GLOBAL RESEARCH IMMERSION PROGRAM FOR YOUNG SCIENTISTS

Is Major Depressive Disorder related to brain activity lateralisation in reward circuitry?

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Introduction

- Major Depressive Disorder (MDD) is a mental health disease representing a large disease burden worldwide, with an average lifetime prevalence of 12%- this requires urgent research into the causes and effects of MDD.
- The two hemisphere structure of the brain means that there can be lateralisation in many aspects- structural, functional, and connectional.
- We wanted to understand if there was a potential link between lateralisation and MDD.

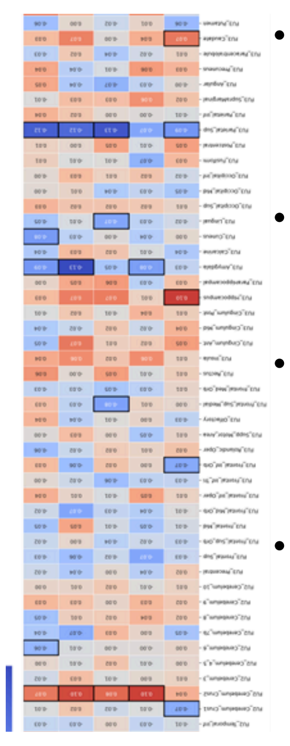
What did we do?

- We utilised the IMAGEN Dataset, a longitudinal fMRI study done across thousands of participants, at age 14, 16 and 19. This data also includes information about MDD symptoms.
- Using this information, we wanted to establish if there was a correlation between MDD and lateralised brain activity shown in fMRI scans during the monetary incentive delay (MID) task, associated with reward processing.

Our hypothesis

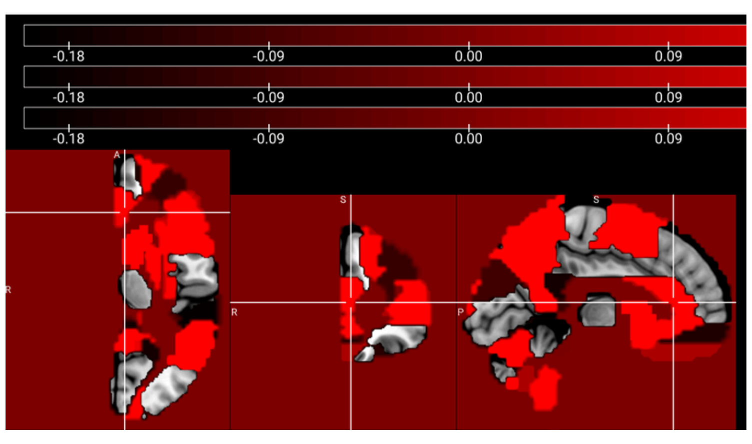
- As a patients depression score (Measured by ADRS adn DAWBA scales) changes, so too will their performance in the MID task, and this will be related to changes in the functional lateralisation of their brain.

1. Determining the regions of interest



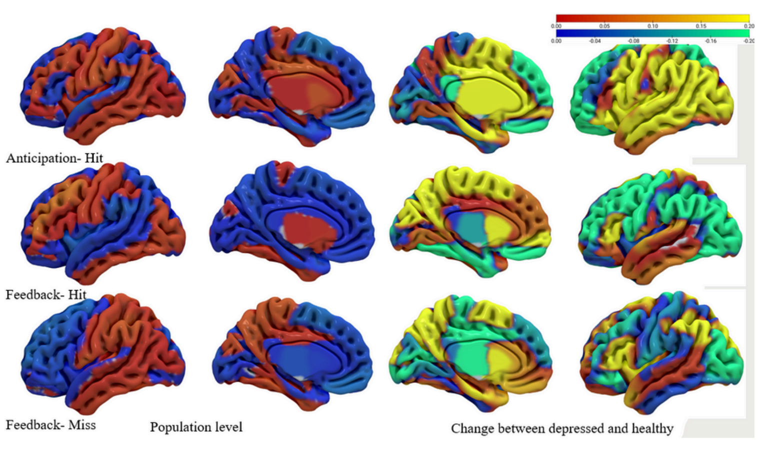
- To determine the regions important in MDD and possibly related to lateralisation, we created heat maps of our preprocessed data.
- This was done by first determining the lateralisaiton indices of all regions for different conditions, using masks from MRIcroGL.
- These LI indices were then analysed for correlation with DAWBA and ADRS scores, while correcting for multiple variables, to produce a partial coefficient.
- Using these heatmaps alonside reviews of the literature we determined 3 main areas of interest: the caudate, putamen and the anterior cingulate cortex (ACC).

2. Calculating the lateralisation indices



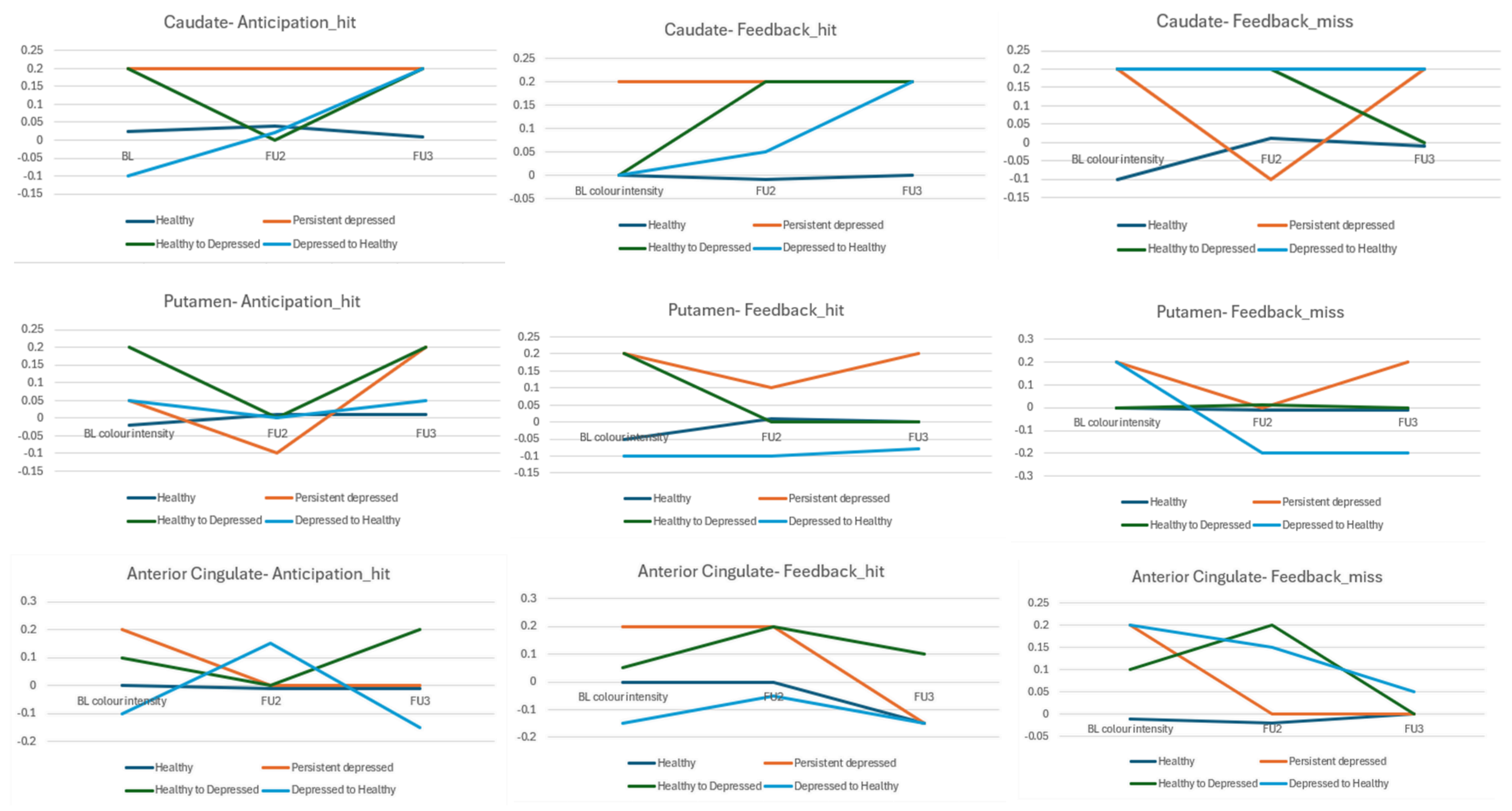
- Next, we wanted to actually calculate laterisation indices for each area, and so we created MRIcro.GL masks to show activation in our ROIs for different conditions
- We used the anticipation conditions, where subjects hit the correct target and received a big win and no win, for contrast. We also looked at similar feedback conditions when the subject hit or missed the target.
- This gave us a large spread of conditions to more fully determine effects of lateralisation.

3. Determining longitudinal change in the LI over time



- Finally we used these masks to determine the lateralisation index across time for different groups of participants.
- Our groups included persistent depressed individuals (ADRS score >6, DAWBA >5), depressed then re-covered (DAWBA > 5 at baseline, then ADRS < 6 at follow up), recovered then depressed, and healthy (ADRS < 6, DAWBA < 5)

Results



X-axis: time- baseline (age 14), follow up 2 (age 19), follow up 3 (age 23).

Y-axis: Lateralisation index- negative is right lateralised and positive is left lateralised

Conclusions

General trends observed:

- Healthy subjects appear to be less lateralised in ROIs
- Depressed patient caudates appear to be left lateralised. The ACC becomes more right lateralised over time. The putamen activity is less clear.
- When there are changes in depression status, trends are less consistent.
- Reasons for this may be:
  - Different forms and symptoms of depression in different cases
  - Other regions are more responsible for symptoms, so have clearer trends
  - The conditions we used to determine lateralisation may have been unsuitable for this type of analusis
  - Further measures of depression may have to be used, as well as information about treatment (unavailable in this dataset).

Future work

Future work should focus on:

- Looking at covariates such as gender and comorbidity
- Look at treatment data
- Look at related diseases, ie anxiety
- Identify more ROIs.

References

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