

Joshua W. Zollman, B.S.

Judith K. Morgan, Ph.D.

Training Dates: 7/1/17 – 8/31/17

### **Project Summary**

This summer, I focused on a project investigating mother-child dyadic relationship quality concordance and its relationship to dyadic concordance of child affective symptoms. I also spent time learning how to analyze functional imaging data (fMRI) to better understand the underlying neural correlates of dyadic concordance. A summary of this work is outlined below. I plan to use the results of this study to present a poster at the Developmental Affective Neuroscience Symposium (DANS) this fall at the University of Pittsburgh, and possibly another local conference such as the University of Pittsburgh Department of Psychiatry's annual research day. Data collection for the umbrella study of this project is still ongoing (Dr. Judith Morgan's Family, Affect, and the Brain (FAB) study, funded by the Klingenstein Third Generation Foundation) and is projected to be completed at the end of 2018. I plan to continue working on the project with the goal of eventually presenting it at a national conference and submitting it for publication in a peer-reviewed academic journal. I also hope to use it as my scholarly research project for the University of Pittsburgh School of Medicine prior to graduation in 2020. Lastly, I plan to use the knowledge and skills that I have learned from working with Dr. Morgan this summer to contribute to her lab's continued efforts with the FAB study and other future projects.

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Association between concordance of dyadic relationship quality and ratings of child symptom severity

## **Background**

Extensive research demonstrates that parental depression is associated with negative effects on child development in a wide range of domains (Burke, 2003). Additionally, youth are especially vulnerable to depression-related effects if they have poor relationship quality with their parents (Hazel et al., 2014). A large body of literature demonstrates that depressed mothers show alterations in their ability to judge their children's affective states (see Angold et al., 1987; Garstein et al., 2009) leading to detrimental effects on the child and mother's own parenting behavior (Chi & Hinshaw, 2002). We suggest that these depression-related distortions may be partially due to underlying disruptions in theory of mind, which have been documented in individuals with current and remitted major depressive disorder (Wang et al., 2008; Inoue, et al., 2004). The current study underscores the importance of both concordance, or agreement, in dyadic relationship quality and theory of mind related neural alterations in the development of affective disorders and provides evidence that the two may be closely related.

In this study, we hypothesize that maternal depression is associated with less dyadic concordance of perceived relationship quality and child affective symptoms, perhaps due to underlying deficits in theory of mind. We also hypothesize that parent-child dyads that are more concordant in their perceptions of relationship quality are more likely to also be concordant about child's affective symptoms. Lastly, we predict that fMRI testing will reveal that dyads that are more concordant in perceived relationship quality and child affective symptoms will also be more concordant in their neural response to video clips of their own dyadic interactions, particularly in regions implicated in theory of mind. This study is important because we believe that getting mothers and children "on the same page" regarding their relationships could improve dyadic communication, help parents adjust parenting styles to suit the needs of their child, and potentially improve the theory of mind deficits that are associated with depression. Investigating the neural correlates of dyadic concordance in an exploratory manner could also help identify heritable endophenotypes associated with emotional processing and dyadic concordance.

## **Method / Materials**

Participants were 28 mother-adolescent dyads (adolescents aged 11-14), who each completed parent and child versions of the CRPBI (Schludermann & Schludermann, 1988), the MFQ (Angold & Costello, 1987), and the SCARED (Birmaher, 1997). Parents also completed the CES-D (Radloff, 1977). These questionnaires were used to assess dyadic relationship quality, child depressive symptoms, child anxiety symptoms, and parental depression symptoms, respectively.

Functional magnetic resonance imaging was carried out on a Siemens 3T TIM Trio and whole brain analysis was used to probe regions of activation associated with greater brain activation when participants watched video clips of a stranger dyad interacting positively (“Stranger Positive”) versus a stranger dyad interacting in a neutral manner. Clusters (threshold  $p < .001$ , corrected for multiple comparisons at  $p < .05$ ) were extracted from SPM12 and used in stepwise linear regression models (controlling for age and sex) in SPSS. Post-scan, the participants were asked to evaluate how positive and negative they perceived both members of the stranger dyad to be during the interaction on a 5-point Likert scale. Concordance scores were calculated by taking the absolute value of the difference between parent and child ratings on the CRPBI, MFQ, SCARED, ratings from the post scan task, and neural response to stranger happy faces.

## Results

CRPBI concordance was associated with MFQ concordance,  $B = .427$ ,  $t(26) = 2.248$ ,  $p = .044$ . No significant relationship between parent depressive symptoms on the CES-D and dyadic CRPBI concordance was found. However, moderation analysis revealed that CES-D severity moderated the association between CRPBI and MFQ concordance at high levels of CES-D ( $B = 1.470$ ,  $p = .002$  at +1 SD of CES-D from the mean), but not low levels ( $B = -.472$ ,  $p = .211$ , at -1 SD from the mean).

Cluster-wise analysis yielded significant activation in bilateral rolandic operculum ( $[-58, -10, 8]$ , 573 voxels,  $t = 5.81$ ,  $p_{FWE} = .000$ ;  $[62, 6, 18]$ , 191 voxels,  $t = 4.37$ ,  $p_{FWE} = .000$ ) when viewing stranger dyads expressing positive affect versus neutral affect. A significant correlation between the right rolandic operculum cluster and concordance of child anxiety symptoms ( $r = .442$ ,  $p = .045$ ) was observed. Dyadic concordance in post-scan ratings of child positivity for the “Stranger Positive” video was positively

associated with concordance in child anxiety symptoms ( $r = .568, p < .05$ ) and concordance of responding in the right rolandic operculum cluster ( $r = .487, p < .05$ ). Concordance of ratings of child negativity was also positively associated with concordance on SCARED ( $r = .405, p < .05$ ).

## **Discussion**

The results suggest that mothers that are more on the “same page” with their children regarding their relationship, are also more likely to be on the same page about difficulties their children are having internally. It also appears that as levels of maternal depression increase, greater agreement of relationship quality may facilitate greater agreement of child symptoms. Bilateral activation of bilateral rolandic operculum, an area implicated in theory of mind processing (see Hipwell et al., 2015, Abu-Akel, 2003), in response to the functional imaging task suggests that theory of mind and emotion processing may play a role in dyadic concordance, especially considering that that concordance of child anxiety symptoms was associated with concordance of neural response. This complements emerging research by Colich et al., (2017), which also demonstrated significant dyadic concordance in functional response and suggests that responding in neural circuitry may be passed from mother to child. Overall, these results suggest that targeting relationship quality concordance, or working to get the mother and child “on the same page” regarding their relationship, could also help get dyads to be more in tune with each other affectively and behaviorally. Focusing on theory of mind and communication skills by coaching parents and their children on how to better understand and express each other’s mental states could be one way of achieving improved concordance. Ultimately, this has the potential to improve the parent-child relationship and help parents provide support for children who may be at risk for psychopathology.

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