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BUILDING A QUANTITATIVE MR DATABASE OF THE HEALTHY POPULATION

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INTRODUCTION

Brain imaging data, encompassing the range of normal values found in the healthy population, provides valuable information for clinical research. Normative data specific to a brain region or regions can be used when studying specific diseases. The purpose of this project is to create a database of quantitative magnetic resonance (MR) measurements of the brain to better characterize the healthy population. When collecting such a database, it is important to determine the overall quality of the data by assessing the reliability and variability.

METHODS

The overall objective was to recruit 120 healthy participants between the ages of 18-89 (with approximately 10 male and 10 female participants per age decade) to participate in the study. Exclusion criteria for the study included: a) history of neurological disorder, b) MR incompatible, c) claustrophobia, d) composite score below 27 on the Montreal Cognitive Assessment (MoCA). The MoCA is a sensitive tool for detecting mild cognitive impairment, which is administered by a qualified tester during the study. A series of quantitative MR measurements of the brain were acquired during the session, including: high resolution T1-weighted images, T1 relaxometry, T2 fluid attenuated inversion recovery (FLAIR), T2 relaxometry, diffusion tensor, arterial spin labelling (ASL) perfusion imagining, and quantitative susceptibility mapping (QSM). To begin assessing the reliability and variability of the data, a subset of the participants (n = 4) underwent three repeated scans. The intra-class correlation coefficient (ICC) and the minimal detectable difference (MDD) [1] were determined for the ASL MR sequence. *A priori* minimum ICC of 0.8 was selected as the minimum level of agreement.

RESULTS

To date, 36 subjects have been assessed for eligibility and recruited into the study (Figure 1). The ICC for the ASL global brain perfusion data (n = 4) was 0.91, although not statistically significant. The MDD in global brain perfusion reported to be 7.89mL/100g tissue/ min.

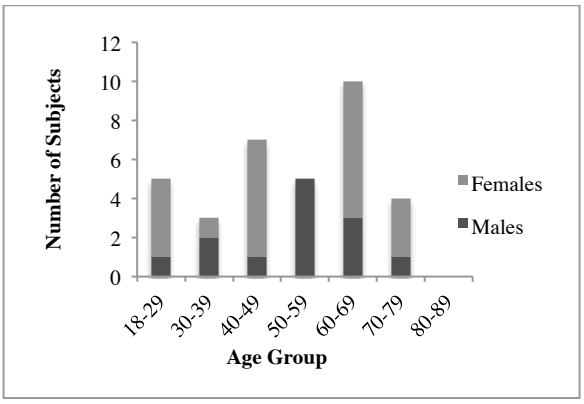

Figure 1. The number of subjects in each of the age groups recruited to date.

DISCUSSION AND CONCLUSIONS

The high ICC for the ASL data provides a good indication that the data collected is reliable. However, a larger sample size of individuals participating in the repeated scans is necessary to draw a conclusion. Typically, approximately 25 participants are needed to test a reliability hypothesis at 5% significance level with 80% power, for an ICC of 0.80 [2]. The MDD is the minimum amount that a parameter must change for observers to reliably measure a difference. This is useful for understanding the minimum difference that is inherent in the dataset, and any changes resulting from an intervention must surpass the minimum detectable difference in order to be reliably detected. In the case of global perfusion, this minimal detectable difference is 7.89mL/100g tissue/min (average global normal blood perfusion is ~50ml/100g tissue/min). Ultimately, a fully completed and validated database will provide valuable information that can be applied to clinical research of various neurological disorders. For future studies, reliability and variability assessments will be applied to other acquired quantitative MR sequences, including T1-weighted MRI, T2 relaxometry and diffusion tensor imagining.

REFERENCES

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