Letter of intent

File number 175.2021.008
Grant 2021/2022

Applicant

Title
Nationwide MRI infrastructure for cardiometabolic atlas construction (NOMINATOR)

Abstract
Applied and Engineering Sciences (AES/TTW)
Life Sciences: 21.60.00 Anatomy, Morphology, 21.70.00 Physiology, 21.90.00 Life Sciences, other

Economic prosperity, sedentary lifestyle and overeating has caused a stark increase in the incidence of cardiometabolic disease (CMD) across the globe, including the Netherlands. The high prevalence of obesity, hypertension and non-alcoholic fatty liver disease (NAFLD) that leads to CMD poses a huge health burden on our society.

MRI offers unprecedented possibilities to non-invasively assess structural and functional changes in the human body. Further insight in the link between obesity, hypertension and NAFLD and their relation with aortic disease, myocardial dysfunction, and liver cirrhosis can be achieved with MRI. For this purpose, establishing points of reference for both anatomically and functionally normal development are essential. Techniques to create age and sex-stratified 3D atlases of aortic and cardiac blood flow have been developed and will be expanded to create 3D reference atlases for intravoxel incoherent motion values (IVIM) of the liver.

The principle aim of the proposal is to create infrastructure to facilitate the design of benchmark atlases for 4D flow (heart and aorta) and IVIM MRI (liver) throughout the life course for a nationally representative population. These benchmarks will greatly enhance scientific and clinical developments for earlier recognition, treatment and prevention of CMD including hypertension and NAFLD.

Our stepwise objectives are:
1. To generate 4D flow and IVIM MRI data in current Dutch cohort studies
2. To use deep learning methods for automated processing and analysis of the images
3. To create atlases for the normal structure and function of the heart, aorta and liver
4. To compare datasets of patients with the atlases to facilitate the assessment of CMD.

Work packages
WP1: To obtain standards for normal development, aortic and cardiac 4D flow and liver IVIM MRI datasets will be acquired in men and women of all ages taking part in national cohort studies in The Netherlands. Data will be acquired, analyzed and shared fulfilling FAIR (Findable, Accessible, Interoperable, Reusable) standards.
WP2: Deep learning methods will be developed and applied to available and newly generated MRI datasets for automated data analysis.
WP3: Atlases for normal development and dimensions of the heart, aorta and liver will be constructed. We will organize optimal access to the data, and facilitate and stimulate re-use, while maintaining ethical and legal standards, thereby adhering to general data protection regulations (GDPR).
WP4: Additional MRI datasets will be acquired in individuals with at least one major or 2 minor pathological cardiometabolic risk factors for comparison with the atlases to learn more about common deviations from normal development.

Researchers
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Erasmus MC: Wiro Niessen, Vincent Jaddoe, Marleen de Bruijne
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Road map
NOMINATOR will align with and contribute to Health-RI, HELIUS and NCC initiatives of the Health Sciences Groups GWIs within the LSRI Roadmap.
Organisation responsible for the application

Confirm letter of intent
With submitting this form via ISAAC I declare to have filled in this form completely and truthfully.

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