SOCIAL COGNITION IN EARLY-ONSET SCHIZOPHRENIA: PERFORMANCE COMPARED TO SCHIZOAFFECTIVE DISORDER, GENETIC HIGH RISK, AND CONTROLS

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A thesis submitted to the faculty of the University of North Carolina at Chapel Hill in partial fulfillment of the requirements for the degree of Masters of Arts in the School of Education (School Psychology).

Chapel Hill
2011

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ABSTRACT

SHANNON MIRAMANEE LEWIS: Social Cognition In Early-Onset Schizophrenia: Performance Compared to Schizoaffective Disorder, Genetic High Risk, and Controls
(Under the direction of Rune Simeonsson)

There is a significant body of literature on the social cognitive deficits in adults with schizophrenia, and little information describing the social cognitive functioning of children and adolescents with early-onset schizophrenia. The purpose of this study was to investigate: (1) factors impacting social cognition and (2) the social cognitive abilities of youth with early-onset schizophrenia by comparing their performance on the Eyes test to (a) controls, (b) genetically high-risk youth, and (c) youth with early-onset schizoaffective disorder. The study drew from data in the Conte and TEOSS studies, which included measures of social cognition and attention for 176 youth. A Pearson correlation and analysis of variance was used to identify variables impacting social cognition. An analysis of covariance was used to examine social cognition in youth with schizophrenia after controlling for extraneous factors. Results indicated age and attention as covariates, and significant social cognitive deficits in youth with schizophrenia.

ACKNOWLEDGEMENTS

First and foremost, I want to thank Jesus who has been the source of my strength throughout this project (2 Corinthians 12:9). I want to thank my committee members for supporting me in developing the idea and throughout the writing process. Thank you for the encouragement and invaluable feedback the three of you have given me. Thank you dad, mom, Josh, and Bani, because you have always supplied me with love, laughter, and motivation throughout my academic journey. To my mentor, Dr. Debra Barksdale, thank you for your words of wisdom, inspiration, and always challenging me to continue on and reach higher in my academic endeavors. Thank you Pastor Mike, Ms. Cheryl, and all of Celebration for your love and encouragement, keeping me in your prayers, and being a family away from home.

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LIST OF ABBREVIATIONS

GHR	Genetically High-Risk
SA	Schizoaffective disorder
SZ	Schizophrenia
ToM	Theory of Mind

CHAPTER 1

INTRODUCTION

Schizophrenia is a mental disorder that is characterized by two or more of the following symptoms: delusions, hallucinations, disorganized speech, grossly disorganized or catatonic behavior, and negative symptoms (Criterion A). The disorder is also characterized by social/occupational dysfunction and symptoms must persist for at least six months. Also symptoms cannot be due to substance use, a medical condition, a mood disorder with psychotic features, or schizoaffective disorder (American Psychiatric Association [*DSM-IV-TR*], 2000).

Schizoaffective disorder is a related mental illness that is characterized by an uninterrupted period of illness where, at some period, there are symptoms from Criterion A of schizophrenia occurring simultaneously with either a major depressive episode, manic episode, or mixed episode. During the illness, delusions or hallucinations need to remain for at least 2 weeks without mood symptoms and when mood symptoms occur they need to be present for a substantial portion of the total duration of the active and residual points in the illness. Lastly, schizoaffective disorder cannot be due to substance use or a general medical condition (*DSM-IV-TR*, 2000).

Two primary differences between schizophrenia (SZ) and schizoaffective (SA) disorder are the mood component and social/occupational dysfunction. Healthy social functioning requires well-developed social cognitive skills, which researchers have found to be especially limited in schizophrenia (Bellack, Morrison, Wixted, and Mueser, 1990).

Social cognition has been a major field of inquiry within the SZ population because of the marked deficits in social functioning. There are three main social cognitive domains studied in SZ, which include attributional style, emotion perception and Theory of Mind (ToM) (Penn, Sanna, and Roberts, 2008). Most studies have specifically investigated ToM in individuals with SZ, with the majority finding significant deficits (Penn, Sanna, and Roberts, 2008; Sprong, Schothrorst, Vos, Hox, and Van Engeland, 2007).

Researchers have used various designs to study social cognitive deficits in SZ. For example, researchers have compared social cognitive abilities of SZ patients with by comparing them to healthy controls, first-degree relatives, and patients with SA disorder. These comparative designs have also helped to evaluate if genetic traits or psychotic symptoms underlie social cognitive deficits in SZ. Most of the research supports the trait theory (Penn, Sanna, and Roberts, 2008), but conflicting evidence still exists. One method that could further examine the trait versus symptom conflict is a four-group comparison design using children and adolescents with SZ, SA disorder, child and adolescent first-degree relatives, and controls. Studies have evaluated social cognition in these populations and in children and adolescents with early-onset SZ but not in a four-group child/adolescent design. Therefore, a literature review on social cognition and how it has been examined in first-degree relatives of patients with SZ, SA disorder, and in children and adolescents with early-onset SZ follows to better understand findings, methodology, and limitations.

CHAPTER 2

LITERATURE REVIEW

This chapter provides a review of current literature on social cognition and the social cognition research in individuals with a SZ spectrum disorder and their first-degree relatives. In particular, this chapter will review studies conducted on the first-degree relatives of individuals with SZ to gain a better understanding on what is known about their abilities. Also, this chapter will discuss current studies on the social cognition abilities of individuals with schizoaffective disorder and children and adolescents with early-onset SZ. Finally, it will end with a summary of the findings in current literature, discuss gaps in the literature, provide a rationale for the current study, and the present study's research questions.

Social Cognition

Social cognition is a concept that has been widely studied in cognitive psychology and social psychology. It is a complex concept that involves knowledge of the self and others, person memory, facial-affect perception, knowledge of social situations and social context, social judgment, and role taking (Newman, 2001; Penn, Combs, and Mohamed, 2001). There is evidence that social cognition begins to develop in infancy. Twelve to 18-month old infants have been shown to nonverbally express (e.g. pointing) what others may want or be thinking (Slaughter, 2011). As language begins to emerge, social cognition continues to become more sophisticated. With language, a child is able to express what they feel and think as well as what others seem to be feeling or thinking. The ability to express one's own and other's emotions, thoughts, or other mental states, and recognize that individuals have

different mental states is called Theory of Mind (ToM). In sum, social cognition becomes more sophisticated as a child continues to develop language and an awareness that their own mental states as different from others.

There are many different components and demographic factors that affect and impact the functioning of social cognition, such as attention, age, IQ, socio-economic status (SES), gender, and illness severity. First, the attention of one's self and others, or joint attention, is necessary before social cognition can develop (Mundy and Newell, 2007). Attention impacts one's social cognition because in order receive social information the individual needs to visually orient their attention to incoming sensory information (Frischen, Bayliss, and Tipper, 2007). In general, as one's attention capabilities continue to grow, the capacity to retrieve and process social-cognitive information also increases.

Social cognition is a skill that tends to develop and increase with age and grade in typically developing individuals. Branden-Muller, Elias, Gara, and Scheider (1992) found that from third to fifth grade, social cognition improved in children. Furthermore, there is evidence that IQ and SES are significantly positively correlated with social cognition (Peelegrini, 1985). Also, Ford (1982) and Adams (1983) found significant gender differences in social cognition and social competence judgments, with females having higher scores.

As noted previously, social cognition is impaired in individuals with schizophrenia, but it is especially impacted by the severity of the illness. The severity of the illness can vary in patients with SZ, and more so depending on medication and other therapies the patient may be undergoing. In a meta-analytic review, authors found that in SZ the severity of clinical symptoms; along with positive and negative symptoms further impair social cognitive functioning (Kohler, Walker, Martin, Healey, Moberg, 2010). Since the severity of

clinical symptoms vary widely among SZ patients, due to medication and other therapies, studies tend to control for this variable when investigating social cognition abilities (Poole, Tobias, and Vinogradov, 2000).

Measuring Social Cognition

There are many instruments used to measure social cognitive abilities and theory of mind. Some tasks and measures often used for ToM include, the False Belief Task (also known as the 'Sally-Anne' task), the Strange Stories test (Happé 1994), the Faux-pas Recognition test (Stone, Baron-Cohen, and Knight, 1998), the Hinting Task (Corcoran, Mercer, and Frith, 1995), and 'Reading the Mind in the Eyes' test (Eyes test; Baron-Cohen, Wheelwright, Hill, Raste, and Plumb, 2001). The present study used the Eyes test because it was selected as the measure of choice during initial data collection. This Eyes test is often selected above other measures and tasks because it has been demonstrated as an effective measure of ToM in adults and children, it is relatively simple to administer, and it is time efficient. The Eyes test was originally developed to study ToM in individuals with autism; a disorder partially defined by social cognitive impairment. Research using both the child and adult versions of the Eyes test has shown that even individuals with high-functioning autism perform poorly on the measure (Losh and Piven, 2006). Therefore, the Eyes test seems to be a robust measure that is able to give an accurate picture of social cognitive skills, regardless of IQ or language skills.

Studies using the Eyes Test to measure ToM abilities in patients with SZ have found significant impairments compared to healthy controls (Irani et al., 2006; Kelemen et al., 2005; Kettle, O'Brien-Simpson, and Allen, 2008; Shur, Shamay-Tsoory, and Levkovitz, 2008). Moreover, compared to another ToM measure, the Hinting task, the Eyes Test was

found to be the best predictor of social functioning (Bora, Eryavuz, Kayahan, Sungu, and Veznedaroglu, 2006), which makes it an appropriate and preferred measure of social cognition.

First-Degree Relatives

Studies on relatives of patients with SZ have shown that relatives and patients share a number of impairments in attention, executive functioning, social cognition, and working memory (Whalley, Harris, and Lawrie, 2007). Several studies have specifically examined social cognition in patients and relatives and have found marked deficits in both groups. In 2003 Janssen, Krabbendam, Jolles, and van Os used two Theory of Mind (ToM) tasks, the hinting task and false-belief task, in patients with SZ or schizoaffective disorder, first-degree non-psychotic relatives, and controls. They found that relatives had significant deficits on the hinting task when compared to controls. Also, in relation to patients and controls, the relatives had intermediate scores between patients and controls, suggesting that change in ToM is related to risk of SZ. Similarly, in 2006 Irani and colleagues found that unaffected relatives of patients with SZ had an intermediate performance on the Eyes Test, between patients and controls. Anselmetti, et al. (2009) conducted a study assessing social cognition with a ToM picture-sequencing task in patients with SZ and their asymptomatic parents. Similarly, their results showed social cognition to be significantly impaired in patients and their parents compared to controls and the parents of controls. Again this suggests that ToM performance is impaired in parents of patients, even when symptoms are not present.

A recent 2010 study by Achával and colleagues found that patients with SZ and their unaffected first-degree relatives exhibited similar deficits in performance but distinguishable patterns of social cognition processing. They measured social cognition with the Faces Test,

the Eyes Test, Faux Pas Test, and ToM stories test. The patients exhibited significant impairments on the Faux Pas and ToM stories compared to controls, while the relatives displayed deficits in the Faces Test, the Eyes Test, and Faux Pas tests compared to controls. Moreover, they found that Faces test was associated with performance in the ToM tests in only the relatives and healthy controls.

Shim, et al. (2008) studied first-degree relatives of patients with SZ, or genetically high-risk (GHR) individuals, in a different design. They compared GHR subjects to ultra-high-risk (UHR; in addition to being GHR they also have signs of declining functioning) subjects, and age- and IQ-matched controls on social cognition using Social Functioning Scale (SFS). Their results indicate that compared to control subjects the UHR and GHR subjects were significantly more impaired on the SFS, and the UHR group was more impaired than the GHR subjects. With regards to significant impairments in UHR groups, their results were consistent with other studies (Chung, Kang, Shin, Yoo, and Kwon, 2008).

Another study investigated the social cognition of GHR individuals using a longitudinal prospective design (Schiffman, Lam, Jiwatram, Ekstrom, Sorenson, and Mednick, 2004). When the participants were children they were administered the Role-Taking Task (RTT), a theory of mind task that assesses perspective-taking ability. When the participants were given follow-up examinations 20 year later they found that those who later developed SZ or a SZ spectrum disorder has lower RTT scores at the initial evaluation. The results of this study support the vast majority of research that suggests social cognitive skills, or theory of mind abilities, are impaired in individuals with GHR before the development of the disorder begins to manifest.

Although there have been many studies indicating that first degree relatives have deficits on social cognition tasks, there is research that presents divergent evidence. Kelemen, Kéri, Must, Benedek, and Janka (2004) demonstrated that ToM abilities, as measured by the Eyes Test, was impaired in affected relatives of patients with SZ, not unaffected relatives, when compared to controls.

Similarly, Marjoram et al. (2006) examined ToM deficits in unaffected relatives and relatives with psychotic symptoms by comparing them to healthy controls on the Hinting task, Self-Monitoring drawing task, and cartoon pictures stories. There were no significant differences between both groups of relatives and controls on the Hinting task. Significant impairments on the cartoon task existed for relatives who experienced psychotic symptoms and significant differences on the Self-Monitoring task only existed for relatives who experienced symptoms at or around the time of test administration.

Additionally, Riveros et al. (2010) found no significant differences between SZ patients, healthy relatives, and controls on the Eyes test but found that patients and relatives performed significantly more poorly on the Faux pas Test. In another recent study that used adolescents with genetic-high risk and compared them to controls on the Eyes test, they found no significant difference in performance on the ToM task (Gibson, Penn, Prinstein, Perkins, and Belger, 2010).

The research on patients with SZ and relatives consistently show deficits in patients and some conflicting evidence with regards to relatives. Conflicting evidence with regards to relatives may be associated with the different measures that are used to study ToM and social cognition, or whether the relatives are asymptomatic or not. Therefore, it is not clear if social

cognition deficits in SZ are a result of genetic traits or the presence of psychotic symptoms but most of the evidence supports the trait theory (Penn, Sanna, and Roberts, 2008).

Schizoaffective Disorder

Social cognition has also been examined in patients with SZ by comparing them to patients with schizoaffective (SA) disorder. SA disorder is a schizophrenia-spectrum disorder (SSD) that is similar to SZ in that it is characterized by distortions in perception, but these symptoms also alternate or occur with recurring episodes of elevated and/or depressed mood. Since patients with SZ and SA disorder have similar and differing symptoms they are ideal groups to compare in order to gain a better understanding of the role symptoms play in social cognitive abilities.

Many studies that have investigated social cognition in patients with SZ and SA disorder have combined the groups (Addington, Girard, Christensen, and Addington, 2010; Bell, Tsang, Greig, and Bryson, 2009; Fiszdon and Bell, 2009; Gard, Fisher, Garrett, Genevsky, and Vinogradov, 2009; Greig, Bryson, and Bell, 2004; Meyer and Kurtz, 2009), making it impossible to study differences between them. However, in 2007, Fiszdon, Richardson, Greig, and Bell investigated social cognition in patients with SZ and SA disorder using the Hinting Task and the Bell Lysaker Emotion Recognition Task. They found that patients with SZ performed significantly worst on the ToM Hinting task compared to individuals with SA disorder. In contrast, Hooper et al. (2010) did not find any significant differences on the Eyes Test between children and adolescents with early onset SZ and SA disorder. The lack of research comparing social cognition in SZ and SA populations coupled with divergent evidence suggests a need for more research in this area.

Early-Onset Schizophrenia

Early-onset SZ is defined as the onset of illness before the age of 18 whereas onset before the age of 13 is considered childhood-onset SZ. The majority of studies have focused on adults with SZ, without investigating the early-onset in children and adolescents. Studies that have investigated the disorder in children and adolescents tend to broadly look at neurocogntive functioning, and not focus in on social cognition. Kumra et al. (2000) found attention, learning, and abstraction deficits in children with early-onset SZ. Similarly, Ueland, Øie, Inge Landrø, and Rund (2002) examined cognition in adolescents with SSD and healthy adolescents and found deficits in executive functioning and psychomotor speed, and relative impairments in preattentional processing, early visual information processing, visual long-term memory, auditory short-term memory, and working memory. Likewise, Rhinewine and colleagues (2005) examined neurocognitive functioning in adolescents with early-onset SZ and found executive functioning deficits.

Others have specifically investigated attentional capacity deficits in early-onset SZ (Thaden et al., 2006) and high-risk adolescents (Cornblatt, Obuchowski, Roberts, Pollack, and Erlenmeye-Kimling, 1999). McClellan, Prezbindowski, Breiger, and McCurry (2004) found similar deficits in global cognition in adolescents with early-onset SZ but also found they had more difficulties with social knowledge when compared to adolescents with bipolar disorder or psychosis not otherwise specified (NOS).

A study that specifically examined ToM in children and adolescents with SZ found deficits in their performance on the false belief task when compared to healthy mental-age matched children (Pilowsky, Yirmiya, Arbelle, and Mozes, 2000). Since most studies have

broadly examined the neurocognitive functioning of early-onset SZ, there is a need for more research focusing on the social cognitive functioning in this population.

Summary

In sum, previous literature indicates that social cognition is a complex skill that is impacted by many different variables. Furthermore, studies generally support that it is a skill significantly impaired in individuals with SZ. Researchers have sought to better understand social cognitive deficits in SZ by exploring how their social cognitive skills compare to other groups, using measurements such as the Eyes test. Social cognition has been investigated in first-degree relatives and individuals at ultra-high risk for SZ, in individuals with SA disorder, and in children/adolescents with early-onset SZ and SA disorder. Studies evaluating social cognition in first-degree relatives and individuals at ultra-high risk for SZ have found deficits. However, the deficits in this group are less pronounced compared to the deficits observed in SZ. Also the majority of the findings support the theory that genetic traits underlie these impairments.

Thus, studies examining social cognition in SA disorder are especially important for two reasons. First, social dysfunction is a diagnostic criterion in SZ but not in SA disorder. Second, it may potentially provide more evidence on whether social cognitive skills are the result of genetic traits or symptoms shared by both disorders (Criterion A). It may be intuitive to assume that social cognitive skills are significantly more impaired in SZ compared to SA disorder. However, the vast majority of research has not designed studies to compare the two groups; they have collapsed the two groups into one SZ spectrum disorder group.

Two studies have separated the two groups but the results in regards to differences in social cognitive skills are conflicting. One study conducted in adults with SZ and SA disorder found significant differences on a ToM task, with pronounced impairments in SZ. The other study (Hooper et al., 2010) was conducted in children and adolescents with SZ and SA disorder using a different ToM task (Eyes test) and results provided no evidence for significant differences between the groups. The lack of research in this area limits our knowledge on the trait versus symptom theory. The small body of literature comparing social cognition in SZ and SA disorder also makes it impossible to know if the conflicting evidence is the result of different ToM tasks or differences in adults and children. If different results are due to developmental level, this also indicates the need for social cognitive research in children and adolescents with early-onset SZ.

Social cognition in early-onset SZ has been evaluated in two studies (Hooper et al., 2010); Pilowsky et al., 2000). Pilowsky et al. (2000) found ToM deficits in early-onset SZ on the false belief task. Other studies examining early-onset SZ have investigated neurocognitive functioning globally. These studies have found deficits in attention, preattentional processing, learning, abstraction, executive functioning, psychomotor speed, visual information processing, visual long-term memory, auditory short-term memory, and working memory.

Rationale

Most studies have found social cognitive deficits in SZ, first-degree relatives, SA disorder, and early-onset SZ, with impairments being more pronounced in SZ. Research in these areas has resulted in conflicting evidence on whether deficits are the result of genetic traits or symptoms. Therefore, I believe it is important to conduct a study that on social

cognition in SZ that includes (1) SA disorder, (2) genetically high-risk (GHR) individuals, and (3) controls to clarify the role of traits or symptoms. There is also limited research on social cognitive performance at an earlier developmental stage of the mental illness. Meaning, it is important to examine children and adolescents with SZ, SA disorder, and GHR youth to better understand functioning in a younger population. For this reason, I examined social cognition in SZ by comparing them to three separate groups: children and adolescents (1) with early-onset SA disorder, (2) who are genetically-high risk relatives, and (3) controls. With this methodological design, this study significantly contributes to the scientific literature on early-onset SZ and aspires to help narrow some of the gaps by describing how the illness effects social cognitive functioning in youth and youth at risk for the illness, as well as the severity of the possible deficits in functioning. Furthermore, the study aims to provide results that will help inform prevention and intervention measures for youth with this pervasive psychiatric illness.

Research Questions

1. What are significant correlates of social cognitive functioning?

   Hypothesis: Previous studies have shown that a number of factors impact social cognition, but I hypothesize that two factors, age and attention, are significant correlates.

2. After controlling for correlates of social cognitive functioning, how do children and adolescents with early-onset SZ perform on the Eyes test, a social cognitive measure, compared to children and adolescents with early-onset SA disorder, genetically high-risk relatives, and healthy controls?

Hypothesis: Based on literature, I hypothesize that children with early-onset SZ will perform significantly more poorly on the Eyes- test than healthy controls and GHR youth but not children with SA disorder

CHAPTER 3

METHODS

The primary goal of this study was to investigate the social cognition abilities of children and adolescents with early-onset SZ, by comparing them to youth with SA disorder, first-degree relatives, and healthy controls. This chapter includes a description of the methods, procedures, and the participants involved in the study. Specifically, the chapter includes descriptions of the participants, instrument parameters, and the test statistics used.

Participants

Participants from the Conte Center for the Neuroscience of Mental Disorders and The Treatment of Early Onset Schizophrenia (TEOSS) study were used. The Conte Center consists of five project cores and five principal investigators. Dr. Aysenil Belger is the principal investigator of the "Mapping Cortical Circuit Maturation n High Risk Adolescents" project, which is where the neurocognitive data for the present study was obtained. The Conte Center recruited and collected data on the neurocognitive functioning of 60 GHR and 60 healthy children and adolescents (60 females and 60 males), aged 9-18. Inclusion criteria for this study included: (1) GHR subjects having a first-degree relative diagnosed with SZ spectrum disorder, and (2) healthy controls being recruited from the same community as GHR subjects. Exclusion criteria were as follows: (1) Any Axis I disorder in the healthy control or their first-degree relative, (2) GHR subjects meeting criteria for psychotic or bipolar disorders, and (3) subjects with serious medical or neurological disorders.

The Conte study has investigated the social cognition abilities of GHR youth by comparing them to controls (Gibson, Penn, Prinstein, Perkins, and Belger, 2010). Their findings indicated no significant differences between the two groups on the Eyes test, a social cognition task. Previous research on social cognition in GHR when compared to healthy controls has provided mixed evidence, with the vast majority of research demonstrating a significant social cognitive deficit in GHR individuals. The Gibson et al (2010) findings support the studies that do not indicate a significant difference between asymptomatic GHR subjects and healthy controls (Kelemen, et al., 2004; Marjoram et al., 2006; Riveros et al., 2010). As such, it is important to note that GHR subjects used for the present study include children and adolescents that were asymptomatic and did not have any Axis I disorders, psychotic disorders, or bipolar disorder.

The TEOSS study has one of the largest samples of children and adolescents with SZ spectrum disorders (Frazier, et al., 2007). It consists of 119 subjects (49 males and 30 females) with SZ (n=79) and SA disorder (n=40), ranging from ages 8-19. Inclusion criteria included: (1) subjects that met diagnostic criteria for SZ, SA disorder or schizophreniform disorder at baseline, (2) a score of at least moderate on at least one of the essential psychotic items on the Positive and Negative Symptom Scale (PANSS) or the Brief Psychiatric Rating Scale for Children (BPRS-C), (3) good physical health, and (4) ability to give informed consent and guardian consent (Frazier, et al., 2007). Exclusion criteria were as follows: (1) bipolar disorder diagnosis, primary major depressive disorder diagnosis, primary posttraumatic stress disorder diagnosis, primary personality disorder diagnosis, or psychosis not otherwise specified, (2) substance abuse or dependence diagnosis, (3) premorbid diagnosis of mental retardation, (4) endocrinological or neurological conditions that

confound SZ spectrum disorder diagnosis or confound treatment with antipsychotics, and (5) individuals with concurrent major depressive disorder and/or taking antidepressants and/or mood stabilizers within the 30 days before enrollment (Frazier, et al., 2007).

The total sample from both studies includes 247 subjects. This study only included child and adolescent subjects who were administered the child version of the Eyes test. The total sample for this study includes 176 subjects, with a mean age of 13.65 (range from 8.08 to 19.33 years old), who had either a diagnosis of early-onset SZ or early-onset SA disorder or who were GHR, or controls. Males comprised 56.8% of the sample and 74.14% of the sample was White. Ninety-nine percent (1 missing) of the children were enrolled in school, from grades 1-12. The majority of these subjects (61%, 3 missing) were reported to have never attended a special education classroom.

Procedures

Upon receiving IRB approval, the data sets from the Conte project and TEOSS study were combined. They were combined using both PASW Statistics 18 (SPSS Inc., 2010) and Microsoft excel. The following data points were collected from both studies to create the final data set: Diagnosis; Child Eyes test; Vigil Continuous Performance Test (ommissions, commissions, total errors and response time); Age; Gender; Race; Ethnicity; Grade level; and Special education status.

Instrumentation

Social Cognition measure

1. *Reading the Mind in the Eyes Test, Children's Version.* The Eyes Test was designed to measure social cognition in children. The child version of the Eyes test was adapted from the adult version, which was originally used with subjects with Autism

Spectrum Disorder. There are 28 items on the Eyes Test and there are four response choices for each item. For example, a child will look at a picture of eyes and have four choices that include "friendly", "sad", "surprised", and "worried". There is only one correct choice out of the four that are presented to the subject. Therefore, each item is given a score of zero or one, meaning total scores have a range from zero to 28. Baron-Cohen, Wheelwright, Spong, Scahill, and Lawson (2001) indicate that a score of nine or more out of 28 possible is above chance. During an administration of the Eyes test children are asked to carefully look at the picture of eyes and choose the word that best describes what the person in the picture is thinking or feeling. Sample words include, jealous, scared, relaxed, or hate. Although this is a widely used ToM measure, psychometric studies have not been conducted on the tool (Baron-Cohen, Wheelwright, Spong, Scahill, and Lawson, 2001).

Attention Measure

2. *Vigil Continuous Performance Test (CPT).* The Vigil CPT is a computer-administered test designed to assess sustained attention in individuals between ages 6 through 90. The subjects are visually presented with alphanumeric symbols. They have to press a key as quickly as possible when the target stimuli are presented. The administrator determines the test length and number of trials meaning there is no standard range of scores derived from the CPT variables. The Vigil CPT provides six different test variables. They include: (1) Hit rate: target discrimination accuracy; (2) False Alarm: incorrect anticipation of target when no target is presented; (3) Error of Commission: total number of incorrect target anticipations; (4) Error of Omission: total number of missed targets; (5) Reaction time: average time from the onset of a

stimuli to the response; and (6) Perseverations: the total number of responses greater than one that were made during the interstimulus intervals. Partial, alpha, and split-half reliability coefficients range from .80 to .90 (The Psychological Corporation, 1994). The data also includes a Total Errors Score that includes all the errors (False Alarm, Error of Commission, and Error of Omission) an individual made.

Statistical Procedures

Data analysis was completed with the raw total scores from the child's Eyes Test as a measure of social cognition, Vigil CPT total error scores as a measure of attention, and demographic information (age, gender, grade, and race). Descriptive statistics and percentages were also generated. Data were screened and analyzed using the statistical package, PASW Statistics 18 (SPSS Inc., 2010).

Initial Screening

Preliminary analyses of the data were conducted prior to completing the analyses for the two research questions. The data were examined for normality and outliers with kurtosis and skewness statistics, and stem-and-leaf plots for Eyes test and Vigil CPT scores. Also, group statistics were completed on participants' demographic information, Eyes test scores, and Vigil CPT total error scores, to screen any potential differences between groups.

Analysis by Research Question

Research Question 1: What are significant correlates of social cognitive functioning?

As noted in the literature review on social cognition, age, grade, gender, and attention are known to impact social cognition. There is no evidence to suggest that race impacts social cognition abilities, but it is a demographic factor that may impact social cognition in the current sample. To answer research question one, two analyses were used. First, Pearson

correlations were conducted between Eyes test scores and (1) age, (2) grade, and (3) Vigil CPT total error scores to examine if any of these variables impact social cognition. Correlational analysis was chosen because it is based on the covariance statistic and yields information on how related two variables are and the degree to which the two variables tend to move together (Howell, 2007). If the Eyes test is significantly correlated with any of these variables, then those variables might account for some of the differences observed between the four groups. If any of the variables are significantly correlated with the Eyes test, then that variable will be used as a covariate in the analysis for the second research question to remove any extraneous variance.

Secondly, the four groups were compared on three factors (age, grade, and Vigil CPT total error scores) using a one-way Analysis of Variance (ANOVA) to examine if any of the group means were significantly different on any of the three variables that could potentially impact Eyes test score. If groups were found to significantly differ on one of these variables, it would need to be controlled for when testing the second research question to remove the variance explained by that variable.

Research Question 2: After controlling for correlates,, how do children and adolescents with early-onset SZ perform on the Eyes test, a social cognitive measure, compared to children and adolescents with early-onset SA disorder, genetically high-risk relatives, and healthy controls?

For the second research question, a statistical approach to compare all four groups, while controlling for potential covariates was selected. An Analysis of Covariance (ANCOVA) was chosen because it would compare Eyes test performance across all four groups, while removing variance explained by covariates. A post hoc analysis will be

completed if the F statistic indicates a significant difference between the means. Bonferonni's Method of Multiple Comparison's procedure would be used to determine which means were significantly different from one another. The Bonferonni Method would be used to examine pair-wise contrasts because it controls for Type I errors. Lastly, if the analysis results in significant pairwise differences, effect sizes would be calculated to determine the magnitude of this difference.

CHAPTER 4

RESULTS

This chapter includes the results of the statistical analysis conducted to answer the research questions. First, results of the exploratory analysis and descriptive statistics are discussed. Then, results are presented for the research questions, specifically each groups performance on the Eyes Test when compared to each other.

Preliminary Analysis

Exploratory analyses were conducted across the variables used for the ANCOVA to screen for non-normality and outliers. Stem-and-leaf plots for the Eyes Test and Vigil CPT scores revealed outliers. However, cases were not removed because it did not change the results of the analysis and a larger sample size would be necessary to increase statistical power. Normality was assessed with kurtosis and skewness statistics. Examination of kurtosis and skewness statistics revealed non-normality, which is to be expected when having four groups from different populations.

Descriptive Statistics

Descriptive statistics by group were completed on participant demographics, the Eyes test, and Vigil CPT total error scores. Table 1 provides statistics on the mean or percentage for the total sample and the four groups. The descriptive statistics indicate that the groups with SZ and SA disorder tend to be slightly older and in higher grades than the children and adolescents in the control and GHR groups. Also, there are more males in the SZ and SA groups than the control and GHR groups. All four groups are predominately comprised of

White participants, with the SZ group having slightly more minority participants and the GHR group having more individuals with a Latino ethnic background. More than half of the SZ and SA groups, and less than half of the GHR group, are in special education. The SZ and SA groups had lower scores on the Eyes test than the control and GHR groups. Lastly, the SZ group had a higher total number of errors on the Vigil CPT measure.

Table 1 Demographic Characteristics for the Total Sample and Clinical Subsamples

Characteristic	Total Sample (N = 176)	Control (n = 58)	GHR (n = 25)	SZ (n = 63)	SA (n = 30)
Chronological Age (years)	13.65 (2.47)	12.80 (2.42)	13.49 (2.01)	14.19 (2.60)	14.31 (2.23)
Gender (% male)	56.80%	46.55%	44.00%	66.66%	66.66%
Race (% White)	71.02%	74.14%	76.00%	65.08%	73.33%
Ethnicity (% Hispanic)	6.3%	3.45%	20.00%	6.35	0.00%
Grade Level	7.06 (2.52)	6.21 (2.48)	6.40 (2.20)	7.69 (2.59)	7.97 (2.11)
Special Education (% Attended)	38.60%	0.00%	32.00%	63.49%	56.66%
Eyes Test	18.54 (3.60)	19.67 (2.55)	20.20 (2.58)	17.89 (4.23)	17.33 (3.66)
CPT Total Errors	25.50 (31.42)	24.28 (29.33)	20.80 (20.80)	27.05 (32.39)	23.83 (29.74)

Analysis

Following the preliminary screening procedures, the statistical analyses were conducted as explained in Chapter 3, Methods. Below, the analysis findings are reported.

Research Question 1: What are significant correlates of social cognitive functioning?

Question one was answered using two statistical analyses. First, Pearson correlations, were conducted to examine how the Eyes test correlated with three factors: age, grade, and Vigil CPT scores. The results of the correlation analysis indicate that the Vigil CPT total

errors score, a measure of attention, was significantly negatively correlated with the Eyes test *r = -.25, p =.001.* This suggests that as error scores decline (or an individual does better) on the CPT attention measure, scores on the Eyes test increase. Based on this result, the CPT total errors will be used as a covariate in the analysis for question two.

Second, a one-way ANOVA was completed to examine potentially significant group differences on the variables of age, grade and Vigil CPT. The results of ANOVA (Table 2) indicate significant group differences on: (1) age, *F (3, 172) = 4.28, p = .006*; and (2) grade *F (3, 171) = 5.83, p = .001*. A Bonferroni post hoc procedure was completed to examine where the significant differences were found. The results indicate that youth in the SZ and SA groups are significantly older than youth in the control group. Relatedly, those in the SZ and SA groups are in higher grades than those in the control group. The differences in age and grade were significant at the p= <.05 level..

Table 2 Summary ANOVA results by Group

		SS	*df*	*MS*	*F*	*p*
Age	Between Groups	74.23	3	24.74	4.28	.006**
	Within Groups	994.73	172	5.78		
	Total	1068.96	175			
CPT Total Errors	Between Groups	1234.20	3	411.40	.412	.744
	Within Groups	158686.42	159	998.03		
	Total	159920.63	162			
Grade	Between Groups	102.65	3	34.22	5.83	.001**
	Within Groups	1003.66	171	5.87		
	Total	1106.31	174			

*p < 0.05, **p < 0.01

As significant group differences were found for age and grade on the results of the ANOVA, they needed to be considered as potential covariates in testing group differences on the Eyes test scores. Age and grade are very much related, because typically as a child gets older they are promoted to a higher grade. Since these factors are highly correlated, only one of these variables was chosen as a covariate. Since more evidence indicates that age impacts social cognition, it was used as a covariate in the analysis for the second research question.

Research Question 2: After controlling for age and Vigil CPT, how do children and adolescents with early-onset SZ perform on the Eyes test, a social cognitive measure, compared to children and adolescents with early-onset SA disorder, genetically high-risk relatives, and healthy controls?

Question two was answered using the analysis of covariance (ANCOVA) procedure. An ANCOVA was conducted to determine whether the SZ group's Eyes test scores were significantly different than the other three group's scores (control, GHR, SA) after controlling for age and attention (Vigil CPT errors). The independent variable, group, includes four levels (control, GHR, SZ, and SA). The dependent variable was the Eyes test and the covariates were age and attention. Levene's Test of Equality of Error Variances was significant, $F\ (3, 158) = 3.99, p = .009$, meaning that the groups do not have equal variances. Although the assumption of homoscedasticity was not confirmed, this was to be expected because the four groups are derived from different populations. Furthermore, ANCOVA is known to be a robust procedure. The ANCOVA results indicate that the Eyes test group means were significantly different, $F\ (3, 163) = 6.59, p = .00$, when controlling for the variance explained by age and attention (Table 3).

Table 3 Analysis of Covariance for Eyes test by Group

Source	*SS*	*df*	*MS*	*F*	*p*
Age	30.00	1	30.00	2.76	.099
Attention	72.87	1	72.87	6.70	.011
Group	215.04	3	71.68	6.59	.000
Error	1706.88	157	10.87		
Total	59389.00	163			

Next, follow-up tests were conducted with the Bonferroni method to examine pair-wise comparisons of the groups. The Bonferroni method was chosen to control for Type I errors. The results indicate that the SZ group (M = 17.80) performed significantly lower on the Eyes test, when controlling for the effect of age and attention, than the control group (M = 19.81); and the GHR group (M = 20.14). The results do not show a significant difference between the SZ (M = 17.80) and SA (M = 17.08) groups on the Eyes test when controlling for the effect of age and attention. The effect sizes for the significant adjusted mean differences were 0.61 and 0.71, respectively, indicating medium effects. The results of the pairwise comparisons and effect sizes can be found in Table 4.

Table 4 Pairwise Comparisons and Effect Sizes of Eyes test scores by Group

			Adjusted Mean Differences (Effect Sizes are indicated in parentheses)			
Group	Mean	Adjusted Mean	1.	2.	3.	4.
1. Control	19.67	19.81	--			
2. GHR	20.20	20.14	0.32	--		
3. SZ	17.89	17.80	-2.02* (0.61)	-2.34* (0.71)	--	
4. SA	17.08	17.03	-2.79* (0.85)	-3.11* (0.94)	-0.77	--

* $p < 0.05$

CHAPTER 5

DISCUSSION AND IMPLICATIONS

This study sought to describe the social cognition performance of youth with schizophrenia by comparing their performance on the Eyes test to youth in a control group, GHR group, and SA group. The study also intended to identify variables that had a potential impact on the Eyes test performance.

In this chapter the findings and implications of the study are discussed. The children and adolescents of the study are described, covariates are identified, and the social cognition of children and adolescents with SZ are described. The findings are discussed by research question. Next, limitations of the study are considered as well as the overall implications and contributions of the study. Lastly, the chapter concludes with a discussion on future directions for research.

Sample Characteristics and Descriptive Statistics

In general, the demographic profile of participants in the study matched what has been presented in previous studies. Past research on youth with a SZ spectrum disorder included participants who had mean chronological ages that ranged from approximately 12 to 16 years of age. The mean ages of the participants in this study fell within this age range. Previous studies had larger percentages of males represented in the SZ and SA groups, which was also found in this study. This is consistent with literature demonstrating that males represent the majority of the SZ population. Lastly, previous research varies in regards to participant ethnicity and education level of children with early-onset SZ and GHR children.

(Hooper, et al., 2010; Kumra, et al., 2000; McClellan, et al., 2004; Pilowsky, et al, 2000; Rhinewine, et al., 2005; Shim, et al., 2008; Thaden, et al., 2006; Ueland, et al., 2004)

With regards to descriptive statistics on the measures, average scores on the Eyes Test were above chance (9 or more is above chance) for all four groups. The SZ and SA groups had the lowest average scores, which was to be expected because evidence exists for social cognitive deficits in these groups. The SZ group had the highest total Vigil CPT error scores. Individuals with SZ have consistently been shown to have attention deficits; therefore this observation aligns well with previous studies (Cornblatt, 1999; Thaden et al., 2005).

Discussion by Research Questions

Research Question 1: What are significant correlates of social cognitive functioning?

The results supported the hypothesis for question one, which postulated that two of the more prominent factors, age and attention, would be potential covariates for the analysis. Age is an important factor to consider in regards to social cognition, because as typically developing children get older, their capacity to process social cognitive information expands. Age was not significantly correlated with social cognition, as measured by the Eyes test. This does not align with previous literature showing the impact of age on social cognition. The differences found could be two-fold. First, previous studies investigating age and social cognition did not use the Eyes test. They used other measures of social cognition that relate more to social judgments, whereas the Eyes test is focused on Theory of Mind. Second, studies examining age differences in social cognition were focused on younger children (birth to elementary school), while the mean age of participants in the current study is 13.65 years.

Although age was not highly correlated with the Eyes test, the results of the ANOVA showed that youth with SZ, were significantly older than the control group. While this age difference is unique to the current sample it was important to control for its potential affect on group differences on the Eyes test.

Research on attention and social cognition indicate that attention impacts one's ability to retrieve and process social cognitive information. Although there were no significant group differences on attention, as measured by total errors on the Vigil CPT, it was significantly correlated with the Eyes test measure. This aligns with what has been found in the literature on attention and social cognition. For this reason, Vigil CPT total error scores were used as a covariate in the analysis to examine the Eyes test performance of children with SZ, without the impact of attention.

Research Question 2: After controlling for age and Vigil CPT, how do children and adolescents with early-onset SZ perform on the Eyes test, a social cognitive measure, compared to children and adolescents with early-onset SA disorder, genetically high-risk relatives, and healthy controls?

After controlling for the potential impacts of age and attention on social cognition, the SZ group performed significantly lower on the Eyes test than youth in the control group, which supports the first part of the hypothesis for question two. This finding supports the evidence from the social cognition studies on adults with SZ. This finding adds to the body of literature on social cognition and SZ because it provides evidence those social cognitive deficits are present even when individuals have an early-onset of the mental illness.

The second part of the hypothesis for question two was also supported. The findings show that the SZ group performed significantly lower on the Eyes test than GHR youth.

Much of the adult literature has studied social cognition in GHR or first-degree relatives by comparing their performance to controls; instead of comparing them to adults with SZ. Those studies that have used a design that includes a SZ group, a GHR group, and controls have found mixed evidence; some results indicating differences between SZ and GHR groups and others that show no difference. The majority of studies have found that GHR subjects perform intermediately, with controls having the highest performance and SZ subjects with the lowest. The findings in this study support the evidence indicating that individuals with SZ perform lower on social cognition tasks than GHR groups who don't exhibit any psychiatric symptoms.

The last part of the hypothesis for question two was supported because the SZ group did not perform significantly different from the SA group, even after controlling for age and attention. The findings support the results of the Hooper et al. (2010) study, which showed no difference in social cognitive functioning. Although that study used the same sample of youth with SZ and SA disorder, it did not include age and attention as covariates. The results of the current study add to the previous finding because it indicates that the similar social cognitive performance is still present when controlling for age and attention. Social/occupational dysfunction is one of the criteria for a diagnosis of SZ, but not for SA. The findings of this study indicate no difference with reference to ToM, an integral part of social functioning. This suggests a need for more research on social functioning differences in SZ and SA, and whether the two diagnoses should be combined and considered a spectrum disorder for diagnostic purposes.

In sum, the findings support all three parts of the hypothesis for question two. The results support the body of literature demonstrating social cognitive deficits in the individuals

with SZ. The present study contributes to this area of research by providing evidence that the deficits exist in children and youth with early-onset SZ. It also contributes by showing that social cognitive deficits exist in this population, even when controlling for the impact of age and attention. Finally, comparing the SZ group to the GHR and SA groups provides more evidence for the symptom theory, which posits that social cognitive deficits are the result of symptoms (those shared in both SZ and SA disorder) as opposed to the trait theory (traits based on genetic predisposition). The results seem to provide more evidence to the state theory because, (1) there is no difference in ToM performance between the SZ and SA groups, which share symptomatology and (2) GHR individuals perform significantly better on the Eyes test than the SZ group, which theoretically should not be the case if there is a inherent trait that blunts the performance on social cognitive tasks. However, since this study used children and adolescents, longitudinal research would be necessary to further distinguish if social cognitive deficits are in fact the result of symptoms, or if GHR children and adolescents have traits that are not expressed until adulthood.

Limitations

Research Question 1

In regards to the first research question on potential covariates, one of the limitations of the study is not including information on socio-economic status (SES), symptom and illness severity, or IQ, which have been shown to impact social cognitive processes. SES would have been an important variable to include because of its potential impact on the Eyes test, and potential SES differences between the four groups. Unfortunately, this information was not collected similarly in the Conte and TEOSS studies. The Conte study includes information on parent education, while the TEOSS study includes information on income.

Although parent education and income both inform SES, these two variables are not the same and could not be combined.

Illness severity is another variable that could have impacted social cognition and been different in the SZ and SA groups. This would have been an important variable to include because the severity of the illness and symptoms during the time of testing can drastically affect the subject's performance. Controlling for this factor would provide reliability to the finding that SZ and SA groups perform similarly on the Eyes test.

Intelligence is known to impact social cognition and may have been different between all four groups in the total sample. IQ impacts social cognitive performance because it can potentially affect an individual's abilities to process that information. Also, if IQ is significantly different across the four groups, it could impact that differences observed on the Eyes test scores. While this information exists for both studies, it was not readily available for use.

Next, it was risky to use attention as a covariate in the analysis because it is an integral part of social cognition; especially as it concerns the Eyes Test. Subjects need to attend to the information that is being communicated in order to comprehend the emotional content. Therefore, if the effects of attention were controlled for, but it is essential to the understanding social cognitive information, it could possibly threaten the reliability of the findings.

Research Question 2

The second research question examined social cognitive differences using the Eyes test. A limitation of the Eyes test is that it does not include information on reliability and validity statistics. Although this is a commonly used assessment for social cognition,

specifically ToM, there is no available psychometric information and psychometric studies on the tool have not been conducted. Therefore, it is difficult to generalize these results to the general population of children with SZ.

Another limitation in answering the second research question relates to the sample. Since the participants used for the present study are a combination of two existing studies, it did not allow participants to be matched on demographics, such as age, mental age, race, gender, IQ, etc. Matching the participants on variables such as these would increase the reliability of the findings and eliminate the need to control for these factors.

Implications

The findings of this study support the need for more research in children with early-onset SZ, especially in the area of social cognition and interventions. This study indicates that youth with SZ show deficits on theory of mind tasks but there are other areas of social cognition. It would be beneficial to study if these children and adolescents have difficulties in other areas of social cognition, such as attributional style and emotion perception, because it will help inform intervention strategies. There should also be studies that compare youth with early-onset SZ to youth with different diagnoses who share similar social cognitive deficits, such as autism because it may provide more information how deficits in specific areas of social cognition affect social functioning.

Based on the findings that children with SZ have deficits in theory of mind measures, such as the Eyes test, exploring interventions that target this area of social cognition may be beneficial for these individuals. As mentioned earlier, the Eyes test is a measure that was originally developed for studying ToM in individuals with autism. Since there are many social skills interventions that focus on teaching children with autism these ToM skills,

research investigating these interventions in youth with SZ would expand our knowledge on how to therapeutically intervene. Lastly, longitudinal studies that can evaluate the development of social cognition in children and adolescents with SZ spectrum disorders would provide a wealth of knowledge on expected social cognition abilities at different stages of the disorder. Furthermore, these studies could provide insight on possible interventions to be used at each stage of the disorder.

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