

For example:

1. MOBH-2.04 Monitoring Recovery in Psychosis with mHealth
2. MOBH-2.01 Development and deployment of an open source informatics platform to support remote monitoring of disease and relapse using smartphones and wearable devices

Important: With your application, in addition to the personal statement, please upload a separate single-side A4 document listing your first and second choice projects with a statement explaining why you have chosen your **first choice** project and why you would like to take this forward as a PhD (**maximum 300 words**).

If you wish to discuss a project before you apply, you will find supervisors' names and their contact details listed with each project in this catalogue.

Further information about project supervisors can be viewed in the King's College London Research Portal. Under **Researchers**, type the name of the person you wish to view information about.

Please note: The final choice of funding, project and project details are agreed after successful interview.

MOBH-2.01 Development and deployment of an open source informatics platform to support remote monitoring of disease and relapse using smartphones and wearable devices

Primary Supervisor: Professor Richard Dobson

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Second Supervisor: Dr Amos Folarin

Academic Department: Social, Genetic and Developmental Psychiatry

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Third co supervisor: Dr Mirco Musolesi. University College London, UK

Project Description

The recent trend towards streaming data, through the emergence of the internet of things for example, has resulted in an explosion of commercial and open source software development. Since mobile phones and networks annually increasing in capabilities, and new mobile sensors entering the market regularly, there is significant interest in the potential for this field for mobile Health (mHealth). While a number of commercial provisions are available for mHealth data aggregation, there is a gap for an open source software stack that provides data collection functionality for research, clinical trials and real-world application.

By leveraging the existing body of general data streaming technologies provided by the open source community the student will contribute to the IMI2 RADAR-CNS initiative (partners including Intel and SoftwareAG; radar-cns.org) in developing an end-to-end system with generalizable aggregation capability of participant data from multiple sources. By focusing on classes of data rather than specific devices, the project will provide enhanced modularity and adaptability as new sensors become available. The platform will support passive and active remote monitoring, data ingestion streaming analytics and data access needs for RADAR disorder work packages. The work will be delivered under open source licence with the aim of providing legacy for downstream RADAR projects and the wider mHealth community.

The open source RADAR data platform will be designed with the intention of providing distributed, durable, fault tolerant, generalised, high-throughput, low-latency and massively scalable data collection solution for the RADAR project.
The key components of the software stack for the RADAR platform will include: 1.Data Ingestion and Schematisation; 2.Database storage and Data Interface; 3.Data Analytics; 4.Front-end ecosystem; Privacy and Security

Keywords: mobile health; informatics; data science; wearables; software development; streaming analytics;

Two representative publications from supervisors:

1: A Multi-Agent Platform for Automating the Collection of Patient-Provided Clinical Feedback Ibrahim, Z., Fernandez de la Cruz, L., Stringaris, A., Goodman, R., Luck, M. & Dobson, R. May 2015 Proceedings of the International Conference on Autonomous Agents and Multiagent Systems. International Foundation for Autonomous Agents and Multiagent Systems (IFAAMAS), Vol. 2, p.831-839 9 p.

2: Transcriptomics and the mechanisms of antidepressant efficacy Hodgson, K., Tansey, K. E., Powell, T., Coppola, G., Uher, R., Zvezdana Dernovšek, M., Mors, O., Hauser, J., Souery, D., Maier, W., Henigsberg, N., Rietschel, M., Placentino, A., Aitchison, K. J., Craig, I. W., Farmer, A. E., Breen, G., Mcguffin, P. & Dobson, R. 1 Jan 2016 In : European Neuropsychopharmacology. 26, 1, p. 105-112 8 p.

MOBH-2.02 Contemporising psychometric measurement of technology acceptance for healthcare environments

Primary Supervisor: Professor Dame Til Wykes

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Second Supervisor: Dr Sara Simblett

Academic Department: Psychology

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Project Description

Chronic health conditions present ongoing challenges to our current healthcare system. People often need continuous management to prevent deterioration and maintain a good quality of life. Costs associated with this, including repeated clinical appointments, mean that over the last decade or more there has been a growing demand for healthcare interventions to encourage self-management (Barlow, Wright, Sheasby, Turner, & Hainsworth, 2002; Beatty & Lambert, 2013). In response to this and with the concurrent global increase in the ownership of smartphone technology and better access to the internet there has been a rise in use of telehealth approaches to augment healthcare practices (Wac & Rivas, 2015; Wilson & Maeder, 2015). With the implementation of new technology comes the need to assess acceptability of these interventions amongst all stakeholders, including service users and clinicians. Telehealth is a fast growing area of research and whilst good models of technology acceptance have been conceptualised (e.g. Venkatesh et al., 2003), there remains the lack of a standardised means of assessing this. The goal of this project would be to use contemporary methods for developing self-reported outcome measures (e.g. Rasch analysis techniques) to create a tool that can be used to measure technology acceptance for healthcare environments, drawing on the existing theory and translating this into practice. This work would integrate with the international RADAR-CNS programme that is due to be collecting data on acceptability throughout 2016 and 2017, providing multiple opportunities for further learning and scope to validate the tool in a cross-cultural context.

Keywords: Technology; Telehealth; Psychometrics;

Two representative publications from supervisors:

1: Development and validation of 'SURE': a patient reported outcome measure (PROM) for recovery from drug and alcohol dependence. Neale, J., Vitoratou, S., Finch, E., Lennon, P., Mitcheson, L., Panebianco, D., Rose, D., Strang, J., Wykes, T. & Marsden, J. 1 Aug 2016 In : Drug and Alcohol Dependence. 165, p. 159–167

2: Dimensions of the Dysexecutive Questionnaire (DEX) examined using Rasch analysis. Simblett, S. K., & Bateman, A. (2011).Neuropsychological Rehabilitation, 21(1), 1-25.

MOBH-2.03 Heroin and opioid overdose: developing wearable sensors to detect and respond

Primary Supervisor: Professor Sir John Strang

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Second Supervisor: Professor Richard Dobson

Academic Department: Social, Genetic and Developmental Psychiatry

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Project Description

Deaths from heroin/opioid overdose could be prevented if devices could detect overdose onset and activate emergency response. This PhD will investigate wearable sensors to detect physiological indicators of overdose and will explore their technological and operational functionality.

There is a world-wide progressively worsening 'opioid overdose epidemic' (CDC, 2015), with most drug-related deaths involving illicit heroin or prescription opioids. In the UK there has been a doubling in heroin overdose deaths since 2011 (Middleton, BMJ, 2016). Globally opioid overdose results in 70,000-100,000 deaths annually (WHO, 2014).

Heroin overdose deaths result from sudden respiratory down-regulation. Overdose is rapidly reversed by injection of naloxone (antagonist). Deaths frequently occur from failure to detect, and consequent failure to summon help. Wearable sensors could monitor vital signs and automatically summons emergency response.

This PhD will develop and test ability to track, on an ambulatory basis, physiological indices of respiratory function (and perhaps cardiac function and intercostal muscle activity) and will investigate the ability of sensors (both bench-based and prototype wearable and remote) to detect, at an early stage, heroin/opioid overdose. The devices should also activate emergency response.

The student will have an interest in software development, data science and more generally, an interest in evaluation of mobile technology for health.

There may also be opportunity to study prototype devices on current heroin/opioid users, in a dedicated clinical research facility (CRF), to establish ability to detect onset of acute heroin/opioid overdose, examining which physiological parameters are most suitable for mobile monitoring technologies.

Keywords: heroin; overdose; wearable; sensors; detection;

Two representative publications from supervisors:

1: Jolley CJ, Bell J, Rafferty GF, Moxham J & Strang J. Understanding Heroin Overdose: A Study of the Acute Respiratory Depressant Effects of Injected Pharmaceutical Heroin. PLoS One. 2015 Oct 23;10(10):e0140995. doi: 10.1371/journal.pone.0140995. eCollection 2015. Erratum in: PLoS One. 2015;10(11):e0143672. PubMed PMID: 26495843; PubMed Central PMCID: PMC4619694.

2: Strang J. Death matters: understanding heroin/opiate overdose risk and testing potential to prevent deaths. Addiction. 2015 Jul;110 Suppl 2:27-35. doi: 10.1111/add.12904. PubMed PMID: 26042565.

MOBH-2.04 Monitoring Recovery in Psychosis with mHealth

Primary Supervisor: Dr Matteo Cella

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Second Supervisor: Dr Daniel Stahl

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Project Description

The aims of this project are: i) implement a mobile health (mHealth) based method to assess functioning problems in people with psychosis and ii) applying analytic methods to predict changes in functioning.
People with schizophrenia experience a significant reduction in their functioning levels from illness onset. This is the main unmet clinical challenge for interventions as functioning problems are largely responsible for the long term consequences of the illness. The measurement of the factors responsible for functioning problems is traditionally done using clinical interviews and self-assessment tools at discrete time intervals. This is a major limitation in tracking people's recovery progress and for preventing functional decline and relapse.

mHealth devices and wearables can collect continuous and vast amount of information on health states. This information can be instrumental in predicting change and monitoring recovery but poses challenges in relation to its complexity and handling. The aim of this study is to recruit a cohort of 35 service users with psychosis and use wearables and mobile devices to record health states information. Together with a statistician the student will use machine learning methodology to recognise patterns or signals in the data predicting change in health state. Applying this method to health information collected via mHealth devices may make it possible to exploit fully the richness of this data source. This may allow predicting future health states and provide the personalised care people with psychosis need to improve their recovery.

Training and objectives
Year 1 – MSc Research method, systematic review of the literature, ethic application; Year 2 – mHealth device familiarization; clinical assessment training; begin recruitment; Year 3 – Data collection; Year 4 – Analysis and thesis writing.

Keywords: Psychosis; Machine learning; Mobile Health; Functioning; Predictive modelling;

Two representative publications from supervisors:

1: Edwards, C.J., Cella, M., Tarrier N, Wykes T. (2016). The optimisation of experience sampling protocols in people with schizophrenia. Psychiatry Research, 30;244:289-93

2: Iniesta, R., Stahl, D. R. & McGuffin (2016). Machine Learning, Statistical Learning and the Future of Biological Research in Psychiatry. Psychological medicine. 46, 12, p.2455-2465.

MOBH-2.05 SlowMo: User-centred digital health for improving outcomes in CBT

Primary Supervisor: Professor Philippa Garety

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Second Supervisor: Dr Amy Hardy

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Project Description

SlowMo is an award winning novel digital therapy platform, designed by a team led by KCL in collaboration with a team of leading psychological therapy researchers in Oxford, Sussex and Manchester, and with the inclusive healthcare design laboratory, Helen Hamlyn Centre for Design, Royal College of Art. The current version of SlowMo targets fast thinking habits that have been empirically demonstrated to contribute to paranoia. It helps people to slow down for a moment and take in extra information to counteract intuitive rapid judgements, thereby reducing distress. The research team is commencing an MRC/NIHR funded RCT in Feb 2017, and has Wellcome Trust and King's Commercialisation Institute funding for further platform development. The PhD candidate will work within the team on integrating a responsive wearable into the digital platform to enhance outcomes through passive stress monitoring, and a new version of SlowMo to target cognitive biases in a non-clinical population. The candidate will conduct a series of studies of the usability, effectiveness and mechanisms of action of the standalone app and wearable, using novel digital health methodologies.

Training: Advanced statistics; Library and database Usage; Weekly seminars and scientific talks; Access to all skills forge training.

Over-arching objectives:
Year 1: MRes or MSc year. Systematic literature review of wearables and biofeedback; training in user-centred digital healthcare design and psychosis; research governance.
Year 2: Training in digital health research; feasibility studies of wearable and app for self-management. Year 3: Pilot evaluations of wearable and self-monitoring app effectiveness.
Year 4: Complete evaluation; analyses; and write-up.

Keywords: digital health; mhealth; psychosis; paranoia; wearable technology;

Two representative publications from supervisors:

1: Garety, P., Waller, H., Emsley, R., Jolley, S., Kuipers, E., Bebbington, P., Dunn, G., Fowler, D., Hardy, A. & Freeman, D. (2015). Cognitive mechanisms of change in delusions: An experimental investigation targeting reasoning to effect change in paranoia. Schizophrenia Bulletin, 41(2), 400-210.

2: Waller, H., Emsley, R., Freeman, D., Bebbington, P., Dunn, G., Fowler, D., Hardy, A., Kuipers, E. & Garety, P. (2015). Thinking Well: A randomised controlled feasibility study of a new CBT therapy targeting reasoning biases in people with distressing persecutory delusional beliefs. Journal of Behaviour Therapy and Experimental Psychiatry, 48, 82-89.

MOBH-2.06 Using smartphone technologies to investigate the impact of the urban environment in psychosis

Primary Supervisor: Dr Andrea Mechelli

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Academic Department: Biostatistics & Health

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Project Description

People who live in urban environments are at higher risk of developing multiple episodes of psychotic illness - the fourth cause of disability worldwide. The aim of this project is to examine the impact of different aspects of the urban environment in people in the early stages of the illness. Two-hundred individuals in the early stages of psychosis and two-hundred healthy controls will be investigated using a smartphone app developed for this project. The app uses a technique called “ecological momentary assessment” to monitor the mental state and behaviour of participants as they go about their daily life. The results will be used to develop a smartphone-based prognostic tool for clinical use. This tool will monitor an individual’s reactivity to urban stressors in order predict clinical and functional outcomes and optimise treatment. There is a critical need for such a tool, since at present clinicians are unable to predict who will and will not suffer a psychotic relapse on the basis of clinical presentation. Because urban environments are associated with higher risk for a range of severe mental illnesses, the tool could easily be adapted for use in other psychiatric populations. While the student will experience all aspects of the research from recruitment to dissemination, the focus will be on the statistical analysis of the data. An interest in the analysis of mobile health data is therefore essential**.**

Keywords: psychosis; urbanicity; relapse; m-health;

Two representative publications from supervisors:

1: Orrù G, Pettersson-Yeo W, Marquand AF, Sartori G, Mechelli A (2012). Using Support Vector Machine To Identify Imaging Biomarkers Of Neurological and Psychiatric Disease: A Critical Review. Neuroscience & Biobehavioral Reviews 36(4), 1140-1152.

2: Mechelli A, Prata D, Kefford C, Kapur S (2015). Predicting clinical response in people at ultra-high risk for psychosis: A systematic and quantitative review. Drug Discovery Today 20(8), 924-7.