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| Host department: Southampton (with University of Oxford)  |
| Project Title: |
| Using big data and artificial intelligence (AI) to quantify holistic need in people with multiple long-term conditions (MLTC-M)  |
| Proposed supervisory team:  |
| Dr Hajira Dambha-Miller (big data and epidemiology) SouthamptonProfessor Andrew Farmer (clinical and mixed methods expertise) OxfordProfessor Beth Stuart (statistics) Southampton |
| Potential for cross consortium networking and educational opportunities: |
| The project includes access to mid and senior-level researchers across three SPCR departments (Oxford, Nottingham, Southampton) alongside external collaborators (Cambridge and Kent). The candidate will have access to leading experts in primary care, data science, epidemiology, statistics, AI and multimorbidity. The wider AIM team have a breath of methodological, subject and practical expertise to provide educational opportunities to the candidate. This will include 1:1 support and formal tutorials, in addition to networking opportunities through weekly cross-departmental AIM study meetings. There is also the opportunity for the candidate to network across the NIHR with monthly meetings across all the NIHR AIM funded PI’s.  |
| Project description: |
| BACKGROUND:This PhD will be embedded within research funded by the NIHR Artificial Intelligence (AI) programme which utilises AI and Big Data to manage multiple long-term conditions (MLTC-M). MLTC-M are increasingly prevalent and associated with high rates of morbidity, mortality and healthcare expenditure. Strategies to tackle this have primarily focused on addressing biological aspects of disease but MLTC-M are the result of and associated with additional psycho-social, economic and environmental barriers. A shift towards more personalised, holistic and integrated care could be an effective approach. This could be achieved by clustering heterogenous populations by health *and* social need, and then tailoring interventions to the needs of each homogenous cluster. Evidence is required on how to generate clusters based on health and social need and to quantify the impact of clusters on long-term health and costs.AIM:* To develop and validate population clusters that consider health and social care determinants and subsequent health and social care need for people with MLTC-M using data-driven AI methods compared to expert-driven approaches
* To evaluate cluster trajectories and quantify their association with health outcomes and costs

Methods: We anticipate a mixed-methods PhD but this will be tailored to the candidate’s interest with a particular focus on developing the AI and epidemiology skills within primary care big data. The team are using a number of datasets (CPRD, SAIL, ELSA and local social care data). The candidate can access these for cohort analysis with generated MLT-C clusters and trajectories characterised, and associations quantified in relation to clinical outcomes (e.g. incidence mortality, additional long-term conditions, disease severity and ten-year health care costs), using appropriate regression modelling.Potential impact:The work from this research will examine the utility of AI methods in health and social care research, and explore the methodology used to provide signals on intervention development and recommendations on targeted individual-level service delivery for managing MLT-C.  |

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| Training and development provision by host: |
| *Formal training:*Bespoke training will be provided depending upon the learning needs and experience of the successful candidate. We anticipate specific training in statistics, big data processing/cleaning and epidemiology (using STATA to conduct descriptive analysis alongside Cox, Multivariable, Logistic modelling). Training will be directed towards helping the candidate develop as an independent researcher, as well as towards the needs of the PhD project.The formal taught postgraduate research training programme at the University of Southampton includes epidemiology, statistics, research governance and study design. In addition, transferable skills courses are offered including Good Clinical Practice, time management, leadership, grant writing, and presentation skills. The candidate on-line masterclasses on systematic reviews and meta-analysis, research governance, ethics, patient and public involvement and engagement, developed by leaders in the SPCR. The PhD will be awarded by the University of Southampton but as a key supervisor is based at the University of Oxford, we anticipate that the candidate will benefit from relevant training and expertise across both departments including the extensive SPCR and Wellcome PhD training programme . |
| *Informal training:*The candidate will join our fortnight study meetings and be offered regular tutorials from supervisors and the wider study team who provide leading national expertise in AI, big data, epidemiology, statistics and subject expertise in big data. The candidate will also have access to informal mentoring from senior members of the collaboration at an annual training meeting, and to participate in doctoral exchange programmes.  |
| *PPIE:* We have PPI collaborators on the study team who the candidate will work with; this has helped us to ensure that our research is addressing public need, and is feasible and acceptable to patients.  |