# UNIVERSITY OF MISSOURI COLUMBIA Effects of the beta-adrenergic antagonist propranolol on adaptive and problem behavior and relationship with heart rate variability in patients with autism spectrum disorder Esirioghene Emeje, Kathy Hirst, Julie Muckerman, Katie Bellesheim, Nicole Takahashi, David Beversdorf, & Bradley Ferguson

### INTRODUCTION

•Autism spectrum disorder (ASD) is a neurodevelopmental disorder that affects many individuals in the United States. According to the CDC, its prevalence is on a continual rise with a 15 percent increase nationally affecting 1 in 68 children in the United States.

•One of the main issues that affects children with ASD is their ability to communicate and their behavior. People, who suffer from ASD, have difficulty with social communication and social interaction, causing them to behave in socially unacceptable ways at times. As such, it is important to find ways to help increase socially-appropriate behavior in ASD and maximize their social communication and interaction.

•Studies indicate that ASD may be characterized by hyper-restrictive associative networks, which may be related to increased noradrenergic signaling in the brain. Research indicates that propranolol, a pharmaceutical drug that blocks the brain and body's use of norepinephrine both centrally and peripherally, reduces noradrenergic system activity.

• Ppropranolol also decreases blood pressure and reduces anxiety. A previous study in our lab examined the effects of serial doses of propranolol, on social interactions and secondarily on language tasks, anxiety and adaptive behavior in high functioning adults and adolescents with ASD. We found that when taking the serial doses of propranolol for 15 weeks, it helps benefit people with autism in the realm of social interaction and anxiety.

• We expect the results to show that after the participants take the drug for 12 weeks, there will be a significant increase in their adaptive behaviors and a decrease in problem behavior.

## **MATERIALS AND METHODS**

**Participants:** Male youth and adolescent boys (7-14) and (15-24)

**Apparatus:** BIOPAC MP150 Data Acquisition System with an ECG100C amplifier (BIOPAC Systems, Inc., Goleta, CA.)

### **Baseline Session:**

Participants are randomized to receive either a placebo or propranolol. The drug will be titrated slowly to ensure the drug is tolerated well.

### **During the study:**

Participants will undergo psychophysiological (heart rate variability) and behavioral (Vineland Adaptive Behavior Scales) assessments at two separate study visits at the following time points: (1) prior to drug administration, for establishment of a baseline; (2) the end of drug period (approximately week 12). Participants (15-24): are slowly ramped up to 100mg.While participants (7-14) dosage was based on their weight (mg/kg).

Week 1: 40 mg propranolol (1 capsule, nightly) Week 2: 80 mg propranolol (2 40mg capsules, morning & night) Weeks 3 - 12: 100 mg propranolol (3 capsules, 40 mg/morning, 20mg/afternoon, & 40mg/night)

### RESULTS

- Preliminary results indicate that anxiety reduced significantly and social interaction increased significantly after 12 weeks of propranolol (See Figures 1 & 2).
- Heart rate variability analyses are ongoing. We expect the results to show that after the participants take the drug for 12 weeks, there will be a significant increase in their adaptive behaviors and a decrease in problem behavior.



**Figure 1**. Mean CGI-S for anxiety at baseline was 3.81 (*SD*=1.17), decreasing to 3.4 (*SD*=1.3), (*p*=0.014) and mean CGI-I at 12-weeks was 2.8 (*SD*=1.2) for anxiety.



**Figure 2**. Mean CGI-S for social interaction at baseline was 3.81 (*SD*=0.83) (scores range from from 1-7, where 1=normal and 7=most severe), decreasing to a mean of 3.53 (*SD*=0.74) at week-12 (*p*=0.019).



### Values

- Average of Baseline Anxiety Severity Average of 12 WK Anxiety Severity

- Values
- Average of Baseline Social Interaction
- Average of 12 WK Social Interaction Severity

- their heart rate variability.





- percent-1-59-children
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# CONCLUSIONS

• Preliminary analyses show that anxiety significantly decreased and social interaction significantly increased after taking propranolol for 12 weeks.

We expect that the change in adaptive behavior and problem behavior will be associated with the change in



More variation in heart rate intervals is indicative of better parasympathetic activity

# REFERENCES

• Johnson, C. (2017). CDC increases estimate of autism's prevalence by 15 percent, to 1 in 59 children. Retrieved July 28, 2020, from https://www.autismspeaks.org/sciencenews/cdc-increases-estimate-autisms-prevalence-15-

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