BOLD Signal Variability Patterns in Neural Correlates of Reflection and Brooding Components of Rumination

Katie Leutzinger
kal3vk@umsystem.edu

Carissa Philippi
University of Missouri- St. Louis, philippic@umsystem.edu

Follow this and additional works at: https://irl.umsl.edu/urs

Part of the Biological Psychology Commons

Recommended Citation
Leutzinger, Katie and Philippi, Carissa, "BOLD Signal Variability Patterns in Neural Correlates of Reflection and Brooding Components of Rumination" (2021). Undergraduate Research Symposium. 49.
Available at: https://irl.umsl.edu/urs/49
**Introduction**

- **RUMINATION**
  - Ruminative thoughts and behaviors: the tendency to self-focus and analyze one’s circumstances.
  - Theoretical underpinnings: the urgency for self-awareness and growth.
  - Notions of self-focus and domain-specific self-awareness.

- **NEUROIMAGING**
  - Neuroimaging research has implicated brain regions associated with rumination.
  - Two subtypes of rumination: reflection and brooding.

**BOLD SIGNAL VARIABILITY**

- Variability in brain activity, including blood-oxygen level dependent signal variability (BOLD-SV), is often considered beneficial, indicating neural output stability and adaptability.
- Optimal levels of BOLD-SV seen in normal functioning systems, whereas aberrant levels of variability can indicate network dysfunction, including in depression.
- No prior studies have evaluated whether BOLD-SV is differentially related to rumination versus brooding subtypes of rumination in depression.

---

**Predictions**

- **Aim 1:** To identify BOLD-SV differences between regions of interest (ROIs) implicated in rumination and brooding.
  - **Hypothesis 1.1:** Reflected brooding subtypes of rumination will show distinct correlations with BOLD-SV in neural ROIs implicated in rumination.
  - **Hypothesis 2:** To determine there are differences in BOLD-SV of the neural regions associated with reflection and brooding based on depression history.
  - **Hypothesis 2.1:** Lower BOLD-SV in ROIs associated with brooding for the currently-depressed group.
  - **Hypothesis 2.2:** Higher BOLD-SV in ROIs associated with reflection for both the past depression and no depression groups.

---

**Methods**

- A sample of 79 women were recruited to complete a resting-state fMRI scan, RRS, and BDI-II.
- All resting-state fMRI data were processed using AFNI and FSL according to previous BOLD-SV studies.
- For each participant, the standard deviation of the BOLD signal (BOLD-SV) was calculated for the ROIs implicated in rumination: left amygdala, right amygdala, PCC, ACC, dlPFC, and mPFC.
- The Ruminative Response Scale (RRS) is a 22-item self-report measure of ruminative thought on a 4-point Likert scale.
- Used two subscales: reflection and brooding.
- BDI-II is a 21-item self-report inventory to measure depression severity.

**STATISTICAL ANALYSES**

- Linear regressions were run to explore the relationship between BOLD-SV and adaptability.
- The average root mean squared motion was added as a covariate to control for subject movement in these analyses.
- Group differences were assessed using ANCOVA.
- Post Hoc independent samples t-tests were run to further examine differences between groups.

---

**Results**

- **Aim 1:** There was a significant effect of rumination subtype on BOLD-SV in the dlPFC ($F_{2,69} = 4.86, p = .005$).
- Specifically, greater levels of brooding were associated with lower BOLD-SV in the dlPFC, ($t(78) = -2.612, p = .01$).
- Similar results were found after excluding participants with too much motion ($n=9$), ($t(73) = -2.383, p = .02$).
- **Aim 2:** There was a significant effect of depression group on BOLD-SV in the dlPFC ($F_{2,67} = 3.57, p = .033$).
- Significantly reduced BOLD-SV in dlPFC in currently-depressed group as compared with no depression group, ($t(63) = -2.436, p = .018$).

---

**Discussion**

- Our results yielded significant findings for only one ROI: dlPFC.
- Greater levels of brooding predicted lower BOLD-SV in the dlPFC.
- Within the dlPFC, the no depression group showed significantly higher BOLD-SV than both past depression and currently-depressed groups.
- No significant difference between the past depression and currently-depressed groups is consistent with past research showing changes in BOLD-SV in those with a history of depression.
- Our findings suggest reflection and brooding subtypes of rumination may not be uniquely associated with BOLD-SV in DMN or amygdala regions.

**LIMITATIONS**

- We limited to a relatively small past-depression group (Table 1).
- Research suggests women ruminate more than men.
- Significant results may be due to our sample of only women.

**FUTURE DIRECTIONS**

- Try to replicate findings in a larger, gender diverse, sample.

---

**Table 1. Depression Group Characteristics**

<table>
<thead>
<tr>
<th></th>
<th>NoDep (n=30)</th>
<th>PastDep (n=15)</th>
<th>CurrentDep (n=34)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>M</td>
<td>SD</td>
<td>M</td>
</tr>
<tr>
<td><strong>Age</strong></td>
<td>27.13</td>
<td>7.61</td>
<td>28.02</td>
</tr>
<tr>
<td><strong>RRS_Brooding</strong></td>
<td>7.97</td>
<td>1.85</td>
<td>10.13</td>
</tr>
<tr>
<td><strong>RRS_Reflection</strong></td>
<td>9.67</td>
<td>3.56</td>
<td>11.27</td>
</tr>
<tr>
<td><strong>BDI</strong></td>
<td>0.93</td>
<td>1.46</td>
<td>11.33</td>
</tr>
</tbody>
</table>

**Figure 1. BOLD-SV Differences in dlPFC Between Depression Groups**

---

**References**