Project Details	
Project Code	MRCPHS24Br Caputo
Title	Risks and Health Outcomes of Heart Procedures in Children and Young People with Congenital Heart Disease
Research Theme	Population Health Sciences
Summary	Offering a unique resource, the Outcome Monitoring after Cardiac Surgery study, will enable research in paediatrics with congenital heart disease (CHD) through a large dataset of medical records, questionnaires, and biological samples from hospitals performing heart surgery. You will investigate biochemical, clinical and imaging data to better identify risk of early organ damage and improve long term clinical outcomes in children with CHD undergoing cardiac surgery.
Description	Congenital heart disease (CHD) represents the most common birth defect, affecting from 0.4 – 1.2% of children born in high-income countries. The survival of these patients has increased significantly, but CHD remains one of the major causes of neonatal and childhood morbidity and mortality. The recent James Lind Alliance NIHR Congenital Heart Disease Priority Setting Partnership has identified the better understanding of multi-organ damage occurring during cardiac surgery as the top priority for CHD research [REF]. Significant gaps of evidence remain regarding how to better understand and improve peri-operative organ protection in paediatric heart surgery in order to improve early and long-term outcomes in this very high risk population. This study aims to analyse data from a prospective cohort of patients undergoing cardiac procedures that brings together routinely collected clinical data and biological samples from patients and their biological mothers, to investigate risk factors for myocardial and renal damage and predictors of post-operative- outcomes, as well as better understanding the efficacy of the surgical intervention on the early and long-term outcomes including cardiorespiratory fitness. Aims of the study To evaluate short, medium, and long-term health outcomes [including cardiorespiratory fitness] and its relationship with early myocardial and renal damage in children undergoing cardiac surgery for CHD. Specific research questions and objectives include to: 1) Identify clinical, imaging, and environmental factors that act as predictors for short, medium, and long-term clinical outcomes. 2) Determine the relationship between metabolomic data and exercise tolerance in patients undergoing cardiac surgery for CHD. 3) Minimise myocardial and renal damage to during heart surgery in children with CHD, especially in the high-risk patients) by developing a clinical decision support platform harnessing Machine Learning (ML) algorithms to provide accurate and timely diagnosis and incorporating in an holistic approach pre, intra- and post-operative electronic, imaging and biochemical data and correlate this with highly sensitive markers of organ damage. The Outcome Monitoring after Cardiac Surgery (OMAC) in CHD is an NIHR/BHF supported multi-centre platform launched under Prof Caputo BHF chair, which has already recruited more than 1500 paediatric patients with CHD undergoing cardiac surgery and cardiac catheterization (including 100 foetal patients with CHD) and their parents and projected to recruit around 4000 patients in the next 5 years. The study already has ethical approval (19/SW/0113). We will

expect the PhD student to develop their expertise and independence in clinical and biochemical data management and analysis, as well as learning the principles of cardiorespiratory stress tests and metabolomic bioinformatics. The student will be able to access data collected from patients' medical notes, hospital databases and hospital episodes statistics (HES) and ethically approved questionnaires. Data includes, but is not limited to demographic, lifestyle, and socioeconomic data, as well as maternal risk factors, intraoperative details, post-operative complications, NHS resource use and quality of life. Results from the analysis of biological samples (e.g., metabolomics) will also form part of the final dataset allowing the student considerable flexibility to steer appropriate analyses.

Supervisory Team

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