**University of Leicester**

**Future 50 PhD Scholarship**

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| **Project Reference** | HS Booth |

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**Section 2 – *Project Information***

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| **Project Title** | Adapting prognostic models for individuals with multiple long-term health conditions |
| **Project Highlights:** | 1. | Development of methods (and software) that can be used to improve the accuracy of risk predictions for patients with multiple long-term health conditions |
| 2. | Extensive comparison of these methods to provide guidance on which method may be most appropriate in different scenarios  |
| 3. | Further methodological development to extend these approaches to competing risks |
| **Project Summary**  |
| Prognostic models can be used to provide personalised risk predictions for patients based on their characteristics. For example, a prognostic model for cancer may take into account an individual’s age and the size of their tumour. These predictions can be used to inform patients of their likely prognosis and also aid clinicians in choosing an appropriate treatment strategy.However, often prognostic models will not produce accurate risk predictions for patients who have multiple long-term health conditions (e.g. cardiovascular disease, diabetes) since this is not accounted for as part of the model development process. This may adversely affect patient outcomes if treatment decisions are based on these inaccurate predictions.The overall aim of this project is to develop and compare methods that can be used to improve the accuracy of risk predictions for patients with multiple long-term health conditions. This will include methods such as: * Adapting existing prognostic models to incorporate additional predictors relating to the diagnosis of a long-term health condition (e.g. diabetes, high blood pressure, chronic kidney disease)
* Including a comorbidity index as a predictor
* Recalibrating existing prognostic models amongst individuals who have multiple long-term health conditions to re-estimate the baseline risk

These methods will be compared using simulation studies to provide guidance as to which method may be most appropriate in different scenarios given the clinical application and limitations of the available data. These methods will also be compared using real-world data from the Clinical Research Practice Datalink (CPRD) and the Virtual Cardio-Oncology Research Initiative (VICORI) database. Software will also be developed to help transfer these methods into practice. These approaches can then be extended to the competing risk setting where individuals are at risk from more than one outcome. For example, when developing a prognostic model for survival following a diagnosis of cancer, it is possible to predict an individual’s risk of death from cancer as well as their risk of death from other causes such as cardiovascular disease. This can help to further personalise treatment strategies, particularly amongst individuals with multiple long-term health conditions who will be at a higher risk of death from specific causes.  |