

EXAMINATION OF NON-FACIAL EMOTION RECOGNITION

IN ADOLESCENTS WITH ANOREXIA NERVOSA

A DISSERTATION IN  
Psychology

Presented to the Faculty of the University  
of Missouri-Kansas City in partial fulfillment of  
the requirements for the degree

DOCTOR OF PHILOSOPHY

by  
LAUREN OLIVIA POLLACK

B.A., University of Iowa, 2010  
B.S., University of Iowa, 2010  
M.A. University of Missouri-Kansas City, 2013

Kansas City, Missouri  
2017

© 2017

LAUREN OLIVIA POLLACK

ALL RIGHTS RESERVED

EXAMINATION OF NON-FACIAL EMOTION RECOGNITION  
IN ADOLESCENTS WITH ANOREXIA NERVOSA

Lauren Olivia Pollack, Candidate for the Doctor of Philosophy

University of Missouri-Kansas City, 2017

ABSTRACT

The purpose of this study was to examine social cognitive skills of adolescents with anorexia nervosa. Per the Research Domain Criteria (RDoC), the specific focus of this study was the ability to understand non-facial communication, e.g., emotional content communicated through paralinguistic or body postures. Thirty-one adolescents receiving treatment at an outpatient clinic completed self-report symptom measures, a task-based measure of emotion recognition, and self-reported social media use. Parents also completed measures of behavioral and emotional symptoms and social skills for their child. Results revealed that the study sample performed significantly worse than normative samples on the task of identifying emotions from body language, but not on the task of paralinguistic. Additional analyses revealed no associations between task performance and eating disorder symptoms, treatment-related variables, or social media use. However, there were significant correlations between performance on the paralinguistic task and anxiety, such that higher anxiety or internalizing symptoms

predicted better performance. Lastly, the mean score on the parent-report measure of their child's social skills suggests that this sample was mildly to moderately impaired in the area of social motivation. This was the first study to evaluate the construct of reception of non-facial communication in a sample of adolescents with anorexia nervosa, and adds to the limited body of research about this construct in adults with eating disorders. The findings have potentially important implications for the psychological treatment of adolescents with anorexia nervosa. Additional research with larger and more diverse samples would be beneficial in order to further explore and explain these initial findings.

## APPROVAL PAGE

The faculty listed below, appointed by the Dean of the College of Arts and Sciences have examined a dissertation titled “Examination of Non-Facial Emotion Recognition in Adolescents with Anorexia Nervosa,” presented by Lauren O. Pollack, candidate for the Doctor of Philosophy degree, and certify that in their opinion it is worthy of acceptance.

### Supervisory Committee

Jennifer D. Lundgren, Ph.D., Committee Chair  
Department of Psychology

Tamera Murdock, Ph.D.  
Department of Psychology

Kymerley Bennett, Ph.D.  
Department of Psychology

Seung-Lark Lim, Ph.D.  
Department of Psychology

Sara Gould, Ph.D.  
Assistant Professor of Pediatrics, UMKC School of Medicine

## CONTENTS

ABSTRACT .....	iii
LIST OF ILLUSTRATIONS .....	viii
LIST OF TABLES .....	ix
LIST OF ABBREVIATIONS .....	x
Chapter	
1. INTRODUCTION.....	1
2. REVIEW OF THE LITERATURE .....	2
Description of Anorexia Nervosa .....	2
Epidemiology of Anorexia Nervosa in Adolescents .....	2
Social Cognition in Adolescence .....	4
Review of Social Cognitive Constructs As They Relate To Anorexia Nervosa .....	7
Research Domain Criteria .....	15
Social Media.....	22
Summary.....	25
Study Aims .....	25
3. METHODOLOGY.....	28
Procedure and Participants.....	28
Measures.....	30
Statistical Analyses.....	36
4. RESULTS.....	39
Descriptive Statistics .....	39

Aim One .....	44
Aim Two .....	48
Aim Three .....	50
Exploratory Aim .....	51
5. DISCUSSION.....	53
REFERENCE LIST .....	64
VITA .....	72

LIST OF ILLUSTRATIONS

Figure	Page
1. Summary of social cognitive constructs as they relate to anorexia nervosa. ....	6



## LIST OF TABLES

Table	Page
1. Summary of previous studies of non-facial communication and eating disorders.....	21
2. Summary of types of social media .....	24
3. Summary of assessments.....	35
4. Mean (SD) scores of eating disorder measures .....	39
5. Mean (SD) scores of mood and anxiety measures.....	40
6. Mean (SD) scores of social measures .....	41
7. Bivariate correlations of all symptom measures .....	42
8. T-test results for DANVA2 Paralanguage and Posture tests .....	44
9. Correlations between DANVA2 task performance and eating disorder measures.....	45
10. Correlations between DANVA2 task performance and mood and anxiety measures.....	47
11. Descriptive summary of social media use for the study sample .....	48
12. Correlations between social media use and DANVA2 task performance.....	49
13. Correlations between social media use and DANVA2 task performance.....	50
14. Correlations between STS-2 and social media use; DANVA2 task performance, eating, mood, and anxiety measures .....	52

## LIST OF ABBREVIATIONS

Anorexia Nervosa = AN

National Institute of Mental Health = NIMH

Research Domain Criteria = RDoC

Diagnostic and Statistical Manual-5 = DSM-5

Body Mass Index = BMI

Standardized Mortality Ratio = SMR

National Comorbidity Survey Replication Adolescent Supplement = NCS-A

International Affective Picture System = IAPS

Institutional Review Board = IRB

Children's Mercy Kansas City = CMKC

Diagnostic Analysis of Nonverbal Accuracy 2 = DANVA2

Diagnostic Analysis of Nonverbal Accuracy for Postures = DANVA2-POS

Social Responsiveness Scale-2 = SRS-2

Eating Disorder Examination Questionnaire = EDE-Q

Beck Depression Inventory-II = BDI-II

Children's Depression Index-2 = CDI-2

Multidimensional Anxiety Scale for Children 2 = MASC 2

Behavioral Assessment Scale for Children 2 = BASC 2

## CHAPTER 1

### INTRODUCTION

Adolescence is a common time for the development of anorexia nervosa (AN) and a critical time for the development of social cognitive skills. Research indicates that adults with AN demonstrate several social cognitive deficits including high prevalence of alexithymia, deficits in theory of mind, and information processing biases associated with understanding and producing social information. Only alexithymia research has been extended to adolescents with AN, suggesting that it is also prevalent in this younger demographic. This study aims to examine social cognitive skills among adolescents with AN. Guided by the National Institute of Mental Health (NIMH) Research Domain Criteria (RDoC), the specific focus of this study is the ability to understand non-facial communication, e.g., emotional content communicated through paralanguage or body postures. Non-facial communication was chosen because it is an essential component of communication through social media platforms, e.g., Instagram, Snapchat, and Vine, and the majority of adolescents use social media. Research examining the effects of social media on communication skills is minimal because it is a recent phenomenon. Therefore, the current study will also consider the role of social media use in adolescents' ability to recognize non-facial communication. The results of this study may lead to the development of novel interventions that target both eating disorder symptoms and non-facial communication skills through technology such as social media, ultimately improving treatment outcomes.

## CHAPTER 2

### REVIEW OF THE LITERATURE

#### **Description of Anorexia Nervosa**

Anorexia nervosa (AN) is an eating disorder for which the hallmark symptoms are distorted body image and restriction of food intake leading to low body weight. According to the Diagnostic and Statistical Manual of Mental Disorders 5 (DSM-5) (APA, 2013) individuals are diagnosed with AN when they restrict their food intake relative to physiological requirements, leading to significantly low body weight for age, gender, developmental trajectory, and physical health. *Significantly low body weight* is defined as weight that is less than minimally normal or, for children and adolescents, less than that minimally expected (e.g., based on growth charts). Individuals with AN must express intense fear of gaining weight or becoming fat (i.e., fat phobic), *or* demonstrate persistent behavior that interferes with weight gain despite being a significantly low weight. Finally, they must endorse disturbance in the way in which body weight or shape is experienced, undue influence of body weight or shape on self-evaluation, or persistent lack of recognition of the seriousness of their current low body weight. The diagnosis is specified by restricting type or binge-eating/purging type and by severity according to body mass index (BMI).

#### **Epidemiology of Anorexia Nervosa in Adolescents**

Citing data from eating disorder clinics across five continents, Halmi (2009) states that AN is becoming an increasing problem for children and adolescents. Further, given trends of hospitalization of seriously ill patients with AN, she predicts an increase

in morbidity and mortality rates for pre- and early-adolescent onset AN (Halmi, 2009). The standardized mortality ratio (SMR) for AN is 5.86, the highest of any mental disorder (Smink, van Hoeken, & Hoek, 2012). The SMR is the ratio of observed deaths in a study population to expected deaths in the population of origin. The reported SMR of 5.86 means that deaths of patients with AN were 586% of expected deaths in the population over a mean follow-up period of 14 years for this particular study.

Prevalence rates of AN for adolescents living in the United States have been established from the National Comorbidity Survey Replication Adolescent Supplement (NCS-A). The NCS-A is a national psychiatric epidemiological survey of over 10,000 adolescents ages 13-17 years. Data were collected using a modified version of the World Health Organization Composite International Diagnostic Interview (Merikangas, Avenevoli, Costello, Koretz, & Kessler, 2009). Swanson and colleagues extracted data from the NCS-A to describe epidemiological characteristics of eating disorders, based on DSM-5 criteria (Swanson, Crow, Le Grange, Swendsen, & Merikangas, 2011). According to this survey, the lifetime prevalence rate of AN was 0.3% for males and females and the 12-month prevalence rate was 0.2% for males and 0.1% for females. Although not statistically significant, more non-Hispanic white adolescents reported AN than other racial/ethnic groups. Socioeconomic status was not associated with any eating disorder presentation. The median age at onset of AN was 12.3 years, the lowest among all of the eating disorders.

Eating disorders are often comorbid with other psychological disorders. For example, 55.2% of adolescents with AN met criteria for one or more comorbid psychological disorders (Swanson et al., 2011). Oppositional defiant disorder was the

only comorbid disorder of significant association with AN. In terms of impairment, 97.1% of adolescents with AN reported impairment within the past 12 months and 24.2% reported severe impairment (as measured by the Sheehan Disability Scale). Of note, eating disorders were most strongly associated with social impairment; 88.9% of adolescents with AN reported social impairment and 19.6% reported severe social impairment. Significantly elevated suicidal ideation was associated with all eating disorders. Unfortunately, only 27.5% of adolescents reported seeking treatment specifically for their AN (Swanson et al., 2011).

### **Social Cognition in Adolescence**

Social cognition is the ability to construct mental representations of relationships and to use these representations to function effectively in the social environment (Adenzato, Todisco, & Ardito, 2012). Adolescence is a critical time for development of social cognitive skills. This time of transition from childhood to adulthood is a unique period in which one's social environment and social skills change and develop considerably. Group interactions and relationships become hierarchical and more complex. Adolescents develop their identity and begin to understand themselves in relation to the social world. As they develop, adolescents become more self-conscious and concerned with other people's opinions. They also begin to assert more independent control over their decisions, emotions, and actions and start to disengage from parental control (Steinberg & Morris, 2001).

In addition to the environment, biological changes during adolescence contribute to development of social skills. The "social brain" is defined as a network of brain regions (including the posterior superior temporal sulcus and medial prefrontal

cortex) that allows one to recognize others, evaluate their mental states, feelings, and actions. Neuroimaging studies suggest that these regions undergo significant functional and structural development during adolescence (Blakemore, 2008; Blakemore & Choudhury, 2006; Choudhury, Blakemore, & Charman, 2006).

Given the importance of the adolescent period to the development of social cognitive skills, the overarching goal of this proposal is to examine social cognition in a sample of adolescents with AN. Social cognition is a broad construct that encompasses numerous sub-constructs. Figure 1 presents an integration of a portion of the social cognitive literature in the context of eating disorder research. This figure is not all-inclusive; rather it serves to highlight specific constructs and sub-constructs most relevant to eating disorders and the proposed study.

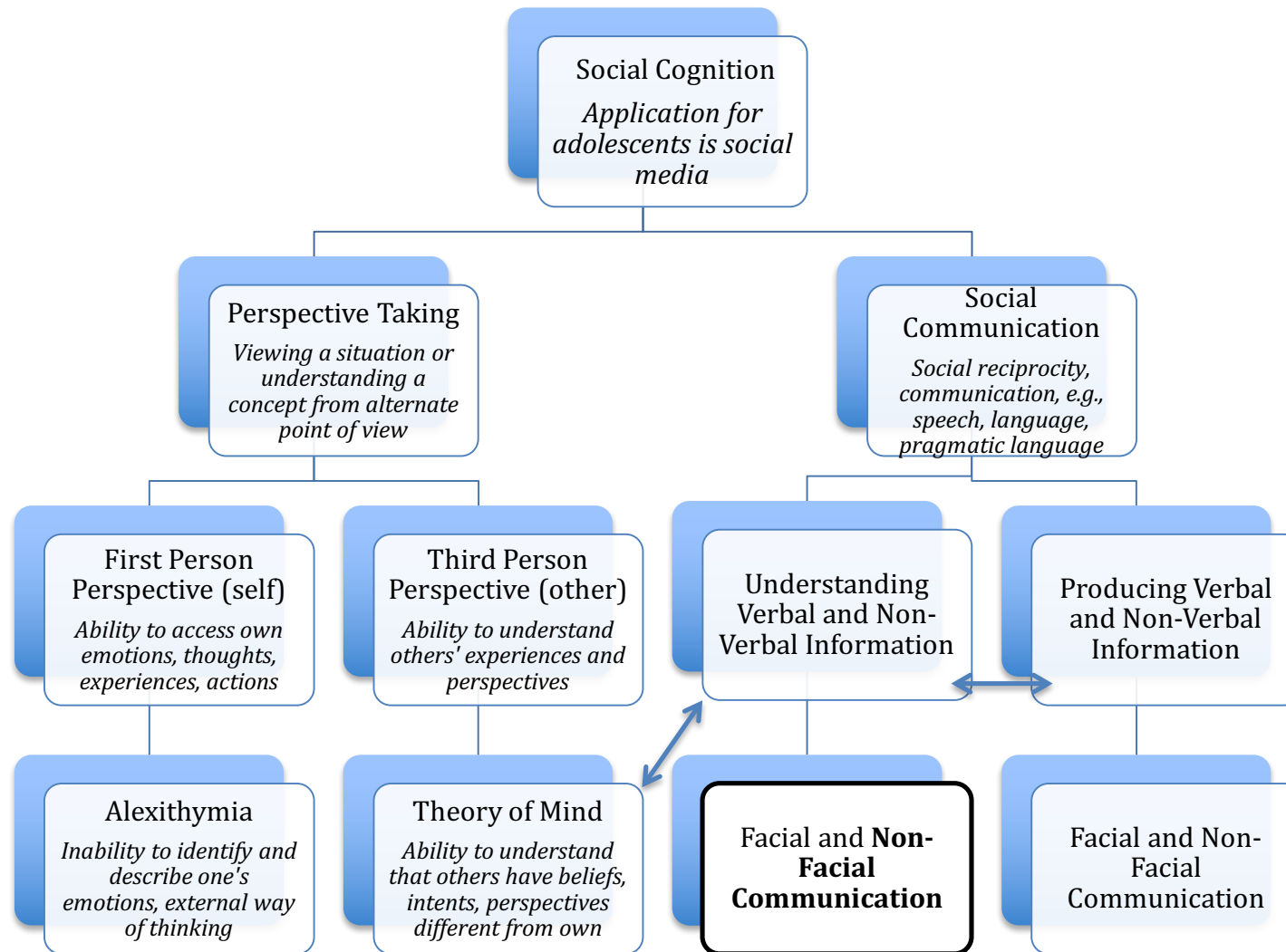


Figure 1. Summary of social cognitive constructs as they relate to anorexia nervosa.

Note. The bolded construct, understanding non-facial communication, is the focus of this study.



## **Review of Social Cognitive Constructs As They Relate to Anorexia Nervosa**

### **First Person Perspective Taking**

#### **Alexithymia and AN.**

Perspective taking is a fundamental component of social interactions. First person perspective taking is centered upon one's own body. It refers to the ways in which an individual has access to herself/himself and the world and to his/her experiences, emotions, thoughts, and actions (Chisholm et al., 2014). Alexithymia is a personality construct characterized by an inability to identify and describe emotions that one is experiencing and an externally oriented way of thinking. Individuals with this trait have poor emotional awareness, social attachment, and interpersonal functioning.

Alexithymia has been extensively researched in the field of eating disorders. It is now considered a common feature in individuals with eating disorders; prevalence rates of alexithymia among adults with AN range from 63% to 77%. Zonneville-Bender and colleagues used both questionnaires and tasks to study alexithymia in adolescents with AN, adolescents with depression and anxiety, and healthy controls. The AN group scored higher (worse) than the healthy control group on a self-report measure of alexithymia. There were no significant differences between the AN group and the psychiatric group on the self-report measure of alexithymia. Participants also completed several tasks that measured different aspects of alexithymia, including emotion recognition tests and a word association task. Non-emotional parallel tests were also administered. Overall, results of task performance were similar to the self-report findings. The AN and psychiatric groups demonstrated emotional deficits

compared to the healthy control group. However, there were no significant differences between the AN and psychiatric groups (Zonneville-Bender, Van Goozen, Cohen-Kettenis, van Elburg, & Van Engeland, 2004).

Researchers have also studied how adolescents with AN compare to adults with AN in terms of alexithymia. Zonneville-Bender and colleagues compared 48 adolescents with AN to 23 adults with AN on aspects of emotional functioning including alexithymia, depressive, and anxiety disorders. Overall, the adolescent and adult groups were very similar. Both groups performed poorly on task measures of alexithymia and self-reported similar levels of alexithymia on a questionnaire. The groups also self-reported similar levels of depression and agoraphobia. The adult group reported significantly more social phobia and anxiety than the adolescent group (Zonneville-Bender, van Goozen, Cohen-Kettenis, van Elburg, de Wildt, et. al., 2004).

In summary, data indicate that adolescents with AN report high rates of alexithymia, similar to other psychiatric groups. As well, adolescents and adults with AN demonstrate similarly high rates of alexithymia. A three-year prospective study of 102 females with eating disorders (63 with AN, 39 with bulimia nervosa, average age 21.5 years) reported that difficulty in identifying feelings, one aspect of alexithymia, is a negative prognostic factor for long-term outcome of patients with eating disorders (Speranza, Loas, Wallier, & Corcos, 2007). This deficit in first person perspective taking is significant and it negatively affects treatment outcomes.

## **Third Person Perspective Taking**

### **Theory of mind and AN.**

Third person perspective taking is the ability to understand experiences from the perspective of others. This ability develops secondarily to first-person perspective, typically around age seven (Chisholm et al., 2014). The ability to distinguish one's own experiences from the experiences of others is crucial for the development of theory of mind. Theory of mind is the ability to attribute mental states including beliefs, intents, desires, etc. to oneself and others and to understand that others have beliefs, desires, intents, and perspectives that are different from one's own. The research on theory of mind and AN is mixed with some studies reporting no difference between AN patients and healthy controls and other studies reporting worse performance by AN patients on theory of mind measures. The most recently published studies will be reviewed. Note that no studies of theory of mind and adolescents with AN have been published.

Adenzato and colleagues examined theory of mind, emotional functioning, and perceived social support of 30 adult females diagnosed with AN and 32 matched healthy controls. Emotional functioning was assessed through self-report measures including the Empathy Quotient and Toronto Alexithymia Scale. Theory of mind was assessed with the Reading the Mind in the Eyes test. For this test, participants are presented with a set of pictures of the eye region of various human faces and make a forced choice response of the word that best describes the mental state of the person in the picture. Patients with AN performed significantly worse on assessments of emotional functioning (consistent with alexithymia research reviewed) but performed similarly to healthy controls on theory of mind task (Adenzato et al., 2012). Tchanturia

and colleagues recruited 20 adult females with AN and 20 healthy controls to complete theory of mind tasks (story comprehension task and a cartoon task, each with a theory of mind condition and a control condition). The AN group demonstrated impairment on both tasks, including the theory of mind and control conditions, leading the authors to conclude that patients with AN did not demonstrate selective impairment in theory of mind (Tchanturia et al., 2004). Hambrook and Tchanturia also found no differences between 22 adult females with AN and 41 healthy controls on a self-report measure of theory of mind (Hambrook & Tchanturia, 2008).

Supporting an association between theory of mind deficit and AN, Russell and colleagues studied theory of mind in 22 adult females with AN and 22 healthy controls. Theory of mind was assessed using the Reading the Mind in the Eyes task and Happé's cartoon task. The cartoon task includes six single frame cartoons that require an understanding of the character's mental state, beliefs, or intentions to accurately explain the humor. The AN group performed worse on both tasks (Russell, Schmidt, Doherty, Young, & Tchanturia, 2009). This pattern of results is supported by additional studies (e.g., Harrison, Sullivan, Tchanturia, & Treasure, 2009). Interestingly, Oldershaw and colleagues studied theory of mind in a group of currently ill AN patients, a group recovered from AN, and a group of healthy controls. They found deficits in theory of mind in the ill group and restoration of theory of mind in the recovered group. These findings suggest that impairments in theory of mind may be related to starvation (Oldershaw, Hambrook, Tchanturia, Treasure, & Schmidt, 2010). However, Harrison and colleagues found that individuals recovered from AN performed worse than healthy

controls on the reading the mind in the eyes task (Harrison, Tchanturia, & Treasure, 2010).

## **Social Communication**

### **Understanding social information.**

Social communication encompasses social reciprocity and communication inclusive of speech, language, and pragmatic language. Pragmatic language is the use of verbal and non-verbal behaviors combined to express and respond to requests for basic needs, assistance, protest, and persuasion (Cook, 2013). One component of ability to understand social information is third person perspective taking or theory of mind, previously discussed. Another consideration of this ability to understand social information is processing of social information, i.e., information processing bias.

Only one study of processing bias of auditory emotional stimuli among adolescents with AN was identified. This study highlights possible deficits understanding pragmatic language in social communication. Specifically, neutral, positive, and negative words were presented and participants were instructed to generate an associated word. Then the original cue words were presented and participants were asked to recall their associated word. Bias was measured as the time taken to generate an associated word and the number of recall errors. Results revealed no significant differences between psychiatric controls, adolescent patients, or healthy controls for neutral words. The psychiatric control group took the longest time to generate a word associated with emotional words and made the most recall errors. The healthy control group had the best time scores and accuracy, and the AN group was in the middle (Zonnevillle-Bendek, Van Goozen, Cohen-Kettenis, Van Elburg, & Van

Engeland, 2002). These researchers replicated this study with adult AN participants and found the same pattern of results ( Zonneville-Bender, van Goozen, Cohen-Kettenis, van Elburg, de Wildt, et. al., 2004). It seems that individuals with AN have difficulties processing emotional information, which negatively impacts their ability to understand and interact socially.

### **Producing social information.**

The ability to produce social information is related to the social reciprocity component of social communication. Social reciprocity involves use of joint attention to share experiences and emotions with another person. Joint attention is the ability to coordinate visual attention and gestures and to respond to and initiate behaviors in a socially reciprocal manner (Cook, 2013).

Few studies have examined the judgments, behavior, and emotions of patients with eating disorders in response to social information (context sensitive regulation). One study evaluated the cognitive appraisal of social situations in an eating disorder group (both AN and bulimia nervosa) and a healthy control group. The participants were presented with 20 social scenarios (10 pleasant and 10 unpleasant) each described once applying to the self and once applying to a female friend. The eating disorder patients demonstrated bias to interpret the cause of unpleasant-self social events as weight and shape related.

Although not a direct measure of social information, choice-based and outcome-based regulation has been assessed using the Iowa Gambling Task. This task instructs participants to earn as much money as possible, which requires them to learn that low-risk cards are more profitable in the long-term compared to high-risk cards.

Individuals with AN perform worse on the Iowa Gambling Task than healthy controls. As well, individuals with AN demonstrate less skin-conductance when choosing cards and after loss compared to healthy controls. Interestingly, people recovered from AN demonstrate task performance and skin conductance patterns similar to healthy controls (Oldershaw et al., 2011). Collectively, studies suggest difficulties regulating emotions to make appropriate appraisals and choices for individuals with an active eating disorder.

This high-level overview of social cognitive constructs including perspective taking and understanding and producing social information highlights significant deficits for individuals with AN. A large body of literature has established a strong association between the trait of alexithymia and AN, including adolescents with AN. The association between theory of mind and AN is less clear; some studies suggest deficits while others show no difference between individuals with AN and healthy controls. It is possible that theory of mind deficits are associated with starvation, although the two existing studies reported contrasting results. Studies on theory of mind in adolescents with AN have not been reported. As well, few studies investigating abilities of AN population to understand and produce social information have been published. Limited research suggests bias in processing and interpreting social information and difficulty regulating emotions and behaviors in response to information. Collectively, these social cognitive deficits have significant implications for treatment of AN.

## **Role of Social Cognitive Functioning in Treatment of Anorexia Nervosa**

Given the social cognitive deficits commonly associated with AN, it is important to consider these deficits as part of treatment. As discussed by Zucker et al. (2007), eating disorder patients commonly express limited motivation for treatment. However, improvement in social acceptance and interpersonal skills are domains in which ill individuals often express desire for improvement. Therefore, interventions that specifically target these domains may enhance motivation to participate in treatment.

To investigate the efficacy of psychotherapy for eating disorders, a study (McIntosh et al., 2014) examined three manualized psychotherapies in adults with AN. One of the key results of this study was that interpersonal psychotherapy performed poorly. One possible explanation for this finding is that “more basic social cognitive processes need to be addressed prior to a more macro-level, goal-oriented intervention like interpersonal psychotherapy. In contrast, interventions that enhance social cognitive processes may address existing barriers to treatment progress and provide innovative domains to enhance and create intervention strategies” (Zucker et al., 2007 p. 977). For treatment of adolescent AN, family-based therapy has demonstrated relative success, however not all families have a good outcome. Lack of treatment success has been associated with poor interpersonal communication. Again, interventions that address deficits in interpersonal communication and social skills domains may serve to enhance the success of established treatments, such as family-based therapy.

Given the challenges to engage patients in treatment and the considerable room for improvement in treatment outcomes, attention should be given to further



investigating alternative or augmented treatments that address the established pervasive social cognitive dysfunction in this patient group. The Research Domain Criteria (RDoC), proposed by the National Institute of Mental Health (NIMH), serves as a possible guide to conduct research related to social processes. These criteria will be discussed in the next section, followed by a more specific discussion of considerations for conducting research on social processes in adolescents (i.e., social media use).

### **Research Domain Criteria**

The RDoC is a framework developed by the NIMH to improve the quality and utility of mental health research (Insel et al., 2010). The overarching goal of this framework is to “translate rapid progress in basic neurobiological and behavioral research to an improved integrative understanding of psychopathology and the development of new and/or optimally matched treatments for mental disorders” (<http://www.nimh.nih.gov/research-priorities/rdoc/index.shtml>), ultimately shifting mental health care to a personalized medicine approach. Specifically, major goals of RDoC research should be: (1) to identify fundamental components that may span multiple disorders (e.g., executive function, affect regulation); (2) to determine a full range of variation, from normal to abnormal; (3) to integrate genetic, neurobiological, behavioral, environmental, and experimental components; and (4) to develop reliable and valid measures of these fundamental components for use in basic and clinical studies. It is recommended to focus research studies on one or two constructs and to carefully select the population sampled; the RDoC encourages research beyond the constraints of the current psychiatric diagnostic system, i.e., DSM-5.

The five identified domains of the RDoC include: (1) Negative Valence Systems, (2) Positive Valence Systems, (3) Cognitive Systems, (4) Systems for Social Processes, and (5) Arousal/Modulatory Systems. Each domain is comprised of several identified constructs and sub-constructs. For example, the domain of Systems for Social Processes includes the construct of Social Communication and sub-constructs of Reception of Facial Communication, Production of Facial Communication, Reception of Non-Facial Communication, and Production of Non-Facial Communication.

Caglar-Nazali et al. (2014) recently published a collection of meta-analyses that applied the RDoC Systems for Social Processes constructs to the existing body of eating disorder research. They concluded that people with eating disorders demonstrate aspects of psychopathology across several constructs and experience extensive social impairments (e.g., insecure attachment, poor facial emotional recognition, difficulty identifying emotions of self and others, general social inferiority, etc.). Studies most relevant to the current proposal are reviewed in detail below.

### **Reception of Facial Communication**

One study examining emotional recognition through facial expressions in adolescents with eating disorders was identified. Zonnevijlle-Bendek and colleagues examined 30 female adolescents with eating disorders (16 with AN, 8 with bulimia nervosa, and 6 with eating disorder not otherwise specified) and 33 matched healthy controls. The average age of the AN group was 16.1 years. The authors measured alexithymia of all participants using a shortened version of the Toronto Alexithymia Scale. They also administered an emotional facial expression test; participants were presented with 28 photos of facial expressions for two seconds each and asked to

generate a label to describe each expression. They viewed the photos a second time and were asked to describe each expression from a fixed response list. The emotions included were happiness, anger, sadness, fear, disgust, surprise, and contempt. The eating disorder group scored significantly higher than the healthy control group on the alexithymia measure. There were no significant differences in alexithymia scores among the eating disorder subtype groups. The eating disorder group also performed significantly worse on the emotion recognition test, including the free response and forced choice versions. The authors concluded that adolescents with eating disorders demonstrate emotional deficits, specifically labeling or categorizing emotions, similar to adults with eating disorders (Zonnevijlle-Bendek et al., 2002).

### **Reception of Non-Facial Communication**

Reception of Non-Facial Communication is defined as the capacity to perceive social and emotional information based on modalities other than facial expression, including non-verbal gestures, affective prosody, distress calling, cooing, etc. The eating disorder-specific research on this construct is limited to four studies to date, all conducted with adult samples. Each study is described in turn below and summarized in Table 1. Some of these studies also include measures of facial communication, which are clearly identified in the study summaries.

Nandrino and colleagues examined the cognitive and physiological responses to emotional pictures. They studied four groups of participants: 16 participants with AN restricting subtype, 18 participants with alexithymia, 16 participants with depression, and 20 control participants. The participants with AN were hospitalized for their eating disorder. All were females between the ages of 17 and 24 years. The control

participants were matched to the AN group based on age, gender, and education level. The remaining two groups were selected from a larger sample of adult females who demonstrated high levels of alexithymia or depression based on self-report measures. All participants completed two tasks. The first task required participants to categorize the emotional valence (positive, negative, neutral) of pictures from the International Affective Pictures System (IAPS) as quickly as possible. It is important to note that some of the pictures in each emotional valence category included human faces. The positive pictures included couples and adventure scenes; the negative pictures included scenes of car accidents, crying women, combat or weapons; and the neutral pictures included scenes of inactive people, neutral human faces, or household objects. The second task asked participants to subjectively evaluate the pictures based on the intensity of their emotional reaction to them. Skin conductance was measured while the participants completed these tasks. For task one, AN participants were significantly less accurate at categorizing the neutral and positive valence pictures compared to the control group. The AN group did not differ from the healthy controls in skin conductance response. For task two, AN participants reported higher intensity of negative stimuli than the alexithymia participants and they reported higher intensity of positive stimuli than both the alexithymia and control participants. Only the control group demonstrated an expected association between skin conductance and perceived emotional intensity. Collectively, these results suggest that individuals with AN may have a unique deficit in emotional processing, characterized by disconnection between cognitive and physiological responses. (Nandrino et al., 2012)

Joos and colleagues also studied emotional perception using visual stimuli from the International Affective Picture System. They studied 15 participants with AN restricting subtype, 18 participants with bulimia nervosa, and 25 control participants. All participants were adult females, with average age around 25 years. All participants were shown pictures on a personal computer, specifically instructed to pay attention to their emotions, and then asked to rate their emotions on a questionnaire after viewing each picture. There was no time limit imposed on this task. Pictures were taken from the IAPS and they belonged to the emotional categories of fear, anger, sadness, and happiness. These pictures included both faces and scenes. The AN group reported significantly more fear and disgust in response to anger stimuli than the control group. No other statistically significant group differences emerged. Therefore, this study suggests that individuals with AN demonstrate relatively few deficits in emotional perception, at least for the emotions of fear, sadness, anger, and happiness. (Joos, Cabrillac, Hartmann, Wirsching, & Zeeck, 2009)

Jones-Chesters and colleagues used a Stroop test paradigm to study 16 females with AN and 16 healthy control participants matched for age and socioeconomic status. The AN group average age was 23.5 years. Participants were asked to name the color in which the word was displayed. Words came from the categories of food/eating, weight/shape, emotion, other affectively neutral words, or a matched set of unrelated control words. The results showed that participants with AN were significantly slower to color-name words related to food/eating and weight/shape. The emotion words and other neutral words did not produce significant color-naming latencies. Despite these group differences, there were no significant correlations between Stroop effects and

measures of eating disorder pathology, so the authors posit that the Stroop paradigm may be assessing a different aspect of eating disorders. (Jones-Chesters, Monsell, & Cooper, 1998)

Lastly, Kucharska-Pietura and colleagues studied the visual (facial) and prosodic (non-facial) emotional recognition of 30 adults females with AN (23 with AN restricting subtype and 7 with AN binge/purge subtype) and 30 healthy controls. Average age of the AN group was about 20 years. The visual emotional recognition task was comprised of 36 photographs of emotional faces depicting the emotions of interest, happiness, surprise, sadness, disgust, contempt, anger, shame, and fear. The participants viewed each photo for 10 seconds and then had 10 seconds to select one emotion from the list that best described the photo. The prosodic emotional recognition task included five semantically neutral sentences spoken by a professional male actor in such a way to convey, through tone of voice, one of six basic emotions: happiness, sadness, fear, anger, surprise, disgust, and neutral. The participants listened to each sentence then chose which of the six emotions best described the speaker's tone of voice. Overall, the AN group demonstrated poor emotional recognition, especially for the negative emotions of sadness and fear. The AN group was also significantly less accurate in perception of emotions in prosodic task, with particular impairment for emotions of happiness and sadness. However, when the authors statistically adjusted for group differences on variables of age, education, current mood, and depressive symptom severity, no significant differences on the prosodic task remained. (Kucharska - Pietura, Nikolaou, Masiak, & Treasure, 2004)

The studies reviewed suggest difficulty comprehending different types of facial and non-facial communication (e.g., gestures, vocal tone) for individuals with AN. It seems that both adolescents and adults with AN have difficulty recognizing facial communication. However, only adults with AN have been included in studies about non-facial communication, therefore it remains unknown how adolescents with AN understand non-facial communication. One consideration in the study of social communication skills of adolescents is the role of social media, which the majority of adolescents use to communicate. Because social media is a new technology, minimal research on its effects on communication skills has been published. No studies have investigated social media use among adolescents with AN or its effects on social cognitive skills, such as understanding of non-facial communication. It is possible, given the nature of some social media platforms such as Instagram, that adolescents have improved abilities to understand non-facial information, i.e., social media use could serve as a protective factor against certain social cognitive deficits. Therefore, the proposed study will assess ability to understand non-facial communication and social media use in a sample of adolescents with AN.

Table 1.

*Summary of previous studies of non-facial communication and eating disorders*

Citation	N and Sample	Non-Facial Measures	Results
Nandrino et al. (2012)	16 AN 20 HC	Categorization of emotional valence of pictures and subjective rating of intensity of emotional reaction to pictures	Subjects with AN demonstrated more difficulty categorizing emotional images and more intense emotional response to unpleasant pictures than controls
Joos et al. (2009)	15 AN 19 BN 25 HC	Rating emotional response to viewing pictures demonstrating 4 emotions	Subjects with AN and BN reported lower emotional response to pictures

Jones- Chesters et al. (1998)	16 BN 16 AN 32 HC	Stroop task including emotional words	Subjects with BN experienced more interference on emotional words than controls. Subjects with AN did not differ from controls on emotional words.
Kucharska- Pietura et al. (2004)	30 AN 30 HC	Recognition of facial and vocal stimuli expressing specific emotions	Subjects with AN had poorer emotional recognition, most marked for negative facial emotions and all vocal emotions.

Note. AN = anorexia nervosa, BN = bulimia nervosa, HC = healthy controls



## Social Media

According to Webster's dictionary, social media is "forms of electronic communication (such as websites for social networking and microblogging) through which users create online communities to share information, ideas, personal messages, and other content (such as videos)." There are six different types of social media (see Table 2 for summary): (1) Social networks are services that allow one to connect with other people of similar interests and backgrounds. (2) Bookmarking sites allow one to save, organize, and manage links to various websites and resources around the Internet. (3) Social News services allow one to post various news items or links to outside articles. Users then "vote" on items to determine how prominently they are displayed. (4) Media sharing sites allow one to upload and share various media such as pictures and videos. Most sites also allow users to create profiles and comment on posted media. (5) Microblogging applications focus on short updates that are pushed out to anyone subscribed to receive the updates. (6) Blog Comments and Forums allow members to hold conversations by posting messages. (<http://outthinkgroup.com/tips/the-6-types-of-social-media>)

Use of social media has dramatically increased over the past several years, especially among children and adolescents. A 2009 national survey reported that 22% of teenagers log on to their favorite social media site more than 10 times per day, and more than half of adolescents log on to a social media site more than once per day. Overall, in 2009 73% of teens used an online social network website, up from 65% in 2008 and 55% in 2006 (Lenhart, Purcell, Smith, & Zickuhr, 2010). A clinical report issued by the American Academy of Pediatrics noted that "a large part of this

generation's social and emotional development is occurring while on the Internet and on cell phones" (p. 800, O'Keeffe & Clarke-Pearson, 2011).

Research has identified both pros and cons of social media use. General use of social media may have a beneficial effect on children and adolescents by enhancing communication, social connection, and technical skills (Ito et al., 2008). Benefits of social media use include extending friendships and interests, engaging in self-directed and peer-based learning, enhancing school learning opportunities, and accessing health information. Risks of social media use include cyberbullying and online harassment, sexting, and the phenomenon of "Facebook Depression," which occurs when individuals experience depressive episodes associated with spending a lot of time on social media sites such as Facebook (Ito et al., 2008).

Particularly relevant to the proposed study, Pea and colleagues (Pea et al., 2012) conducted an online survey of 3,461 North American girls, eight to twelve years of age to examine the associations between social well-being and media use, inclusive of video, video games, music listening, reading/homework, e-mailing/posting on social media sites, texting/instant messaging, and talking on phones/video chatting. Face-to-face communication was also measured and compared to forms of social media communication. Reported average daily media use was 6.9 hours and average daily time spent in face-to-face interaction was 2.1 hours. In general, participants were more likely to derive positive feelings from face-to-face rather than online friends. The data also suggest that online communication and face-to-face communication are not interchangeable. The authors indicate that this variable of face-to-face communication is often not assessed in studies of media use but they encourage it to be included.

Social media has influenced the way in which its users communicate, relying less on traditional face-to-face communication and more on communication through posting photos, videos clips, and written comments. Its popularity among adolescents has grown significantly. Adolescence is a critical time for the development of social cognitive skills. Thus, examining the effects of social media use on the development of social cognitive skills for adolescents is important. The social cognitive skills that social media use tap into include producing and understanding non-verbal and non-facial communication; again, this emphasis is different from traditional face-to-face communication. Given the known social cognitive challenges of adults with eating disorders, one could expect that adolescents with eating disorders may demonstrate social cognitive deficits in skills that the popular form of adolescent communication demands: namely, understanding and producing non-verbal and non-facial communication through social media.

Table 2.

*Summary of types of social media*

Type	Description	Example
1. Social networks	Connect with other people of similar interests and backgrounds.	Facebook, LinkedIn, Google Plus+
2. Bookmarking sites	Save, organize, and manage links to various websites and resources around the Internet.	Pinterest, StumbleUpon
3. Social News services	Post various news items or links to outside articles.	Digg, Reddit, BuzzFeed
4. Media sharing sites	Upload and share various media such as pictures and videos. Users can also create profiles, comment on posted media.	Instagram, YouTube, Flickr, Vine
5. Microblogging applications	Short updates that are pushed out to anyone subscribed to receive the updates.	Twitter, Tumblr
6. Blog Comments and Forums	Hold conversations by posting messages.	Many popular blogs and forums

## **Summary**

In summary, AN is a deadly eating disorder that commonly begins during adolescence. Numerous studies indicate that adults with AN demonstrate social cognitive deficits. Relatively few studies have examined these social cognitive abilities in adolescents with AN, which is surprising given that adolescence is a critical time for the development of social cognitive skills. One consideration in studying social cognitive skills among adolescents is social media use, which is extremely popular in this demographic. It remains unknown whether or how social media use affects social cognitive abilities. Many popular social media platforms involve communication through non-facial information (e.g., Instagram, Twitter, Snapchat). The ability to understand non-facial communication is also a construct identified by the RDoC. To date, only four studies of adults with eating disorders have been conducted on this construct and no studies have been conducted to assess this construct in adolescents with eating disorders. Therefore, the purpose of this study is to examine both ability to understand non-facial communication and use of social media in a sample of adolescents with AN. The results of this study will fill a large gap in the literature. Most importantly, the results may lead to additional research examining ways in which technology and social media can be incorporated into treatment of adolescent AN, ultimately improving treatment outcome of this potentially fatal disease.

## **Study Aims**

(1) To characterize the reception of non-facial communication skills of adolescent females with AN

- a. Hypothesis 1: Adolescent females with AN will perform worse (i.e., make more errors) on reception of non-facial emotion recognition tasks (DANVA2, DANVA2-POS) compared to age-matched normative samples.
- b. Hypothesis 2: Severity of eating disorder symptoms will be positively correlated with performance on reception of non-facial emotion recognition tasks. Specifically, higher scores on EDI-3 scales of Interpersonal Problems, Affective Problems, and Eating Disorder Risk, and EDE-Q Shape Control and Global scales will be associated with more errors on the DANVA2 and DANVA2-POS tasks.
- c. Hypothesis 3: Severity of mood and anxiety symptoms will be positively correlated with DANVA2 and DANVA2-POS performance. Specifically higher depression score (BDI-II or CDI-2), the MASC Social Anxiety subscale score, and the BASC Internalizing Problems subscale score will be associated with more errors on the DANVA2 and DANVA2-POS tasks.

(2) To characterize social media use of adolescent females with AN

- a. Hypothesis: Severity of AN symptoms, measured by EDE-Q Restricting and Global scales and the EDI-3 Eating Disorder Risk Composite score, will be negatively correlated with social media use, specifically time spent on social media.

(3) To examine association between reception of non-facial communication skills and social media use

- a. Hypothesis 1: Reception of non-facial emotion skills will be negatively correlated with social media use. Specifically, greater number of errors

committed on the DANVA2 and DANVA2-POS tasks will be associated with less time spent on social media.

- b. Hypothesis 2: AN symptoms will account for significant variance in the association between social media use and skills deficit, above and beyond depressive and anxiety symptoms.
- (4) An exploratory aim to examine how parental report of child social skills is associated with AN, mood, and anxiety symptoms measures; social media use; and reception of non-facial emotion skills

## CHAPTER 3

### METHODOLOGY

#### **Procedure and Participants**

The Institutional Review Board (IRB) at Children's Mercy, Kansas City (CMKC) and UMKC approved this study. The target sample size for recruitment was 30 female adolescents with AN who were receiving treatment at the Eating Disorders Center at CMKC. The Eating Disorders Center has between 60 and 80 active patients at any given time, most of whom are female, so this target sample size is reasonable. Sample inclusion criteria included a diagnosis of AN, either binge/purge or restricting subtype, and participation in treatment at the Eating Disorders Center. Comorbid mood disorder diagnoses were acceptable. The age range of participants was 10-17 years and individuals and their parents had to speak English.

#### **Recruitment**

The CMKC Eating Disorders Center nurse identified eligible patients currently receiving treatment at the Eating Disorders Center. Patients scheduled to complete the depression, anxiety, and eating disorder measures as part of their clinical care were approached for study participation first. The nurse contacted the parent or legal guardian of the eligible patients via phone to inform them that their child was eligible for a research study and provided them with a brief description of the study. If the parent/legal guardian and the patient expressed interest in participating, then the researcher met with them when they were at the Eating Disorders Center for one of

their regularly scheduled appointments. This was the preferred recruitment method because the parents and patients were already familiar with the nurse. The nurse could also quickly identify eligible patients based on the current patient schedule because she sees all of the patients. In contrast, each psychologist, medical doctor, and nutritionist only sees a proportion of the patients. Pre-appointment phone calls were also important to make the potential participants feel more comfortable when the researcher approaches them and to make efficient use of recruitment efforts. The researcher did not approach patients who declined to learn more about the study over the phone.

A second form of recruitment was proposed to target eligible patients as they completed the depression, anxiety, and eating disorder measures. These patients typically receive a folder with the measures at their appointment. In addition, they would receive a brief written description of the study. They could indicate in writing whether or not they were interested in finding out more about the study. This form of recruitment was not necessary to utilize.

### **Consent and Assent**

The researcher approached the patient and her parent or legal guardian when they were at the Eating Disorders Center for one of their regularly scheduled appointments. The researcher explained the purpose and procedures of the study (in an empty patient room or the clinic break room) to the parent/legal guardian and the patient. If they agreed to participate, the parent/legal guardian and the patient signed the consent and assent form, respectively.



## **Data Collection**

Following provision of consent and assent, the participants completed the study in either an empty patient room or the clinic break room. Study participation involved the parent/legal guardian completing one questionnaire about his/her child's social skills (see Measures section). The patient also completed a battery of measures (see Measures section). Data collection primarily occurred electronically through an online database called Research Electronic Data Capture (REDCap) and participants used a tablet or laptop. Data collection was completed and compensation was provided before the participants left the clinic. Patients and parents received a \$15 Target gift card and a \$10 Target gift card for compensation, respectively.

After participants provided consent and assent, the researcher accessed the patient's medical record to extract the following data: age, race/ethnicity, height, weight, BMI z-score, and length of treatment. If the patient had recently (i.e., within two weeks) completed the mood, anxiety, and eating disorder symptom measures as part of her regular clinic care, these data were extracted as well.

## **Measures**

As seen in Table 3, measures to assess understanding of non-facial communication, eating disorder symptoms, mood and anxiety symptoms, and social media use were administered. The mood and anxiety measures and one eating disorder measure are already administered to patients at the Eating Disorders Center. These measures were re-administered if the patient had not completed them within two weeks of study participation.

## **Reception of Non-Facial Communication Skills**

### **Diagnostic Analysis of Nonverbal Accuracy 2.**

The Diagnostic Analysis of Nonverbal Accuracy 2 (DANVA2) is an assessment of an individual's ability to identify emotions in faces and tone of voice (Nowicki Jr & Duke, 1994). Adult faces and adult paralinguistics reflect the emotions of happy, sad, angry, and fearful. Two levels of emotional intensity, high and low, are included. Both males and females are included in the stimuli. A total of 32 images are presented for two seconds each. The participant selects the emotion reflected following the presentation of each image. The paralinguistics subtest consists of the auditory stimulus "I'm going out of the room now, but I'll be back later." This sentence is stated one time and then the participant selects the emotion reflected in the voice. The total number of trials is 32. Normative data are available for children ages five to 18 years old, which is why this task was selected despite the inclusion of facial stimuli. The facial data will not be analyzed for the proposed study.

More recently, the Diagnostic Analysis of Nonverbal Accuracy 2-Posture Test (DANVA2-POS) was developed to measure an individual's ability to identify emotions in human standing and sitting postures. The emotions of happy, sad, angry, and fearful are reflected in each of these postures. The images are each presented for about two seconds. The participant selects the emotion reflected following the presentation of each image. The total number of trials is 32 (Pitterman & Nowicki Jr, 2004).

### **Social Responsiveness Scale-2.**

The Social Responsiveness Scale-2 (SRS-2) is an informant-based questionnaire that identifies the presence and severity of social impairment (Constantino & Gruber,

2012). The parent version will be used for this study. It is comprised of 65 items and takes between 15 and 20 minutes to complete. Responses are made on a four-point scale, and higher scores reflect greater impairment. The SRS-2 yields a total score and five subscale scores for social awareness, social cognition, social communication, social motivation, and restricted interests and repetitive behavior.

### **Eating Disorder Symptoms**

#### **Eating Disorder Inventory-3.**

The Eating Disorder Inventory-3 (EDI-3) is a self-report questionnaire that is comprised of 91 items (Garner, Olmstead, & Polivy, 1983). It provides the following composite scores: Eating Disorder Risk, Ineffectiveness, Interpersonal Problems, Affective Problems, Overcontrol, and General Psychological Maladjustment. Responses are made on a five-point scale, and higher scores reflect greater eating disorder pathology. Time to complete is 20 minutes.

#### **Eating Disorder Examination-Questionnaire.**

The Eating Disorder Examination Questionnaire (EDE-Q) is a self-report questionnaire that is comprised of 28 items (Fairburn & Beglin, 1994). It provides a global score and four subscale scores: Restraint, Eating Concern, Shape Concern, and Weight Concern. Responses are made on a seven-point scale, and higher scores reflect greater eating-related pathology. Frequencies of disordered eating behaviors including binge eating and compensatory behaviors are also assessed. Time to complete is 10 to 15 minutes.

## **Mood and Anxiety Symptoms**

The Eating Disorders Center administers a measure of depressive symptoms and measure of anxiety symptoms to patients every three months. The Beck Depression Inventory-II (BDI-II) is given to patients age 13 years and older and the Children's Depression Inventory-2 (CDI-2) is given to patients younger than 13 years. The Multidimensional Anxiety Scale for Children 2 (MASC 2) is administered to all patients.

### **Beck Depression Inventory-II.**

The BDI-II is a self-report questionnaire that assesses the intensity of depressive symptoms. It is comprised of 21 items. This questionnaire yields one total score. Responses are made on a four-point scale, and higher scores reflect greater depressive symptom severity (Beck, Steer, & Brown, 1996). Time to complete is five to 10 minutes.

### **Children's Depression Inventory-2.**

The CDI-2 is a self-report questionnaire that assesses depressive symptoms. It is comprised of 28 items. This questionnaire yields a total score, two scale scores (Emotional Problems and Functional Problems) and four subscale scores (Negative Mood, Negative Self-Esteem, Ineffectiveness, and Interpersonal Problems). Responses are made on a three-point scale, and higher scores reflect greater depressive symptom severity (Kovacs, 2010). Only the total score of the CDI-2 will be used for analyses, as this is comparable to the BDI-II. Time to complete is five to 15 minutes.

### **Multidimensional Anxiety Scale for Children 2**

The Multidimensional Anxiety Scale for Children 2 (MASC 2) is a self-report questionnaire that assesses the nature and severity of anxiety symptoms (March, James, Sullivan, Stallings, & Conners, 1997). It is comprised of 50 items. This questionnaire

yields a total score and six subscale scores: Separation Anxiety/Phobias, Social Anxiety, General Anxiety Disorder Index, Obsessions and Compulsions, Physical Symptoms, and Harm Avoidance. Higher scores reflect greater anxiety symptom severity. Norms are available for children eight to 19 years of age. This questionnaire takes 15 minutes to complete.

### **Behavior Assessment System for Children 2**

The Behavior Assessment System for Children (BASC-2) is a parent-report questionnaire that assesses child behavior and emotional status (Reynolds, 2004). It is comprised of 160 items answered on a four-point scale. It yields the following composite scales: Externalizing Problems, Internalizing Problems, Behavioral Symptoms Index, and Adaptive Skills. Higher scores reflect greater severity. This questionnaire takes about 10 to 20 minutes to complete.

### **Social media use**

A questionnaire to assess social media use was developed for this study. This questionnaire asked patients to report which social media platforms they use, how much time they spend using social media on a typical weekday and weekend day, and the purpose(s) of social media use.

Table 3

*Summary of study assessments*

<b>Citation</b>	<b>Measure Name</b>	<b>Description of Measure</b>
Nowicki Jr, S., & Duke, M.P. (1994)	Diagnostic Analysis of Nonverbal Accuracy 2 (DANVA2)	32 high- and low-intensity facial expressions and 32 vocal trials representing happiness, sadness, anger, and fear
Pitterman, H., & Nowicki Jr, S. (2004)	Diagnostic Analysis of Nonverbal Accuracy for Postures (DANVA2-POS)	32 high- and low-intensity standing and sitting postures representing happiness, sadness, anger, and fear, faces are blocked out, two male and two female adults
Constantino, J. N., & Gruber, C. P. (2012)	Social Responsiveness Scale-2 (SRS-2)	65-item informant-based (parent) questionnaire that assesses social impairment in natural settings
Garner, D. M., Olmstead, M. P., & Polivy, J. (1983)	Eating Disorder Inventory-3 (EDI-3)	91-item self-report questionnaire that assesses eating disorder symptoms
Fairburn, C.G. & Beglin, S.J. (1994)	Eating Disorder Examination Questionnaire (EDE-Q)	28-item self-report questionnaire that assesses eating disorder symptoms
Beck, A. T., Steer, R. A., & Brown, G. K. (1996)	Beck Depression Inventory-II (BDI-II)	21-item self-report questionnaire that assesses intensity of depressive symptoms
Kovacs, M. (2010)	Children's Depression Inventory-2 (CDI-2)	28-item self-report questionnaire that assesses depressive symptoms
March, J.S., Parker, J.D.A., Sullivan, K., Stallings, P., & Conners, K.C. (1997)	Multidimensional Anxiety Scale for Children 2 (MASC 2)	50-item self-report questionnaire that assesses the range and severity of anxiety symptoms
Reynolds, C. R. (2004)	Behavior Assessment Scale for Children Second Edition (BASC-2)	160 item parent-report questionnaire that assesses child emotional and behavioral status
None; created for this study	Social Media Use	6 item self-report questionnaire that assesses amount and purpose of social media use

## Statistical Analyses

### Specific Aim One

(1) To characterize reception of non-facial communication skills of adolescent females with AN

a. Hypothesis 1: Adolescent females with AN will perform worse (i.e., make more errors) on reception of non-facial emotion recognition tasks (DANVA2, DANVA2-POS) compared to age-matched normative samples.

i. Independent samples t-tests will be run to test this hypothesis

b. Hypothesis 2: Severity of eating disorder symptoms will be positively correlated with performance on reception of non-facial emotion recognition tasks.

Specifically, higher scores on EDI-3 scales of Interpersonal Problems, Affective Problems, and Eating Disorder Risk, and EDE-Q Shape Control and Global scales will be associated with more errors on the DANVA2 and DANVA2-POS tasks.

i. Pearson correlations will be run to test this hypothesis

c. Hypothesis 3: Severity of mood and anxiety symptoms will be positively correlated with DANVA2 and DANVA2-POS performance. Specifically higher depression score (BDI-II or CDI-2), the MASC Social Anxiety subscale score, and the BASC Internalizing Problems subscale score will be associated with more errors on the DANVA2 and DANVA2-POS tasks. A standardized depression score (t-score) will be created from the BDI-II and CDI-2 scores to test this hypothesis.

i. Pearson correlation will be run to test this hypothesis

### Specific Aim Two

(2) To characterize social media use of adolescent females with AN

- a. Hypothesis 1: Severity of AN symptoms, measured by EDE-Q Restricting and Global scales and the EDI-3 Eating Disorder Risk Composite score, will be negatively correlated with social media use, specifically time spent on social media.
  - i. Pearson correlation will be run to test this hypothesis. If age is significantly associated with both AN symptoms and social media use, then a semi-partial correlation controlling for age will be run.

#### Specific Aim Three

(3) To examine the association between reception of non-facial communication skills and social media use

- a. Hypothesis 1: Reception of non-facial emotion skills will be negatively correlated with social media use. Specifically, greater number of errors committed on the DANVA2 and DANVA2-POS tasks will be associated with less time spent on social media.
  - i. Pearson correlation will be run to test this hypothesis. If age is significantly associated with DANVA2 and DANVA2-POS scores, then partial correlations controlling for age will be run.
- b. Hypothesis 2: AN symptoms will account for significant variance in the association between social media use and skills deficit, above and beyond depressive and anxiety symptoms.
  - i. Multiple hierarchical regression will be run to test this hypothesis

#### Exploratory Aim



- (4) To examine how parental report of child social skills, measured by SRS-2, is associated with AN, mood, and anxiety symptoms (EDEQ, EDI-3, BDI-II/CDI-2, MASC 2); social media use; and reception of non-facial emotion (DANVA2 and DANVA2-POS)
- a. Hypothesis: Parent report of child social skills will be positively correlated with reception of non-facial emotion skills, such that higher scores on the SRS-2 will be associated with more errors on the DANVA2 and DANVA2-POS.
    - i. Pearson correlation will be run to test this hypothesis

## CHAPTER 4

### RESULTS

#### Descriptive Statistics

The final sample was comprised of 31 females with a diagnosis of AN, confirmed through review of electronic medical record. In terms of race/ethnicity, 28 identified as Caucasian. The remaining participants identified as Hispanic, American Indian, and multiracial. The sample average (SD) age was 14.41 (1.82) years. The sample average (SD) BMI was 20.42 (2.83) kg/m<sup>2</sup>. Average (SD) number of days in treatment up to study participation was 300.97 (327.37) days. Mean (SD) scores for all measures are presented in Tables 4, 5, and 6. When available, mean (SD) scores for non-clinical adolescent samples are also presented. Bivariate correlations between all symptom measures were also calculated (Table 7).

Table 4

*Mean (SD) scores of eating disorder measures*

Scale	Subscale	Sample Mean (SD)	Non-Clinical Mean (SD) <sup>1</sup>	Non-Clinical Mean (SD) <sup>2</sup>
EDEQ	Global	2.07 (1.75)	1.61 (1.42)	1.46 (1.4)*
	Restraint	1.45 (1.52)	1.25 (1.45)	1.4 (1.5)
	Eating Concern	1.59 (1.39)	0.91 (1.20)*	1.0 (1.0)*
	Shape Concern	2.92 (2.30)	2.27 (1.77)*	2.2 (1.7)*
	Weight Concern	2.46 (2.13)	1.99 (1.75)	1.8 (1.7)
EDI-3 <sup>3</sup>	Eating Disorder Risk	140.88 (27.49)		
	Ineffectiveness	88.21 (21.49)		
	Interpersonal Problems	91.88 (18.22)		
	Affective Problems	90.88 (20.33)		
	Overcontrol	96.96 (18.46)		
	General Psychological Maladjustment	413.63 (75.62)		

Abbreviations: EDEQ is Eating Disorder Examination Questionnaire and EDI-3 is Eating Disorder Inventory-3.

\*Indicates statistically significant difference between clinical and sample groups.

1. Non-clinical norms on EDEQ for ages 14-18 (White, Haycraft, Goodwin, & Meyer, 2014).
2. Non-clinical norms on EDEQ for ages 12-14 (Carter, Stewart, & Fairburn, 2001).
3. Non-clinical norms for adolescent females not available.

Table 5

*Mean (SD) scores of mood and anxiety measures*

Scale	Subscale	Sample Mean (SD)	Non-Clinical Mean (SD)
BDI-II <sup>1</sup>	N/A	14.77 (13.05)	12.5 (10.50)
CDI-2 <sup>2</sup>	N/A	4.13 (2.95)	9.09 (7.04)*
Depression T-Score	N/A	49.10 (8.86)	
MASC 2 <sup>3</sup>	Total	60.12 (26.28)	47.93 (14.77)*
	Separation Anxiety/Phobias	10.07 (12.73)	8.04 (4.54)
	Social Anxiety	16.27 (15.01)	11.20 (5.81)*
	General Anxiety Disorder Index	16.63 (14.65)	12.20 (4.00)*
	Obsessions and Compulsions	12.83 (14.78)	9.20 (3.62)*
	Physical Symptoms	15.70 (14.90)	10.46 (6.34) *
	Harm Avoidance	19.63 (11.35)	18.23 (4.37)
BASC-2 <sup>4</sup>	Externalizing Problems	50.00 (7.94)	47.41 (8.93)
	Internalizing Problems	58.22 (7.98)	47.38 (11.44)*
	Behavioral Symptoms Index	51.78 (10.07)	47.45 (8.44)
	Adaptive Skills	48.78 (10.88)	50.67 (8.18)

Abbreviations: BDI-II is Beck Depression Inventory II, CDI-2 is Children's Depression

Inventory 2, MASC 2 is Multidimensional Anxiety Scale for Children-2 and BASC-2 is

Behavioral Assessment System for Children 2.

\*Indicates statistically significant difference between clinical and sample groups.

1. Non-clinical norms on the BDI-II for 14-18 year old males and females (Osman, Barrios, Gutierrez, Williams, & Bailey, 2008). 2. Non-clinical norms on the CDI-2 for 8-16 year old males and females (Smucker, Craighead, Craighead, & Green, 1986). 3. Non-clinical norms on the MASC 2 for 8-13 year old females (Baldwin & Dadds, 2007). 4. Non-clinical norms on the BASC-2 for 6-13 year old males and females (Mahan & Matson, 2011).

Table 6

*Mean (SD) scores of social measures*

Scale	Subscale	Sample Mean (SD)	Non-Clinical Mean
SRS-2 <sup>1</sup>	Total Score	53.63 (9.77)	
	Social Awareness	49.78 (9.25)	
	Social Cognition	52.50 (11.03)	
	Social Communication	52.41 (10.47)	
	Social Motivation	61.00 (10.94)	
	Restricted Interests and Repetitive Behavior	51.69 (7.76)	
Social Media Use <sup>2</sup>	Hours per weekday	1.68 (1.83)	6.9 hours/day
	Hours per weekend day	2.72 (3.25)	
DANVA2 <sup>3</sup>	Paralanguage-Errors	7.77 (3.62)	7.3 (3.1)
	Postures-Errors	18.77 (3.82)	8.8 (3.1)

Abbreviations: SRS-2 is Social Responsiveness Scale-2 and DANVA2 is Diagnostic

#### Analysis of Nonverbal Accuracy 2

1. Non-clinical norms for adolescents not available. 2. Non-clinical norms of social medial use for adolescent females (Pea et al., 2012). 3 Non-clinical norms on DANVA2 subscales for 10-17 year old males and females (Nowicki Jr & Duke, 1994).

Table 7

*Bivariate correlations of all symptom measures*

		EDEQ Global	EDI-3 ED Risk	Depression T-score	MASC Total	BASC Externalizing	BASC Internalizing	BASC Behavioral Symptoms	BASC Adaptive Skills	SRS-2 Total
EDEQ Global	<i>r</i>	1								
	<i>p</i>	--								
EDI-3 Eating Disorder Risk	<i>r</i>	<b>.605</b>	1							
	<i>p</i>	<b>.002</b>	--							
Depression T- score	<i>r</i>	<b>.451</b>	<b>.698</b>	1						
	<i>p</i>	<b>.012</b>	<b>&lt; .001</b>	--						
MASC Total	<i>r</i>	<b>.861</b>	<b>.625</b>	<b>.649</b>	1					
	<i>p</i>	<b>&lt; .001</b>	<b>.001</b>	<b>&lt; .001</b>	--					
BASC Externalizing Problems	<i>r</i>	.438	.331	.211	.257	1				
	<i>p</i>	.278	.522	.615	.540	--				
BASC Internalizing Problems	<i>r</i>	.372	.092	.512	.207	.566	1			
	<i>P</i>	.365	.862	.194	.623	.112	--			
BASC Behavioral Symptoms Index	<i>r</i>	<b>.630</b>	.190	.494	.528	<b>.793</b>	<b>.864</b>	1		
	<i>p</i>	<b>.094</b>	.719	.213	.178	<b>.011</b>	<b>.003</b>	--		
BASC Adaptive Skills	<i>r</i>	-.230	.112	-.285	-.205	-.632	<b>-.922</b>	<b>-.876</b>	1	
	<i>p</i>	.583	.833	.494	.626	.068	<b>.000</b>	<b>.002</b>	--	
SRS-2 Total	<i>r</i>	.260	.224	.338	.276	.323	<b>.888</b>	<b>.808</b>	<b>-.832</b>	1
	<i>p</i>	.158	.293	.068	.139	.396	<b>.001</b>	<b>.008</b>	<b>.005</b>	--

Table 7 *continued*

Abbreviations: EDEQ is Eating Disorder Examination Questionnaire, EDI-3 is Eating Disorder Inventory 3, Depression T-score is composite of Beck Depression Inventory II and Children's Depression Inventory 2, MASC-2 is Multidimensional Anxiety Scale for Children-2, BASC-2 is Behavioral Assessment System for Children 2, and SRS-2 is Social Responsiveness Scale-2.

**Specific Aim One: To describe non-facial emotion recognition skills of adolescent females with AN**

I hypothesized that adolescent females with AN would perform worse than normative samples on DANVA2 Paralanguage and Postures tasks. T-tests were run based the age groupings of the normative data to compare the average number of errors on the Paralanguage task and the Postures task. Results are presented in Table 8. For the Paralanguage task, there were no significant differences for 10 to 12 year olds or 13 to 14 year olds. For the 15 to 18 year olds, group differences approached significance,  $t(42)=1.87$ ,  $p = .07$ . For the Postures task, group differences were significant for both the 10 to 14 year olds,  $t(47)=9.79$ ,  $p < .001$ ; and the 15 to 18 year olds,  $t(42)=9.34$ ,  $p < .001$ . The study groups made significantly more errors than the normative groups on the Postures task.

Table 8

*T-test results for DANVA2 Paralanguage and Postures tests*

	Age (years)	Study Group		Norm Group		T	df	p	Effect Size
		M (SD) Errors	n	M (SD) Errors	n				
Para-language	10-12	6.25 (2.36)	4	8.3 (2.8)	24	1.38	26	.179	.79
	13-14	7.10 (3.3)	11	7.10 (3.1)	10	0.00	19	1.00	0
	15-18	8.63 (4.00)	16	6.50 (3.4)	28	1.87	42	.07	.57
Postures	10-14	19.57 (2.68)	15	9.40 (3.6)	34	9.79	47	<.001	3.20
	15-18	18.06 (4.60)	16	8.10 (2.5)	28	9.34	42	<.001	2.69

I hypothesized that severity of eating disorder symptoms would be positively correlated with reception of non-facial emotion deficits. Specifically, EDI-3 composite

scores for Interpersonal Problems and Affective Problems, and EDE-Q subscale of Shape Control would be associated with DANVA2 Paralanguage and DANVA2 Postures task performance. Pearson correlations (see Table 9) revealed no significant associations between eating disorder symptoms and DANVA2 task performance, thus this hypothesis was not supported.

Table 9

*Correlations between DANVA2 task performance and eating disorder measures*

Subscale/Composite Score		DANVA2 Paralanguage Errors	DANVA2 Posture Errors
EDEQ	<i>r</i>	-.145	-.167
Restraint	<i>p</i>	.438	.378
EDEQ	<i>r</i>	-.114	.087
Eating Concerns	<i>p</i>	.542	.648
EDEQ	<i>r</i>	-.179	.061
Shape Concerns	<i>p</i>	.335	.750
EDEQ	<i>r</i>	-.164	-.015
Weight Concerns	<i>p</i>	.377	.939
EDEQ	<i>r</i>	-.190	-.010
Global Score	<i>p</i>	.306	.958
EDI-3	<i>r</i>	-.226	.197
Ineffectiveness	<i>p</i>	.29	.37
EDI-3	<i>r</i>	-.137	.003
Interpersonal Problems	<i>p</i>	.52	.99
EDI-3	<i>r</i>	-.214	.187
Affective Problems	<i>p</i>	.32	.39
EDI-3	<i>r</i>	-.116	.278
Overcontrol	<i>p</i>	.59	.20
EDI-3	<i>r</i>	-.103	-.452
General Psychological Maladjustment	<i>p</i>	.79	.261
EDI-3	<i>r</i>	-.285	.281
Eating Disorder Risk	<i>p</i>	.18	.19

Abbreviations: DANVA2, Diagnostic Analysis of Nonverbal Accuracy 2; EDEQ, Eating

Disorder Examination Questionnaire; EDI-3, Eating Disorder Inventory 3.



Finally, I hypothesized that severity of mood and anxiety symptoms would be positively correlated with DANVA2 Paralanguage and DANVA2 Posture performance. Specifically, the depression t-score (derived from average t-scores of CDI-2 and BDI-II), the MASC Social Anxiety subscale score, and the BASC Internalizing Problems subscale score would be associated with DANVA2 Paralanguage and DANVA2 Postures task performance. Pearson correlations revealed that MASC total score, Tense, and Physical Symptoms subscales were significantly negatively correlated with DANVA2 Paralanguage errors; higher anxiety scores were associated with fewer errors on DANVA2 Paralanguage task only (statistics presented in Table 10). Pearson correlations also revealed that BASC Internalizing Problems and BASC Behavioral Symptoms were significantly negatively correlated with DANVA2 Posture task; higher symptom scores were associated with fewer errors on the DANVA2 Posture task only. This hypothesis was not supported by the data. Follow up analysis revealed no associations between performance on DANVA2 tasks and time elapsed since starting treatment ( $p$  values ranging from .751 to .895).

Table 10

*Correlations between DANVA2 task performance and mood and anxiety measures*

Scale		DANVA2 Paralanguage Errors	DANVA2 Posture Errors
MASC 2	<i>r</i>	-.324	.141
Generalized Anxiety Disorder	<i>p</i>	.081	.467
MASC 2	<i>r</i>	-.240	.170
Separation Anxiety/Phobias	<i>p</i>	.201	.377
MASC 2	<i>r</i>	-.281	.006
Obsessive Compulsive	<i>p</i>	.132	.977
MASC 2	<i>r</i>	-.341	-.058
Harm Avoidance	<i>p</i>	.065	.766
MASC 2	<i>r</i>	-.211	.084
Social Anxiety	<i>p</i>	.263	.665
MASC 2	<i>r</i>	<b>-.395</b>	.103
Physical Symptoms	<i>p</i>	<b>.031</b>	.597
MASC 2	<i>r</i>	<b>-.396</b>	-.006
Total	<i>p</i>	<b>.030</b>	.997
Depression*	<i>r</i>	-.130	.026
Total	<i>p</i>	.494	.892
BASC-2	<i>r</i>	.370	-.743
Externalizing Problems	<i>p</i>	.366	.056
BASC-2	<i>r</i>	.225	<b>-.852</b>
Internalizing Problems	<i>p</i>	.592	<b>.015</b>
BASC-2	<i>r</i>	.191	<b>-.885</b>
Behavioral Symptoms	<i>p</i>	.650	<b>.008</b>
BASC-2	<i>r</i>	-.217	.732
Adaptive Skills	<i>p</i>	.606	.061

Abbreviations: MASC 2, Multidimensional Anxiety Scale for Children 2; BASC-2,

Behavioral Assessment System for Children-2; DANVA2 is Diagnostic Analysis of Nonverbal Accuracy 2

\*Depression is t-score based on average t-score of Beck Depression Inventory-II and Children's Depression Inventory-2

**Specific Aim Two: To describe social media use of adolescent females with AN**

I hypothesized that severity of eating disorder symptoms would be negatively correlated with social media use. Specifically, the EDE-Q Restraint and Global scores and EDI-3 Eating Disorder Risk Composite score would be associated with average total number of hours spent on social media use. Table 11 summarizes descriptive statistics of social media use for the study sample, including average use, types of social media used, and reasons for social media use. Pearson correlations revealed no significant associations between eating disorder measures and social media use (see Table 12).

Table 11

*Descriptive summary of social media use for the study sample*

Social Media	Mean (SD) or Percentage
Average Use Weekday	1.79 (1.81) hours
Average Use Weekend day	2.80 (3.27) hours
Endorsed Use of Social Media Platforms	
Instagram	77%
Snapchat	68%
YouTube	45%
Twitter	35%
Pinterest	32%
Facebook	23%
Tumblr	23%
Other	19%
Messaging Apps	13%
Vine	10%
Endorsed Reasons for Social Media Use	
Entertainment	84%
Communication	77%
News	74%
Other	10%

Table 12

*Correlations between social media use and eating disorder measures*

Scale/Composite		Social media Weekday	Social media Weekend day
EDEQ	<i>r</i>	-.041	-.095
Restraint	<i>p</i>	.829	.616
EDEQ	<i>r</i>	.184	.135
Eating Concerns	<i>p</i>	.329	.476
EDEQ	<i>r</i>	.242	.204
Shape Concerns	<i>p</i>	.198	.281
EDEQ	<i>r</i>	.174	.144
Weight Concern	<i>p</i>	.358	.449
EDEQ	<i>r</i>	.146	.109
Global	<i>p</i>	.440	.565
EDI-3	<i>r</i>	-.106	-.085
Eating Disorder Risk	<i>p</i>	.631	.701
EDI-3	<i>r</i>	-.040	-.018
Ineffectiveness	<i>p</i>	.855	.933
EDI-3	<i>r</i>	-.065	-.010
Interpersonal Control	<i>p</i>	.768	.964
EDI-3	<i>r</i>	-.080	-.069
Affective Problems	<i>p</i>	.717	.754
EDI-3	<i>r</i>	-.046	-.004
Overcontrol	<i>p</i>	.836	.984
EDI-3	<i>r</i>	-.045	.032
General Psychological Maladjustment	<i>p</i>	.916	.941

Abbreviation: EDEQ, Eating Disorder Examination Questionnaire; EDI-3, Eating

Disorder Inventory-3

**Specific Aim Three: To explore whether social media use is related to reception of non-facial emotions**

I hypothesized that performance on DANVA2 Paralanguage and Postures tasks would be negatively correlated with social media use, such that individuals with worse performance on the DANVA2 (higher error scores) report less social media use (fewer hours). Pearson correlations revealed no significant associations between DANVA2 performance and average number of hours spent on social media (see Table 13). This hypothesis was not supported by the data.

Table 13

*Correlations between social media use and DANVA2 task performance*

		Social Media Weekday	Social Media Weekend Day
DANVA2	<i>r</i>	.032	.014
Paralanguage	<i>p</i>	.867	.940
DANVA2	<i>r</i>	.047	.080
Postures	<i>p</i>	.807	.678

Abbreviation: DANVA2 is Diagnostic Analysis of Nonverbal Accuracy 2

Finally, I hypothesized that eating disorder symptoms would account for significant variance in the association between social media use and reception of non-facial emotion skills, above and beyond depressive and anxiety symptoms. Due to lack of significant correlations between these variables, a regression analysis was not run.

**Exploratory Aim: To explore the associations between parent report of social skills and eating disorder, mood, and anxiety symptoms, social media use, and reception of non-facial emotions**

I hypothesized that SRS-2 would be positively correlated with DANVA2 Paralanguage and DANVA2 Postures task performance, such that higher (worse) SRS-2 scores would be associated with more errors committed on the DANVA2 tasks. Pearson correlations revealed no significant associations between SRS-2, symptom measures, social media use, and DANVA task performance; thus the hypothesis was not supported (see Table 14).

Table 14

*Correlations between SRS-2 and social media use; DANVA2 task performance; eating, mood, and anxiety measures*

		Social Cognition	Social Motivation	Restrictive Interests Repetitive Behavior	Social Awareness	Social Communication	Total
Social Media	<i>r</i>	-.131	-.183	-.215	-.290	-.138	-.215
Weekday	<i>p</i>	.489	.333	.253	.120	.468	.255
Social Media	<i>r</i>	-.191	-.211	-.282	-.256	-.190	-.258
Weekend	<i>p</i>	.312	.264	.131	.172	.314	.169
DANVA2	<i>r</i>	-.206	-.175	-.205	-.177	-.291	-.251
Paralanguage	<i>p</i>	.266	.347	.269	.341	.112	.174
DANVA2	<i>r</i>	-.141	.129	-.033	.016	-.092	-.023
Posture	<i>p</i>	.458	.495	.861	.933	.627	.902
EDEQ	<i>r</i>	-.072	.239	.124	-.157	-.080	.002
Global	<i>p</i>	.701	.195	.507	.400	.667	.991
EDI-3	<i>r</i>	.090	.384	.084	.122	-.084	.142
Risk Composite	<i>p</i>	.677	.064	.697	.571	.698	.507
Depression	<i>r</i>	.168	.326	.103	-.045	.065	.173
Total*	<i>p</i>	.376	.079	.587	.812	.731	.360
MASC	<i>r</i>	-.028	.324	.099	-.123	.056	.096
Total	<i>p</i>	.884	.081	.602	.519	.768	.615

Abbreviations: DANVA2 is Diagnostic Analysis of Nonverbal Accuracy 2; MASC 2, Multidimensional Anxiety Scale for Children

2; BASC-2, Behavioral Assessment System for Children-2

\*Depression is t-score comprised of average t-scores for Beck Depression Inventory-II and Children's Depression Inventory-2

## CHAPTER 5

### DISCUSSION

The design of this study was guided by the RDoC principles, which aim to increase the understanding of psychopathology and to develop new treatments for mental disorders. RDoC studies are designed to identify fundamental components that may span multiple disorders and to collect multiple types of data (e.g., genetic, neurobiological, behavioral, environmental, experimental data). When the RDoC domain of Systems of Social Processes was applied to existing eating disorder studies, it was evident that people with eating disorders demonstrate aspects of psychopathology across several constructs and experience extensive social impairments (Caglar-Nazali et al., 2014). It is hypothesized that these impairments may contribute to poor interpersonal psychotherapy outcomes (McIntosh et al., 2014). Based on RDoC recommendations, self-report and informant-based measures as well as task-based measures that assess non-facial emotion recognition were used. When this construct is applied to non-clinical and/or patient samples, the data might suggest underlying similarities across diagnostic groups, ultimately refining existing diagnostic criteria and treatment efforts. Additionally, based on a confluence of factors including the high mortality rate of eating disorders, relatively poor treatment outcomes possibly due to social cognitive deficits of eating disorder patients, documented social cognitive deficits of adults with eating disorders, and the unique aspects of adolescent social media use, the current study was designed and executed.

The specific goal of this exploratory study was to describe reception of non-facial communication abilities of adolescents with AN. The DANVA2, a task of non-verbal



behavior that involves identifying the emotion expressed through (1) a semantically neutral sentence (paralanguage) and (2) body postures, was given to the participants. The DANVA2 error scores of the study group were compared to normative group scores. Additional measures of eating disorder symptoms, mood and anxiety symptoms, and social media use were completed. Parents of the adolescent participants also completed two measures, one of mood and anxiety symptoms and the other of social skills. These additional measures were used to examine associations with reception of non-facial communication abilities and to offer possible explanations of any observed differences in reception of non-facial emotion abilities between the study sample and normative groups.

The first aim was to describe reception of non-facial communication abilities of adolescents with AN. The first hypothesis of this aim was partially supported. For the Paralanguage task, the youngest age group of 10 to 12 year olds made the fewest errors and the oldest age group of 15 to 18 year olds made the most, with the middle age group making an intermediate amount of errors. In comparison to non-clinical norms, the number of errors each age group made was not statistically significantly different. However, the 15 to 18 year olds approached significance with a p-value of .07. The study sample, across age groups, made significantly more errors than the normative groups on the DANVA2 Postures task.

One possible interpretation of these initial findings is that as eating disorder patients get older, their ability to interpret emotions from paralanguage fails to continue improving or worsens with prolonged malnutrition and social isolation. Although there were no statistically significant differences between the study group

and the non-clinical norms, perhaps this would be observed in a study with greater statistical power. There may also be a non-linear association between paralinguistic skills and age in this sample that could be partially explained by other variables. In search of a possible alternative explanation for this finding, there were no significant associations between DANVA2 task performance and duration of treatment, so it does not seem that treatment is confounding this finding. Another possible explanation is that there are other fundamental differences between these age groups of 11 to 12, 13 to 14, and 15 to 18 year-olds that were not measured and might explain differences in performance on the DANVA2 Paralinguistic task, such as other depressive or anxiety symptoms. For example, maybe the older age group has been in multiple treatment programs over time and missed more school, having fewer interactions with peers. In terms of the DANVA2 Postures task performance, given that study participants performed worse than normative groups, one possible explanation is that the study sample might have attended to the body shape of the stimulus rather than the emotional content, which would explain poor performance.

This pattern of findings, i.e., observing deficits in reception of non-facial communication that were unrelated to measures of eating disorder symptoms, is similar to findings of Jones-Chesters and colleagues (1998). They found that adults with AN demonstrated bias of attention to weight/shape stimuli in a Stroop task, but this was not correlated with measures of eating disorder pathology. Another study found adults with AN performed more poorly on a prosodic emotion recognition task compared to healthy controls, but other variables including age, education, current mood, and depressive symptom severity accounted for the group differences

(Kucharska-Pietura, Nikolaou, Masiak, & Treasure, 2004). Collectively, these results may be tapping into a different aspect of eating disorders, such as alexithymia.

Adolescents with AN have demonstrated rates of alexithymia comparable to other psychiatric groups and adults with AN on both self-report and task-based measures. It is possible that this trait, which is associated with poor emotional awareness in oneself, may explain the deficits observed on the DANVA2 tasks. With a larger sample and an additional measure of alexithymia, perhaps one would observe a pattern such that those with poor internal emotion recognition would also have poor recognition of others' emotions.

Significant correlations between the DANVA2 Paralanguage task and anxiety, specifically the MASC Total and Physical Symptoms subscale scores were opposite of predicted associations. Similarly, correlations between the DANVA2 Posture task and parent report of Internalizing Problems and Behavioral Symptoms (BASC) were opposite of predicted associations. These results suggest that more anxious individuals made fewer errors on the DANVA2 Paralanguage and Posture tasks. It is possible that higher levels of anxiety increased efforts of task performance in an adaptive way, leading to more correct responses. Another possible explanation could be found in the attentional control literature. Vytal and colleagues (2012) found that anxiety impairs functioning on "low load" cognitive tasks, but not on more difficult tasks that occupy executive resources. If social cognitive tasks are more difficult for individuals with AN and therefore require more cognitive resources, then perhaps their higher levels of anxiety were overridden by the cognitive demand.

The second aim was to describe social media use of adolescents with AN. For the analyses, self-reported average number of hours spent on social media during an average weekday and weekend day was used. No significant correlations were found between social media use and other symptom measures. Of note, the amount of time spent on social media was much less (1.79 hours per weekday and 2.80 hours per weekend day) than another large sample of healthy adolescents, who spent an average of 6.9 hours per day using social media (Pea et al., 2012). These drastic differences might be due to the way in which social media use was defined and measured for this study. One difference is that Pea and colleagues included time spent reading/doing homework online in their measurement of media use. Pea and colleagues used a self-report online survey with the following forced choice response to each type of media use: never (0), less than 1 hour (0.5), about 1-2 hours (1.5), about 2-3 hours (2.5), about 3-4 hours (3.5), or more than 4 hours (4.5). The current study also relied on self-report data, but allowed participants to enter any numerical values in response to their average media use. It is also possible that the current study participants were not very accurate reporters of this activity. Alternatively, it is possible that this sample is unique in terms of social media use and engages in this activity less than the average adolescent. Increased depressive and anxious symptoms and the isolative, secretive nature of eating disorders may be additional reasons why this sample reported less social media use compared to the healthy sample in Pea and colleagues' study. The parents of the adolescents in this study may limit social media use due to concerns of accessing content that supports eating disorders (e.g., "thinspiration" images or pro-anorexia websites). Small sample size and lack of variability in the sample's social

media use could be considered as possible explanations for non-significant findings for the second study aim. However, the p-values of the correlations are also very high, so increasing the statistical power would make little impact on the amount of variability explained in the associations between social media use and other clinical symptoms would likely not change these main findings.

Data regarding types of social media use was not very refined, but the majority of participants endorsed using media that involve photos and videos (e.g., SnapChat, Instragram, YouTube). The participants also noted entertainment as the most common reason for social media use. For these reasons, the tasks of non-facial communication (DANVA2) may not be related to social media use for this sample. It was hypothesized that social media use would serve as a protective factor against social cognitive deficits, particularly non-facial emotion recognition. If adolescents with AN were already engaging in frequent communication via photo and video sharing online, perhaps these communication skills would not be as impaired as adult samples or other samples studied before social media use became so common. However with entertainment being the most common reason for social media use, social reciprocity is often not part of their social media experience.

Follow-up correlation analysis between social media use and age resulted in significant association ( $r = .476, p = .008$ ), such that older participants reported greater time spent on social media. However, when the sample was split into younger and older participants and correlation analyses were re-run, there were still no significant associations between social media use and eating disorder, mood, or anxiety symptoms.

The third aim was to explore associations between the reception of non-facial emotions and social media use, and to see whether AN, mood, or anxiety symptoms would explain any possible associations. Results revealed no significant associations between DANVA2 task performance and social media use, so no further analyses were conducted. Lack of significant findings for this aim could be due to measurement of social media use and the potential problems previously identified. Another possible explanation is that reception of non-facial emotions is not crucial for social media use as a form of communication. It is also possible that other forms of emotional expression, for example through facial expressions or written language, are used to compensate for deficits in reception of non-facial emotions. Receiving multiple sources of emotional information simultaneously (e.g., a picture accompanied by text) may be more accurate and reflective of the experience of social media use.

Lastly, an exploratory aim of the study was to collect data on parent report of child social skills through the SRS-2 and to see how the parent report was associated with other variables. There were no statistically significant associations between the SRS-2 subscales and other measures. This measure is typically administered to children with autism spectrum disorder. However, it was selected for use in the current study because the RDoC recommended it as a good measure for the construct of reception of non-facial emotions, and is an informant-based measure. The average scores of SRS-2 subscales for the study sample were all in the normal range with the exception of Social Motivation, which fell in the mild to moderate range. This subscale measures motivation to engage in interpersonal behavior, elements of social anxiety, inhibition, and empathic orientation. Mild to moderate scores indicate clinically significant

deficiencies in this behavior that result in mild to moderate interference in everyday social interactions.

Interestingly, Social Motivation was the only SRS-2 subscale that approached statistical significance with other symptom measures in correlation analyses. Specifically, Social Motivation approached significance with the depression composite score ( $p = .079$ ), anxiety composite ( $p = .081$ ), and eating disorder risk composite ( $p = .064$ ). It is possible that these correlations would be statistically significant in a study that is well powered. Lack of social motivation may be a potential transdiagnostic feature of eating disorders and mood and anxiety disorders. These results also suggest that social motivation is another aspect to factor in to possible deficits in social cognitive skills of adolescents with eating disorders.

There are also possible clinical implications of this finding that may inform focus of psychotherapy. Perhaps a fruitful target for psychotherapy would be to explore the value of engaging in social interaction for the patient. Zucker and colleagues (2007) and McIntosh and colleagues (2014) suggested this in their discussions of psychotherapy for eating disorder patients. The current study lends further support to their speculations. It may be important to address low social motivation more explicitly in treatment, rather than as a function of depression or social anxiety that should improve along with other symptom improvement. Social skills training and/or emotion recognition training and perspective taking may also be beneficial adjunctive therapy interventions. These results also suggest that patients with eating disorders may have a difficult time understanding emotional information in interventions that are delivered through alternative means, for example web-based or telemedicine interventions.

The results of this study contribute new information to the existing literature of social cognition and eating disorders. In particular, these findings established that adolescents with AN have deficits in their ability to recognize non-facial communication, specifically to recognize emotions from body posture. Older adolescents, ages 15 to 18, also had more trouble recognizing non-facial emotional information through paralinguistic than younger participants and this approached statistical significance. These deficits seem to be a unique aspect of AN, which are not directly associated with eating disorder symptoms, mood or anxiety symptoms as measured in this study. More objective assessments of eating disorder symptoms, such as body fat, could play a role in cognitive functioning and emotion recognition skills. More objective measures of social media use or social skills, such as a chat room task with external validity, may further explain the association between eating disorders and social cognition. Finally, this study highlights mild to moderate impairment in social motivation for this sample of adolescents with AN.

The current findings also extend the four previous studies that assessed non-facial emotion recognition in adults with eating disorders. Kucharska-Pietura and colleagues (2004) similarly found deficits in perception of emotions during a prosodic task, with particular impairment for emotions of happiness and sadness. However, when the authors statistically adjusted for group differences on variables of age, education, current mood, and depressive symptom severity, no significant differences on the prosodic task remained. The current study found deficits in identifying emotions during a paralinguistic task for older adolescents, however associations with mood or anxiety symptoms were not significant. Findings from Nandrino and colleagues were



in line with the current study findings for non-facial emotion recognition in the form of neutral and positive valence pictures. However, Joos and colleagues (2009) and Jones-Chesters and colleagues (1998) did not find deficits in emotional perception or attentional bias of non-facial emotional stimuli. These findings may contrast with the current study because the non-facial stimuli used included body language whereas the other studies included others scenes with emotional valence.

Limitations of the current study include small sample size, exclusively female and mostly White participants. While AN has younger age of onset than the other eating disorders (i.e., bulimia nervosa, binge eating disorder), it would be useful to include other eating disorder diagnoses and subthreshold forms of eating disorders in future studies. Another limitation of this study is that the data were collected at one time point, and therefore it is impossible to draw conclusions about onset of social cognitive deficits compared to onset of the eating disorder. Social media use was not assessed with a validated measure, and this could potentially be improved for future studies. Likely due to rapid changes in technology, a validated measure of social media use was not available for this study. Lastly, analyses did not include corrections for multiple comparisons.

Future studies could measure social cognitive abilities at pre- and post-treatment time points, to more clearly understand whether these deficits improve with recovery. This type of design could also study whether these deficits predict success in treatment and recovery. Inclusion of additional measures of alexithymia and social motivation would permit testing of possible mediating effects between eating disorder symptoms and non-facial emotion recognition, or other forms of social cognition. It

would also be interesting to track total time spent on social media in more objective measures, for example through activity tracked on smartphones or tablets. This would provide a more accurate understanding of social media use among this population and offer better opportunity to assess any associations between social media use and eating disorder symptoms. Future studies could also look at simulated social interactions, either in person or through social media, to see whether this skill of reception of non-facial emotion impacts “real life” social interactions or therapeutic interactions for that matter. Such studies could lay the groundwork for development of technology to assist with further development of social cognitive skills in the context of psychotherapy for eating disorders.

This was the first study to evaluate the construct of reception of non-facial communication in a sample of adolescents with AN, and adds to the limited body of research about this construct in adults with eating disorders. Results established that adolescents with AN performed more poorly on tasks to identify emotions expressed through body language. Older adolescents (ages 15 to 18) with AN were also worse at identifying emotions expressed through paralanguage than healthy controls. These results also highlight some similarities and differences between adolescents and adults with AN. Finally, the construct of social motivation was mildly to moderately impaired in this sample. It would be worthwhile to further explore this construct future research particularly as it relates to overlaps in mood disorders and autism. Social motivation might also be a worthwhile target for clinical intervention in adolescents with AN.

## REFERENCE LIST

- Adenzato, M., Todisco, P., & Ardito, R. B. (2012). Social cognition in anorexia nervosa: Evidence of preserved theory of mind and impaired emotional functioning. *PloS One*, 7(8), e44414.
- American Psychiatric Association. (2013). *Diagnostic and statistica manual of mental disorders* (5<sup>th</sup> ed.). Arlington, VA: American Psychiatric Publishing.
- Baldwin, J. S., & Dadds, M. R. (2007). Reliability and validity of parent and child versions of the multidimensional anxiety scale for children in community samples. *Journal of the American Academy of Child and Adolescent Psychiatry*, 46(2), 252-260.
- Beck, A. T., Steer, R. A., & Brown, G. K. (1996). Manual for the Beck Depression Inventory-II. San Antonio, TX: Psychological Corporation.
- Blakemore, S.-J. (2008). The social brain in adolescence. *Nature Reviews Neuroscience*, 9(4), 267-277.
- Blakemore, S. J., & Choudhury, S. (2006). Development of the adolescent brain: Implications for executive function and social cognition. *Journal of Child Psychology and Psychiatry*, 47(3 - 4), 296-312.
- Caglar-Nazali, H. P., Corfield, F., Cardi, V., Ambwani, S., Leppanen, J., Olabintan, O., . . . Eshkevari, E. (2014). A systematic review and meta-analysis of 'Systems for Social Processes' in eating disorders. *Neuroscience and Biobehavioral Reviews*, 42, 55-92.
- Carter, J. C., Stewart, D. A., & Fairburn, C. G. (2001). Eating disorder examination questionnaire: Norms for young adolescent girls. *Behaviour Research and Therapy*, 39(5), 625-632.

- Chisholm, J. D., Chapman, C. S., Amm, M., Bischof, W. F., Smilek, D., & Kingstone, A. (2014). A cognitive ethology study of first-and third-person perspectives. *PLoS One*, 9(3), e92696.
- Choudhury, S., Blakemore, S.-J., & Charman, T. (2006). Social cognitive development during adolescence. *Social Cognitive and Affective Neuroscience*, 1(3), 165-174.
- Constantino, J. N., & Gruber, C. P. (2012). *Social Responsiveness Scale-2 professional manual*. Los Angeles, California: Western Psychological Services.
- Cook, B. *What is Social Communication?* Retrieved from <http://www.bibme.org/citation-guide/apa/website/>
- Fairburn, C. G., & Beglin, S. J. (1994). Assessment of eating disorders: Interview or self-report questionnaire? *International Journal of Eating Disorders*, 16(4), 363-370.
- Garner, D. M., Olmstead, M. P., & Polivy, J. (1983). Development and validation of a multidimensional eating disorder inventory for anorexia nervosa and bulimia. *International Journal of Eating Disorders*, 2(2), 15-34.
- Grahl, Tim. *The 6 Types of Social Media*. Retrieved from <http://outthinkgroup.com/tips/the-6-types-of-social-media>
- Halmi, K. A. (2009). Anorexia nervosa: An increasing problem in children and adolescents. *Dialogues in Clinical Neuroscience*, 11(1), 100.
- Hambrook, D., & Tchanturia, K. (2008). A pilot study exploring Machiavellianism in anorexia nervosa. *Eating and Weight Disorders-Studies on Anorexia, Bulimia and Obesity*, 13(3), 137-141.

- Harrison, A., Sullivan, S., Tchanturia, K., & Treasure, J. (2009). Emotion recognition and regulation in anorexia nervosa. *Clinical Psychology & Psychotherapy*, 16(4), 348-356.
- Harrison, A., Tchanturia, K., & Treasure, J. (2010). Attentional bias, emotion recognition, and emotion regulation in anorexia: state or trait? *Biological Psychiatry*, 68(8), 755-761.
- Insel, T., Cuthbert, B., Garvey, M., Heinssen, R., Pine, D. S., Quinn, K., . . . Wang, P. (2010). Research domain criteria (RDoC): toward a new classification framework for research on mental disorders. *The American Journal of Psychiatry*, 167(7), 748-751.
- Ito, M., Horst, H., Bittanti, M., Boyd, D., Herr-Stephenson, B., Lange, P. G., . . . Robinson, L. (2008). *Living and learning with new media: Summary of findings from the Digital Youth Project*. John D. and Catherine T. MacArthur Foundation. Retrieved from <http://digitalyouth.ischool.berkeley.edu/files/report/digitalyouth-WhitePaper.pdf>
- Jones-Chesters, M. H., Monsell, S., & Cooper, P. J. (1998). The disorder-salient stroop effect as a measure of psychopathology in eating disorders. *International Journal of Eating Disorders*, 24(1), 65-82.
- Joos, A. A., Cabrillac, E., Hartmann, A., Wirsching, M., & Zeeck, A. (2009). Emotional perception in eating disorders. *International Journal of Eating Disorders*, 42(4), 318-325.
- Kovacs, M., & Multi-Health Systems Staff. (2011). *Children's Depression Inventory 2 (CDI2)*. Multi-Health Systems, Incorporated.

- Kucharska-Pietura, K., Nikolaou, V., Masiak, M., & Treasure, J. (2004). The recognition of emotion in the faces and voice of anorexia nervosa. *International Journal of Eating Disorders, 35*(1), 42-47. doi:10.1002/eat.10219
- Lenhart, A., Purcell, K., Smith, A., & Zickuhr, K. (2010). *Social media & mobile Internet use among teens and young adults. Millennials*. Pew Internet & American Life Project. Retrieved from <http://www.pewinternet.org/2010/02/03/social-media-and-young-adults/>
- Mahan, S., & Matson, J. L. (2011). Children and adolescents with autism spectrum disorders compared to typically developing controls on the Behavioral Assessment System for Children, (BASC-2). *Research in Autism Spectrum Disorders, 5*(1), 119-125.
- March, J. S., James, P. D. A., Sullivan, K., Stallings, P., & Conners, C. K. (1997). The Multidimensional Anxiety Scale for Children (MASC): Factor structure, reliability, and validity. *Journal of the American Academy of Child and Adolescent Psychiatry, 36*(4), 554-565.
- McIntosh, V. V., Jordan, J., Carter, F. A., Luty, S. E., McKenzie, J. M., Bulik, C. M., . . . Joyce, P. R. (2014). Three psychotherapies for anorexia nervosa: a randomized, controlled trial. *American Journal of Psychiatry, 162*(4), 741-747.
- Merikangas, K. R., Avenevoli, S., Costello, E. J., Koretz, D., & Kessler, R. C. (2009). National comorbidity survey replication adolescent supplement (NCS-A): I. Background and measures. *Journal of the American Academy of Child and Adolescent Psychiatry, 48*(4), 367-379.

- Nandrino, J.-L., Berna, G., Hot, P., Dodin, V., Latrée, J., Decharles, S., & Sequeira, H. (2012). Cognitive and physiological dissociations in response to emotional pictures in patients with anorexia. *Journal of Psychosomatic Research, 72*(1), 58-64.
- Nowicki Jr, S., & Duke, M. P. (1994). Individual differences in the nonverbal communication of affect: The Diagnostic Analysis of Nonverbal Accuracy Scale. *Journal of Nonverbal Behavior, 18*(1), 9-35.
- O'Keeffe, G. S., & Clarke-Pearson, K. (2011). The impact of social media on children, adolescents, and families. *Pediatrics, 127*(4), 800-804.
- Oldershaw, A., Hambrook, D., Stahl, D., Tchanturia, K., Treasure, J., & Schmidt, U. (2011). The socio-emotional processing stream in anorexia nervosa. *Neuroscience and Biobehavioral Reviews, 35*(3), 970-988.
- Oldershaw, A., Hambrook, D., Tchanturia, K., Treasure, J., & Schmidt, U. (2010). Emotional theory of mind and emotional awareness in recovered anorexia nervosa patients. *Psychosomatic Medicine, 72*(1), 73-79.
- Osman, A., Barrios, F. X., Gutierrez, P. M., Williams, J. E., & Bailey, J. (2008). Psychometric properties of the Beck Depression Inventory - II in nonclinical adolescent samples. *Journal of Clinical Psychology, 64*(1), 83-102.
- Pea, R., Nass, C., Meheula, L., Rance, M., Kumar, A., Bamford, H., . . . Yang, S. (2012). Media use, face-to-face communication, media multitasking, and social well-being among 8-to 12-year-old girls. *Developmental Psychology, 48*(2), 327.
- Pitterman, H., & Nowicki Jr, S. (2004). A test of the ability to identify emotion in human standing and sitting postures: The Diagnostic Analysis of Nonverbal Accuracy-2

- Posture Test (DANVA2-POS). *Genetic, Social, and General Psychology Monographs*, 130(2), 146-162.
- Reynolds, C. R. (2004). *Behavior assessment system for children*. John Wiley & Sons, Inc..
- Russell, T. A., Schmidt, U., Doherty, L., Young, V., & Tchanturia, K. (2009). Aspects of social cognition in anorexia nervosa: Affective and cognitive theory of mind. *Psychiatry Research*, 168(3), 181-185.
- Smink, F. R., van Hoeken, D., & Hoek, H. W. (2012). Epidemiology of eating disorders: Incidence, prevalence and mortality rates. *Current Psychiatry Reports*, 14(4), 406-414. doi:10.1007/s11920-012-0282-y
- Smucker, M. R., Craighead, W. E., Craighead, L. W., & Green, B. J. (1986). Normative and reliability data for the Children's Depression Inventory. *Journal of Abnormal Child Psychology*, 14(1), 25-39.
- Speranza, M., Loas, G., Wallier, J., & Corcos, M. (2007). Predictive value of alexithymia in patients with eating disorders: A 3-year prospective study. *Journal of Psychosomatic Research*, 63(4), 365-371.
- Steinberg, L., & Morris, A. S. (2001). Adolescent development. *Journal of Cognitive Education and Psychology*, 2(1), 55-87.
- Swanson, S. A., Crow, S. J., Le Grange, D., Swendsen, J., & Merikangas, K. R. (2011). Prevalence and correlates of eating disorders in adolescents: Results from the national comorbidity survey replication adolescent supplement. *Archives of General Psychiatry*, 68(7), 714-723. doi:10.1001/archgenpsychiatry.2011.22.



- Tchanturia, K., Happé, F., Godley, J., Treasure, J., Bara - Carril, N., & Schmidt, U. (2004). 'Theory of mind' in anorexia nervosa. *European Eating Disorders Review*, 12(6), 361-366.
- Vytal, K., Cornwell, B., Arkin, N., & Grillon, C. (2012). Describing the interplay between anxiety and cognition: From impaired performance under low cognitive load to reduced anxiety under high load. *Psychophysiology*, 49(6), 842-852.
- White, H. J., Haycraft, E., Goodwin, H., & Meyer, C. (2014). Eating disorder examination questionnaire: Factor structure for adolescent girls and boys. *International Journal of Eating Disorders*, 47(1), 99-104.
- Zonnevylle-Bendek, M., Van Goozen, S. H. M., Cohen-Kettenis, P., Van Elburg, A., & Van Engeland, H. (2002). Do adolescent anorexia nervosa patients have deficits in emotional functioning? *European Child and Adolescent Psychiatry*, 11(1), 38-42.
- Zonnevylle-Bender, M. J., Van Goozen, S. H., Cohen-Kettenis, P. T., van Elburg, T. A., & Van Engeland, H. (2004). Emotional functioning in adolescent anorexia nervosa patients. *European Child and Adolescent Psychiatry*, 13(1), 28-34.
- Zonnevylle-Bender, M. J., van Goozen, S. H., Cohen - Kettenis, P. T., van Elburg, A., de Wildt, M., Stevelmans, E., & van Engeland, H. (2004). Emotional functioning in anorexia nervosa patients: Adolescents compared to adults. *Depression and Anxiety*, 19(1), 35-42.
- Zucker, N. L., Losh, M., Bulik, C. M., LaBar, K. S., Piven, J., & Pelphrey, K. A. (2007). Anorexia nervosa and autism spectrum disorders: Guided investigation of social cognitive endophenotypes. *Psychological Bulletin*, 133(6), 976.

## VITA

Lauren Pollack was born in Iowa City, Iowa and currently resides in West Des Moines, IA where she is completing her clinical internship at the Central Iowa VA. She graduated from the University of Iowa in 2010 with a Bachelor of Science degree in Psychology and a Bachelor of Arts degree in Spanish. Lauren is currently working on her Doctor of Philosophy in Clinical Health Psychology at the University of Missouri—Kansas City.