Symposium Title: A Multilevel Approach to Measure the Impact of Theatre to Enhance Social Competence in Children with Autism Spectrum Disorder

Chair: Blythe A. Corbett

Discussant: Beth Malow, MD

Overview: Autism Spectrum Disorder (ASD) exhibits core impairment in many areas of social competence (APA, 2013) to include poor reciprocal social interaction with peers, deficits in social cognition, and enhanced physiological arousal. Moreover, there is limited improvement in functioning without intervention (Seltzer, Shattuck, Abbeduto, & Greenberg, 2004). To address the broad range of challenges, theatre techniques and the use of young actors as interventionists, have been used as a promising treatment approach. The three presentations in this symposium will examine the impact of SENSE Theatre®, a peer-mediated, theatre-based intervention research program, across three cohorts of children in a large randomized control trial (RCT). The first presentation will show treatment effects on reciprocal social interaction and communication with typically developing peers using an ecologically valid paradigm. The second presentation will analyze changes in regards to social cognition; namely, incidental face memory using event-related potentials (ERP). The third presentation will examine the impact of the intervention on physiological arousal using respiratory sinus arrhythmia (RSA) in a sample youth with ASD exposed to the theatre intervention.

Paper 1 of 3

Paper Title: Theatre and Peers to Enhance Real World Social Competence in Children with Autism

Authors: Blythe A. Corbett1,3, Sara Ioannou1,3, Ian Muse1,3, Rachael Muscatello4, Catherine Coke5

Introduction: Autism Spectrum Disorder (ASD) is an archetypal disorder of poor reciprocal social interaction. Recent studies using theatre techniques, such as role-playing, improvisation, and character development, have shown promise in enhancing social competence (Corbett et al., 2016; Lerner et al., 2014) in children and adolescents with ASD. Moreover, peer-mediation has been shown to facilitate social interaction patterns (DiSalvo & Oswald, 2002). The purpose of the current large randomized control trial was to focus on the impact of a peer-mediated, theatre-based intervention, SENSE Theatre®, on reciprocal social communication during natural play with novel peers Significant differences between the Experimental (EXP) and the Control (CON) Group were hypothesized for measures of reciprocal social behavior and communication.

Methods: Participants included 80 high-functioning youth with ASD between 8-to-16 years randomly assigned to the EXP (N=43) or CON (N=37) group. The groups were comprised of three merged cohorts. The primary dependent measures were Cooperative Play and Verbal Bout from the Peer Interaction Paradigm (Corbett et al., 2010). Analysis of Covariance was used in which the post-intervention score served as the outcome variable, group (EXP/CON) as the independent variable, and baseline (pre-intervention) score and cohort as a covariate. Registered with www.clinicaltrials.gov ID# NCT02276534.

Results: The groups did not differ with regards to age, gender, or symptom profile. Post-treatment the EXP compared to the CON group engaged in more Cooperative Play during solicited F (1,79) = 9.05, p = 0.004, and unsolicited play F (1,79) = 5.81, p = 0.02. Verbal Interaction with novel peers was also significant during solicited F (1,79) = 8.40, p = 0.005, but not unsolicited play F (1,79) = 1.90, p = 0.17. The EXP group also showed fewer verbal rejections of the novel peers, than the CON group F (1,78) = 5.74, p = 0.02.

Discussion: Youth who participated in the SENSE Theatre treatment were better able to converse and engage in more natural, reciprocal social interactions with peers. Peer-mediated theatrical approaches contribute to significant gains in social

1 Vanderbilt University Medical Center Department of Psychiatry and Behavioral Sciences
2 Vanderbilt University Medical Center Department of Neurology
3 Vanderbilt Kennedy Center
4 Vanderbilt Brain Institute, Neuroscience Graduate Program
5 University School of Nashville
competence in youth with ASD. Future studies are needed to identify for whom the treatment works and the key active ingredients of the treatment.

References/Citations:


Paper 2 of 3

**Paper Title:** Biomarkers of Treatment Outcomes: ERPs as the Measure of Improvements in Social Cognition

**Authors:** Alexandra P. Key1,3,6, Dorita Jones3, Blythe A. Corbett1,3,4

**Introduction:** Successful development of effective treatments targeting social cognition in children with autism spectrum disorder (ASD) depends in part on the availability of objective and sensitive outcome measures. The purpose of this study was to investigate which neural mechanisms supporting social cognition (perception of vs. memory for faces) are associated with improved social behavior following treatment in children with autism.

**Methods:** Brain mechanisms supporting face perception and incidental memory (Key & Corbett, 2014) were evaluated before and after the treatment using visual event-related potentials (ERPs) in 80 children with autism (age 7-16 years) during passive viewing of color photographs depicting unfamiliar smiling young adults or front views of houses, a subset of which were randomly selected and repeated throughout the test session while the rest were shown only once. Social perception was indexed by the occipito-temporal N70 responses (faces vs. houses), while social memory was quantified as the increased parietal ERP amplitude (300-500 ms) to repeated faces vs. those seen once. Behavioral measures of social cognition included NEPSY Memory for Faces, caregiver reports (Social Communication Questionnaire, Social Responsiveness Scale, Child Behavior Checklist), and coded observations of playground behaviors with peers.

**Results:** All participants demonstrated perceptual discrimination of faces vs. houses as reflected in the larger N170 responses to the former, suggesting social perception mechanisms comparable to those of typical individuals at both test sessions. Examination of the social memory processes indexed by the frontal and parietal “old/new” responses in the 300-500ms interval at baseline revealed no significant differences between repeated faces and those seen once. Following the social skills intervention, children with ASD in the treatment group demonstrated ERP evidence of incidental memory for faces (Corbett et al., 2016) due to increased ERP amplitudes in response to repeated faces compared to the baseline assessment, while the waitlist control group showed no change. This pattern of results was replicated in each of the three treatment cohorts. The ERP index of incidental face memory did not correlate with age, IQ, or ADOS severity scores, but in the treatment group, greater incidental memory trace for repeated faces (more positive amplitudes) at the posttest was associated with increased duration of unsolicited cooperative play with peers, r=-.444, p=.003. The same association was not present in the waitlist control group.

**Discussion:** Evaluating social functioning using a combination of neurophysiological and behavioral assessments offers the most comprehensive approach to the evaluation of treatment effects in children with ASD. The replicated evidence of sensitivity to treatment effects, good test-retest stability in the control groups, correlations with behavioral endpoints, and reduced

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6 Department of Hearing & Speech Sciences, Vanderbilt University Medical Center
susceptibility to the placebo effects due to the passive nature of the task support the value of ERPs as a promising treatment outcome measure.

References/Citations:

Paper Title: Effects of a Theatre-Based Intervention on Parasympathetic Arousal during Social Interaction in Children with Autism Spectrum Disorder (ASD)

Authors: Rachael A. Muscatello\(^1\) and Blythe A. Corbett\(^{1,2,3}\)

Introduction: Many children with autism spectrum disorder (ASD) experience significant stress during social interaction, including increased activation of the hypothalamic-pituitary-adrenal (HPA) axis (Corbett et al., 2014). Dysregulation of an additional physiological system, the autonomic nervous system (ANS), has been reported in ASD (e.g. Vaughan Van Hecke et al., 2009). Respiratory sinus arrhythmia (RSA) is a cardiac measure of the parasympathetic branch of the ANS, and parasympathetic regulation and reactivity has been theorized as a marker of behavioral flexibility and social engagement (Porges, 1995). As theatre-based interventions may improve overall social competence (Corbett et al., 2016b), the current study sought to investigate whether intervention would also promote changes in parasympathetic regulation.

Methods: Participants included 36 children with ASD randomly assigned to the experimental (EXP; n = 21) or control (CON; n = 15) groups. RSA was collected during the Peer Interaction Paradigm (PIP) using mobile electrocardiogram units (MindWare Technologies, Gahanna, OH). Primary dependent measures included RSA (resting and during play) and amount of Cooperative Play. Univariate ANCOVAs were used to assess for group differences in RSA post-intervention while controlling for pre-intervention RSA. Additionally, a suppression score was calculated to serve as a measure of RSA change from baseline by subtracting resting RSA from RSA during the PIP. More negative scores are indicative of greater suppression, or decrease in RSA from resting state. Suppression scores were used in correlational analyses with percent of cooperative play.

Results: There were no differences between groups in post-intervention resting RSA (p>0.05). Additionally, there were no between-group differences for RSA during unsolicited play (T1) or solicited, cooperative play (T4) after the theatre intervention. In order to explore possible associations between physiological arousal and play in the EXP group, Pearson product correlations with RSA suppression and cooperative play were examined; however, no significant correlations were seen at either T1 or T4 (all p>0.05).

Discussion: According to the Polyvagal theory, decreased parasympathetic arousal during a stressor is an adaptive mobilization response to increase cardiac output without engaging the more metabolically demanding sympathetic system (Porges, 1995). As previous studies of a theatre intervention have shown significant improvements in social competence, similar findings were expected in regards to physiological arousal. Additionally, based upon previous findings of the HPA axis (Corbett, Blain, Ioannou, & Balser, 2016a), associations between arousal and cooperative play were expected in the EXP group; however, no significant differences or correlations were seen in RSA following intervention. While this study may have been limited by the relatively small sample and physical demands of the play-based activity, findings suggest the intervention is not having an effect on the highly regulated autonomic system. Future research should be directed at understanding whether altered physiology, even in the face of notable improvements in social competence, is adaptive for youth with ASD. Further, interventions that more specifically target the ANS may elucidate whether changes in autonomic regulation would lead to overall changes in social behavior.
References/Citations:


