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Face Affect Perception in Schizophrenia and Posttraumatic Stress Disorder

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FACE AFFECT PERCEPTION IN SCHIZOPHRENIA

AND POSTTRAUMATIC STRESS DISORDER

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ABSTRACT

Face Affect Perception in Individuals with Schizophrenia and Posttraumatic Stress Disorder

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Schizophrenia (SZ) and Posttraumatic Stress Disorder (PTSD) are often comorbid psychological disorders. Separately, research has previously demonstrated deficits in social cognition, including affect recognition impairment in both disorders; however, less is reliably known about the specific deficits unique to a comorbid diagnosis of SZ and PTSD.

This study examined the ability to correctly identify facial expressions in individuals diagnosed with SZ (n = 38) and PTSD alone (n = 20), comorbid SZ and PTSD (n = 26), and healthy controls (n = 28). Participants were administered a test battery to establish diagnoses of of schizophrenia and PTSD, and to evaluate positive and negative symptoms of psychosis, general psychopathology, and PTSD symptoms. Participants then completed a facial affect identification paradigm which included Inverted Faces, Affect Matching, and Affect Labeling tasks.

Differences between groups on the facial affect tasks were examined using a mixed model ANOVA. Results indicated the schizophrenia and schizophrenia with PTSD groups were less able to accurately identify facial affect when compared to the PTSD and control groups. The schizophrenia groups did not differ from each other suggesting that when PTSD is present in schizophrenia it does not further impair emotional processing in individuals with schizophrenia. Additionally, no significant differences were present between the control and PTSD groups on

individual emotions, and in the case of the emotion fear, individuals with PTSD performed slightly better than controls. In conclusion, when PTSD occurs comorbidly with schizophrenia it does not appear to significantly increase deficits in facial affect perception.

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CHAPTER 1

INTRODUCTION

The ability to navigate complex social situations through nonverbal communication is critical for adaptation and a necessary component of interpersonal relationships. The capacity to accurately identify facial emotions is a core element of this process. Recent research suggests that some cognitive abilities, including the ability to perceive emotions based on facial expressions, are specialized for processing social information. The term "social cognition" has been used to refer to these abilities, which are distinguished from other abilities required for processing non-social information. Humans rely heavily on interpreting emotions expressed by the face in normal interpersonal relationships. When facial cues are not perceived accurately or misinterpreted, there can be deficits in interpersonal functioning including distress, misunderstanding, and miscommunication (Fett et al., 2011; Green, Horan, & Lee, 2015). Research suggests that deficits in social cognitive abilities are associated with a number of negative outcomes, including functional disabilities.

Social cognition is a set of interrelated cognitive abilities which guide social interactions through recognizing, interpreting, and generating a reaction in response to others behaviors (Green et al., 2008). This ability to navigate social interactions while considering the beliefs, intentions, and dispositions of others relies on the ability to identify social cues. Facial affect expression is used as an important tool in human interactions, as it enhances communication of internal emotional states. The inability to recognize these emotional messages can have a negative impact on interpersonal relationships. Deficits in social cognitive abilities, including the ability to accurately identify emotion expressed by others, are present in schizophrenia (SZ; Green et al., 2008; Penn, Sanna, & Roberts, 2008; Salva, Vella, Armstrong, Penn, & Twamley, 2013; Strauss, Jetha, Ross, Duke, & Allen, 2010) and post-traumatic stress disorder (PTSD;

Hayes, VanElzakker, & Shin, 2012; Lysaker et al., 2015; Sharp, Fonagy, & Allen, 2012). While a good deal of attention has been directed toward social cognitive abilities in SZ, relatively less attention has been given to PTSD. Furthermore, studies have not examined whether the co-occurrence of SZ and PTSD (SZ+PTSD) is associated with unique deficits that are not characteristic of either disorder when they are considered separately. The proposed study has extended social cognitive research by examining affect perception in individuals with SZ, PTSD, and SZ+PTSD. The main hypothesis was that when PTSD occurs within the context of SZ a unique pattern of face affect identification deficits will emerge. To provide a context for the proposed hypothesis, the following sections include a review of current knowledge regarding social cognition and affect identification deficits that are observed in individuals with SZ and PTSD and consideration of the compounding effects of affect recognition deficits that are anticipated to occur in comorbid SZ+PTSD.

CHAPTER 2

LITERATURE REVIEW

Schizophrenia

Schizophrenia is a severe and chronic mental illness. Emotional, cognitive, and social deficits are thought to be core symptoms of the disorder. Lifetime prevalence rates of SZ range from 0.3-0.7% (American Psychiatric Association, 2013). However, numerous reviews cite lifetime prevalence rates ranging from 1-4% (for a review see: Saha, Chant, Welham, & McGrath, 2005). Onset of symptoms can occur gradually or suddenly and typically manifest between late-teenage years to early thirties. SZ symptoms are frequently categorized as negative or positive. Negative symptoms include lack of or limited emotional expression, loss of motivation, social withdrawal, anhedonia, and cognitive deficits. Positive symptoms of SZ include hallucinations, which can be auditory or visual, delusions, abnormal motor behavior (e.g. agitation, repetitive movements, or catatonia), and disorganized thought, speech and behavior.

Structural brain abnormalities in SZ include areas such as the temporal lobes and limbic system. Enlargement of brain ventricles, within the temporal lobes, is thought to be key in characteristic features of SZ including disorganized speech, negative symptoms, and hallucinations. Within the limbic system of individuals with SZ, the anterior cingulate cortex is hypoactive during emotional processing (Nelson, Bjorkquist, Olsen, & Herbener, 2015). Decreased hippocampal volume, particularly on the left hippocampus, is one of the most consistent structural abnormalities identified. Functionally, the hippocampus is hyperactive and may account for psychotic features, such as hallucinations and delusions (Heckers, 2001). Studies have shown that the amygdala has reduced size and volume, particularly in the left hemisphere of the brain. This structural difference is associated with emotional processing deficits. fMRI investigation of amygdalar activation in response to a novel emotion recognition

paradigm reports hypoactivation of the amygdala resulting in slower emotion recognition and a negative bias in affect labeling (Mier et al., 2014). Similarly, other studies have found decreased amygdalar activation and impaired accuracy of identifying facial expressions when compared to healthy controls (Phillips et al., 1999; Kohler & Brennan, 2004).

Deficits in facial affect perception have also been identified across a number of psychiatric and neurological disorders with a good deal of research on these deficits in schizophrenia. These studies suggest that social dysfunction in SZ can be attributed to the inability to recognize and accurately identify facial emotion cues (for review, see Kohler & Brennan, 2004; Edwards, Jackson, & Pattison, 2002). Specifically, individuals with SZ demonstrate deficits in recognizing facial emotions when compared to healthy controls. In addition, the deficits are more pronounced in comparison to other mental health disorders. Kohler et al. (2003) reported that positive and negative symptom severity were correlated with deficits in emotion recognition, indicating a unique association in SZ. Previous research has also shown that individuals with SZ demonstrate abnormalities in facial scanning and abnormal fixation when trying to identify facial affect (Green & Phillips, 2004; Williams, Loughland, & Davidson, 1999; Salva et al., 2013).

Studies have also reported that there are particular deficits in recognizing specific facial emotions including sadness, disgust, fear, and neutral faces in SZ (Bryson, Bell, Kaplan, Greig, & Lysaker, 1998; Strauss et al., 2010). Kohler et al. (2003) reported that when individuals with SZ were presented with mild and intense expressions of facial emotion, they had significant difficulty accurately recognizing fear, disgust, and neutral faces even when the emotions were intense. When examining performance errors on neutral faces, individuals with SZ also had a greater tendency to identify neutral faces as negative. These results suggest that regardless of

emotion intensity, fear and disgust are particularly difficult for individuals with schizophrenia to identify and that there is a negative bias when perceiving non-emotional neutral faces.

Posttraumatic stress disorder

Posttraumtic stress disorder is a trauma-related disorder characterized by psychological distress following a traumatic event. Symptoms include hyperarousal, intrusive thoughts, hyperarousal, and persistent attempts to avoidance cues or reminders of the traumatic event. PTSD is also associated with emotional impairment including fear-based reexperiencing, diminished affect response, as well as feelings of guilt, shame, sadness, and anger (American Psychological Association, 2013). Approximately 60% of individuals living in the United States experience a traumatic event at some time in their lives (Kessler, Sonnega, Bromet, Hughes, & Nelson, 1995); however, most individuals will not develop PTSD due to early identification, treatment, or other protective factors (Craine, Henson, Colliver, & MacLean, 1988). The lifetime prevalence rate for PTSD is about 8% in the United States population (American Psychological Association, 2013; Cusack, Frueh, & Brady, 2004; Mueser et al., 2001) although PTSD often goes undetected in secondary care settings, with a recent review suggesting the 28.6% of patients have undetected PTSD (Zammit, Lewis, Dawson, Colley, McCann, Piekarski, et al., 2018). Factors influencing development of PTSD and severity of symptoms include type of trauma (e.g. personal attacks versus witnessing an event), lower IQ, age when the trauma occurred, poor social support, and personal history or family history of another psychiatric disorder (Nathan & Gorman, 2002).

Neuroanatomical differences are reported for individuals diagnosed with PTSD in comparison to healthy controls. Several key structures are regularly demonstrated to have functional differences, including the hippocampus, amygdala, insula, anterior cingulate cortex,

and the medial prefrontal cortex. Each of these brain structures are also central to threat-related processing and social-cognitive processing in the brain (Adolphs, 2001; Sharp, Fonagy, & Allen, 2012). While increased amygdalar activation in response to facial expressions of fear is normal, individuals with PTSD have an exaggerated response (Breiter et al., 1996; Morris et al., 1996). For example, one study found that when primed with threat-associated emotional cues, individuals with PTSD had greater blood-oxygen level dependent (BOLD) responses in the left amygdala and insula, compared to controls (Mazza et al., 2002). Shin et al. (2005) found that individuals with PTSD demonstrated hyperresponsivity in the amygdala and diminished activity in the medial prefrontal cortex when presented with fearful versus happy facial expressions. Several studies have demonstrated decreased hippocampal volume in individuals with PTSD; however, it is unclear whether there was reduced volume prior to experiencing the trauma (indicating susceptibility to developing psychopathology) or if the loss of volume occurred post-trauma (Stein et al., 1997; Bonne et al., 2001; Gilbertson et al., 2002).

Compared to SZ research, less is reliably known about facial affect processing abnormalities in individuals with PTSD. Studies that have been conducted suggest that emotional impairment is a result of changes in functional brain activity (as reviewed above). The result is a deficit in processing emotional messages both within the individual and recognizing it in others (Hayes, VanElzakker, & Shin, 2012). In 2011, Poljac, Montagne, and de Haan evaluated affect recognition in PTSD while controlling for the ability to assess the perception of neutral faces. Results indicated that while individuals with PTSD did not have basic deficits in perception of faces, they did have a selective deficit in sensitivity and accuracy in identifying fear and sadness compared to healthy controls. Similarly, Bell and Naugle (2008) found that increased reaction time to negative expressions of emotion in individuals with PTSD was

predictive of alexithymia, which is the inability to recognize, identify, and label emotional states. This study also found alexithymia to be a unique predictor of increased risk for future sexual revictimization, potentially by impairing decision making and judgement in social situations.

Comorbid Schizophrenia and Posttraumatic stress disorder

Individuals with severe mental illnesses (SMI), including SZ, have increased rates of PTSD than the general population. Mueser and coworkers (2004) found that in a sample of 782 with SMI who were recruited from inpatient and outpatient settings, 34.8% were diagnosed with PTSD. Specific to schizophrenia, prevalence rates of PTSD range between 26 to 52% (Kim, Kaspar, Samuel, & Nam, 2006; Seow et al., 2016). The increased incidence of PTSD in schizophrenia appears to result from a number of factors. First, individuals with SMI experience more trauma than the general population. Mueser and coworkers (2004) reported that 84.4% of their SMI sample reported lifetime exposure to physical abuse and 51.5% experienced sexual assault. Women were significantly more likely than men to report lifetime sexual assault. Estimates of lifetime childhood abuse ranging between 34-53% and lifetime physical or sexual trauma ranging from 43-84% (Cascardi, Meuser, DeGiralomo, & Murrin, 1996; Goodman et al., 2001; Hutchings & Dutton, 1993; Lipschitz et al., 1996). Although not all individuals who experience trauma will develop PTSD, the increased exposure to trauma observed for individuals with SMI undoubtedly contributes to the increased incidence of PTSD.

There is also increased recognition that there is an association between trauma history and psychotic symptoms that is expressed in a number of different ways. For example, trauma history increases transition to psychosis for individuals who are at high risk for psychotic disorders (Grivel, Leong, Masucci, Altschuler, Arndt, Redman, et al., 2018; Kraan, Velthorst, Themmen, Valmaggia, Kempton, McGuire, et al., 2018). PTSD and other traumatic stress

disorders also increase the subsequent development of schizophrenia and other psychiatric disorders such as bipolar disorder (Okkels, Trabjerg, Arendt, & Pedersen, 2017). Also, a recent meta-analysis suggest that for individuals who are having their first psychotic episode, the experience of psychotic symptoms may be traumatic enough to cause the onset of PTSD and other stress disorders (Rodrigues & Anderson, 2017). A full 50% of individuals who are having their first psychotic episode will experience symptoms of PTSD and 33% will develop PTSD (Rodrigues & Anderson, 2017).

When PTSD is present in individuals with SZ, it is associated with an increased prevalence in a variety of negative outcomes. Individuals with SZ who have a comorbid PTSD diagnosis experience greater severity of psychotic symptoms, including increased paranoia, more severe hallucinations and delusions, increased violent thoughts, feelings, and behaviors, as well as increased secondary negative symptoms (Gearon, Bellack, & Tenhula, 2004; Grubaugh, Zinzow, Paul, Egede, & Frueh, 2011; Resnick, Bond, & Mueser, 2003; Sautter et al., 1999; Strauss, Duke, Ross, & Allen, 2011) compared to those with SZ or PTSD alone. Additionally, they have higher levels of depression, and greater severity of delusional symptoms compared to those with SZ, PTSD, and controls (Duke, Allen, Ross, Strauss, & Schwartz, 2010). Kim et al. (2006) also found a significant difference in depression, anxiety, dissociative experiences, and overall psychopathology in individuals with SZ who had a history of sexual and repeated physical abuse. Comorbid PTSD and schizophrenia is also associated with poorer quality of life, increased suicidality, and increased medical utilization (Calhoun, Bosworth, Stechuchak, Strauss, & Butterfield, 2006; Gracie et al., 2007; Strauss et al., 2006). Because of the unique an negative consequences that arise when PTSD occurs in schizophrenia and other severe mental illnesses, specialized behavioral treatments are being developed although continued work is needed to

demonstrate their efficacy (Brand, McEnery, Rossell, Bendall, & Thomas, 2018; Steel, Hardy, Smith, Wykes, Rose, Enright, et al., 2017; Slade, Gottlieb, Lu, Yanos, Rosenberg, Silverstein, et al., 2017)

Lastly, research on comorbid PTSD and schizophrenia has demonstrated neuroanatomical changes such as decreases in hippocampal volume, abnormalities in the frontal and temporal lobes, and alterations in neurotransmitters (Etkin & Wager, 2007). However, neuropsychological studies examining cognitive differences between individuals with SZ and those with SZ+PTSD have provided mixed results. The expectation is that when PTSD is present in SZ, there will be an overall decreased in cognitive performance associated with increased neuropathology. Some studies confirm this expectation by reporting that individuals with SZ+PTSD perform worse on some cognitive tests than individuals with SZ alone (Fan, Henderson, Nguyen, Cather, Freudenreich, Evins, et al., 2008; Goodman, Finkel, Naser, Andreyev, Segev, Kurs, et al., 2007; Halasz, Levy-Gigi, Kelemen, Benedek, & Keri, 2013; Pollice, Bianchini, Conti, Mazza, Roncone & Casacchia, 2010). Other studies find no significant differences between groups (Duke et al., 2010; Halasz, Levy-Gigi, Kelemen, Benedek, & Keri, 2013; Newman, Turnbull, Berman, Rodrigues, & Serper, 2010; Peleikis, Varga, Sundet, Lorentzen, Agartz, & Andreassen, 2013). Differences between studies are influenced by methodology, participant characteristics, and other factors. For example, after controlling for negative symptoms, individuals with SZ+PTSD exhibit impaired neurocognitive functioning in some cognitive domains when compared to SZ (Duke et al., 2010).

Given that face affect perception and processing is a critical social cognitive ability required for adaptation and normal functioning, that neuroimaging studies have identified abnormalities in brain areas critical for emotion perception and processing in SZ and PTSD, that

there is evidence supporting face affect perception abnormalities in schizophrenia and in PTSD, one would expect individuals affected by both disorders would demonstrate more severe deficits in face affect perception particularly for negative emotions such as sadness, disgust, and fear. However, little is reliably known about how SZ+PTSD comorbidity may impact social cognitive abilities. In fact, to our knowledge there are no studies that have specifically evaluated social cognition in co-morbid SZ+PTSD. This area of study is particularly relevant for individuals diagnosed with SZ because they experience traumatic events at a higher rate than the population-at-large, which results in an increased incidence of PTSD and poorer outcomes across a variety of domains.

The current study sought to address this gap in scientific knowledge by examining face affect processing abnormalities in individuals with SZ who have comorbid PTSD. To accomplish this, a standardized face affect identification task was administered to individuals with SZ+PTSD as well as comparison groups consisting of individuals who have a diagnosis of PTSD only, a group of individuals who have a diagnosis of SZ only, and a healthy control sample. Based on review of the literature, it was hypothesized that individuals diagnosed with schizophrenia, including those in the SZ and SZ+PTSD groups, would have a generalized deficit in identifying facial affect expression when compared to individuals without schizophrenia, including those in the normal control (C) and PTSD groups. However, PTSD would be associated with a differential deficit in identifying specific facial expressions, such that the PTSD group would perform significantly worse than the C group and the SZ+PTSD group would perform significantly worse than the SZ group when identifying facial expressions of fear and sadness. Differences among the groups were not expected to be accounted for by more basic disturbances in visuoperceptual abilities.

Results not only have implications for understanding cognitive abnormalities and underlying neural dysfunction in these individuals but also provides information that may be useful for developing interventions designed to target face affect identification deficits and thereby improve social functioning and outcomes.

CHAPTER 3

METHODS

Participants

Participants included 112 individuals recruited from the community, community mental health center, or a university located in the southwestern part of the United States. Participants from the community primarily served in the control group which had 28 participants. Individuals in the PTSD group (*n*=20) were primarily recruited from the university psychology subject pool. Individuals in the SZ (*n*=38) and SZ+PTSD (*n*=26) group were recruited through a community mental health center which provides day services for individuals with severe mental illness. See Table 1 for group demographic data.

Individuals were included in the PTSD group if they had a current or lifetime diagnosis of PTSD as established by the Structured Clinical Interview for DSM–IV (SCID-IV; First, Spitzer, Gibbon, & Williams, 2002) and if they had a score of 30 or higher on the Post-Traumatic Stress Disorder Checklist (PCL-C; Weathers, Litz, Herman, Juska, & Keane, 1993). Responses from the SCID-IV and PCL were compared to new DSM-5 diagnostic criteria for PTSD and found that all participants in the PTSD and SZ+PTSD groups met criteria for PTSD under the new criteria. Types of traumatic events reported by the participants are found in Table 2. Individuals with schizophrenia had a clinical diagnosis of SZ or SZ+PTSD which was be made by their treating physician; these diagnosis were confirmed using the SCID. Individuals in the SZ+PTSD group were included if they have a current or lifetime diagnosis of PTSD and a current diagnosis of SZ. Current diagnosis were made if the individual met diagnostic criteria within the past six months. Participants in the clinical groups were not excluded due to comorbid anxiety or depressive disorders as these disorders occur at a high frequency in individuals

diagnosed with PTSD and SZ. This represents a typical clinical presentation of the overall population of those individuals with SZ and PTSD.

Exclusionary criteria, which applied to all participants, included a history of seizures, traumatic brain injury, intellectual disability, current substance use disorder, English as a second language, or inability to provide consent. Additional exclusionary criteria for individuals in the Control group included any psychiatric diagnosis per the SCID; however, individuals were included if they had a lifetime psychiatric diagnosis that had been resolved for at least 12 months (e.g., depression). Control group exclusionary criteria included exposure to a traumatic event and subthreshold symptoms of PTSD. Individuals in the control group (C) were included if they had never been diagnosed with SZ, PTSD, bipolar disorder, and they did not meet criteria for an Axis I psychiatric disorder during the most recent 12 months. Finally, control participants were excluded if they were currently taking any over-the-counter medications or prescribed medications known to effect the central nervous system, or if they had any relatives (either first or second degree) with a suspected or confirmed psychotic disorder.

Measures used in this study were administered as part of a larger battery of tests. The total test battery took approximately 6 hours for participants to complete. Participants from the subject pool were compensated for participation with SONA credits to satisfy an undergraduate research requirement or with financial compensation. For each hour that a student participated, they received one research credit. Individuals recruited from the community received $5 per hour. If they completed the entire study, participants received a $30 bonus. The average compensation for participants who completed the study as approximately $60.00. Some variability in compensation occurred based on differences in the total amount of participation

time. Participants from the community who did not meet the eligibility requirements were compensated for the amount of time they spent with the interviewer.

Written informed consent was obtained from all participants before they completed any of the study procedures

Measures

Measures for the current study were administered as part of a larger battery of tests. Measures examined in the current study were those needed in order to determine diagnoses of SZ or PTSD, to assess current severity of psychotic, affective and other symptoms, estimate IQ, and assess facial affect perception. Pertinent demographic and other clinical information (e.g., current medications, medical conditions, etc.) was gathered using a standardized form. The following sections include a brief description of each measure used in the current study.

A demographic questionnaire was provided to all participants after providing consent. Then a semi-structured interview was conducted with participants to assess psychiatric symptoms and establish diagnosis. After completing the diagnostic and symptom rating scales, participants completed the neuropsychological testing, which included three face affect identification tasks. All of the measures are regularly used tests in research settings that have been found to be both reliable and valid.

Diagnostic and symptom measures

The Structured Clinical Interview for DSM-IV Axis I Disorders (SCID). The SCID is a semi-structured clinical interview used to make DSM-IV Axis I diagnosis in both psychiatric and research settings (First, Gibbon, Spitzer, & Williams, 1996). Each of the SCID diagnostic criteria are rated as either absent (1), subthreshold (2), or present (3). It has strong validity and reliability evidence, and is considered the gold standard for establishing research diagnoses.

Notably, Fennig et al. (1994) found the SCID to have good specificity (.96) and sensitivity (.89) making it a valid assessment tool for diagnosing SZ.

The Life Events Checklist – Clinician Administered PTSD Scale (CAPS). To assess for different types of trauma, the CAPS (Weathers et al., 1993) was completed for all participants. The CAPS is unique in that it prompts responses regarding many different types of exposure to trauma. Respondents rate their experience of 17 different types of trauma the event on a 5-point nominal scale (1=happened to me, 2=witnessed it, 3=learned about it, 4=not sure, and 5=does not apply). The CAPS has good sensitivity (.90) and specificity (.95).

Post-Traumatic Stress Disorder Checklist – Civilian (PCL-C). The PCL-C (Weathers et al., 1993) is a self-report questionnaire that was given to participants to determine if PTSD symptoms were present and measure the severity of symptoms. The PCL-C has 17 items used in the diagnosis of the DSM–IV criteria for PTSD. Responses are based on a Likert scale format with "1" indicating "Not at all" and "5" indicating "Quite a bit." The PCL-C is written to allow for generalization of symptoms to any type of traumatic event. For the purposes of this study, each response was used to obtain a total score; a low cut-off score for a diagnosis of PTSD is 30. The PCL-C has good diagnostic utility and psychometric properties (Blake et al., 1990). The PCL-C demonstrates sensitivity and specificity comparable to the SCID, .82 and .83, respectively. Test-retest reliability is .96. To ensure accuracy in diagnosis, information from the CAPS and the PCL was used to provide supplement information obtained from the SCID.

Scale for the Assessment of Positive Symptoms (SAPS). The SAPS (Andreasen, 1984) consists of 34 items that assess positive psychotic symptoms. SAPS items are rated on a "0" (absent) to "5" (severe) Likert scale based on information gained from a structured clinical interview with the patient, including both behavioral observations and subjective reports. Each

item provides a detailed description of the statement and a scaled anchoring system. SAPS items are organized according to four symptom domains that include hallucinations, delusions, bizarre behavior, and positive formal thought disorder. A total score can be calculated as can scores for each of the four domains.

Scale for the Assessment of Negative Symptoms (SANS). The SANS (Andreasen, 1984) consists of 25 items and that assess negative symptoms of psychosis. Similar to the SAPS, it is a structured clinical interview using both subjective and objective ratings of behavior. The SANS assess five domains of negative symptoms including, affective flattening, alogia, avolition-apathy, anhedonia-asociality, and disturbance of attention. For this study, a total negative symptom score will be used.

Brief Psychiatric Rating Scale (BPRS). General psychiatric symptoms as well as symptoms of mania and depression were assessed since individuals with schizophrenia and PTSD often experience these symptoms. The Brief Psychiatric Rating Scale (BPRS; Overall & Gorham, 1962) was used to measure the how severe psychiatric symptoms were at the current time. The BPRS consists of 18 items and is administered in a semi-structured interview format. The items are presented on a 7 point Likert scale. A response of "1" indicates "not present" and "7" represents "very severe." The BPRS is rated based on subjective reports provided by the participant and objective observations by assessment administrator.

IQ Estimate

Three subtests from the Wechsler Adult Intelligence Scale 3rd edition (WAIS-III; Wechsler, 1997) were selected to estimate intellectual functioning.

Block Design. The Block Design subtest requires use of blocks to construct a design that is presented to the test subject as a two dimensional photograph. Each block has two red sides,

two white sides, and two sides that are diagonally half white and half red. Initially, the design patterns only require four blocks, then six blocks, and finally the more difficult designs require nine blocks. Each design has a specified administration time. Responses are scored based on both accuracy of the design and completion time. When the respondent receives a score of "0" three times in a row, the subtest administration is discontinued.

Information. During the information subtest, individuals will respond to questions which characterize common knowledge learned from culture. Content domains include science, history, geography, etc. Correct responses are scored as one point; incorrect answers are scored as a zero. After six consecutive scores of zero, administration is discontinued.

Vocabulary. The vocabulary subtest assesses semantic knowledge by asking participants to name objects in pictures or provide definitions of words. This subtest assesses the degree to which one can use learned knowledge and communicate it verbally. Responses are scored as "2" or "complete response," "1" or "partial response," or "0" as "incorrect."

Affect recognition

The test paradigm used in the current study is comparable to one utilized by Feinberg et al. (1986). Participants completed three affect tasks, including: 1) inverted faces (this served as a control task where inverted served to measure basic visuoperceptual skills) where subjects categorized faces as being different or the same; 2) affect matching task, where inividuals were presented with two different faces and responded whether the pairs showed the same emotion or if the pairs show different emotions; and 3) affect labeling task, where subjects were presented with individual faces and asked to label the face affect being displayed from a list of six emotion labels. In each task, the stimuli being used came from the Matsumoto and Ekman (1988) stimulus set which have been found to be easily recognizable by nonpsychiatric populations and

consist of color photographs of Caucasian males and females, as well as Asian males and females. Color images on a grey backdrop were presented for each task on a computer monitor. Participants first saw a fixation point which was on the monitor for 1 s. Stimulus photos remained visible to participants until they provided a verbal response into a voice active microphone, or until 5 s elapsed. After 5 s, the monitor would be blank to prompt participant response. For all affect identification tasks, if participants failed to provide a response after 5 s, it was recorded as an incorrect response; due to the dynamic nature of facial expressions, if an individual is unable to correctly identify a static, high intensity expression in 5 seconds time, it likely indicates an impairment in facial processing.

Inverted face identification task. The inverted face identification task presents two faces on a central location on the monitor, one on top of the other; however, the face on the bottom was upside down. Participants respond by indicating whether the two faces on the screen are the same or different person. The task begins with 8 practice stimuli which are followed by 56 experimental stimuli (where 28 are the same and 28 are different). To increase task difficulty, the faces were always the same gender and ethnicity (Caucasian). A computer monitor was utilized to present images, and participants were instructed to speak into a voice activated microphone and respond by saying "same" or "different." This task assessed for possible differences among the groups in visuoperceptual processing and was used as a control task.

Facial affect matching task. The affect matching task stimuli were presented with both stimuli upright, one on top of the other, and centrally located on the monitor. Participants were asked to verbally indicate if the emotions expressed on the faces were "different" or "same." Faces represented six emotions including neutral, sadness, happiness, anger, disgust, and fear. Individuals were presented with eight practice stimuli, consisting of faces displaying surprise or

contempt (four stimuli showed the same emotion and four showed different emotions). There were 120 face pairs of Caucasian males and females in the experimental stimuli (stimuli pairs were always the same gender). Ten matching stimuli were shown for each emotion (e.g., 10 happy top–happy bottom), as well as 10 different stimuli (e.g., 2 happy–disgust; 2 happy–angry; 2 happy–fear; 2 happy–neutral; and 2 happy–sad).

Facial affect labeling task. Stimuli represented six basic emotions including: neutral, happiness, sadness, surprise, anger, and fear. Each of the six emotions were presented once among eight individual stimuli (2 Caucasian females; 2 Caucasian males; 2 Asian females; and 2 Asian males). There were 48 total experimental presentations. A list of the six possible emotion responses was provided to the participants who were asked to label the emotion they believed was demonstrated on each face.

Procedures

Participants were recruited from advertisements, the SONA subject pool, and flyers. After a brief description of the current study, individuals interested in participating provided written informed consent prior to completing any of the study procedures. There were four informed consent forms used in the study including consent forms for: 1) community control participants; 2) subject pool control participants; 3) subject pool PTSD participants; and 4) SZ, PTSD, and SZ+PTSD community participants.

The demographic, diagnostic, and symptom assessments were completed first to determine if participants were eligible for the study. Participants in the control group did not complete the clinical interviews (e.g.SANS, SAPS, or BPRS) as these instruments are designed for use with clinical populations. The second component of this study included self-report measures and neurocognitive testing. All assessments were administered according to

standardized instructions. Research assistants, who are trained graduate students, allowed time to debrief the participant, answer any questions, and provide experimenter contact information.

Statistical Analyses and Expected Results

Data Entry and Screening

All diagnostic and screening measures were scored by two different individual researchers who received training on the measures and the standardized procedures for scoring each assessment. Data was then double entered and inspected for errors.

Prior to evaluating the main study hypotheses, all variables were inspected to ensure the assumptions of normality, linearity, homoscedasticity, and multicollinearity were met. Frequency distributions, scatterplots and skewness, and kurtosis statistics were used to examine normality. Variables that were not normally distributed were transformed according to standard procedures (Tabachnik & Fiddel, 2012). When outliers were identified, they were retained in the analyses but their influence was minimized using standard procedures (Tabachnik & Fiddel, 2012). If scores were more than 2 SD from the mean, they were considered outliers. Preliminary analyses also included examining demographic differences among the four groups. For continuous variables (age, education), univariate analyses of variance (ANOVA) were used to examine group differences. For categorical variables (gender, ethnicity), chi-square analysis were used to examin groups differences.

Prior to conducting the main analysis to test the study hypotheses, correlations were calculated between the face affect identification task and other variables that may be associated with performance. These variables included the face affect control conditions (inverted faces, affect matching), demographic variables (age, education), and symptoms (depression, positive symptoms, negative symptoms). In cases where significant associations were present between

the face affect identification task and these variables, ANOVA was used to test differences among the groups for each variable. In cases where significant group differences occurred, the variable was examined as a covariate in the main study analyses to determine any influence it had on group differences for the face affect identification tasks.

To test the main hypothesis, a mixed model ANOVA was used that has one between subjects factor, diagnosis (SZ, C, SZ+PTSD, PTSD) and one within subjects factor, emotion (happy, sad, anger, surprise, fear, neutral). Based on the study hypothesis, it was predicted that a significant diagnosis X emotional interaction effect would be present, consistent with the idea that individuals with PTSD (PTSD, SZ+PTSD) have greater difficulty identifying sad and fear face affect compared to those without PTSD (C, SZ). If a significant interaction effect was present, follow up ANOVA's with Tukey post hoc comparisons were used to examine group differences on the individual emotions to determine if differences are consistent with the hypotheses. Covariates were modeled when significant group differences were found, as previously described.

CHAPTER4

RESULTS

Preliminary Analyses

The data was examined to identify outliers. In addition, all variables were assessed to see if they were normally distributed. There were a few variables in which skewness and kurtosis exceeded the acceptable limits, including Facial Affect Identification of the emotions anger, surprise, happy, and neutral, as well as percentage correct for Inverted Faces and Affect Matching, primarily due to the influence of outliers. Outliers were retained in the analyses but were adjusted so that they were one unit greater (or lesser) than the next most extreme score in the distributions (Tabachnik and Fiddel, 2012). This approach maintained important data points but decreased their influence. After correction of outliers, skewness and kurtosis for all variables were within acceptable limits.

Data Analysis

Demographic data are presented for the current sample in Table 1. Group differences on these variables were examined using univariate ANOVA with Tukey-B post hoc comparisons. As can be seen from the table, result of these analyses indicated there were a number of significant differences among the study groups. The control, SZ and SZ+PTSD groups were significantly older than the PTSD group but did not differ from each other. Also, the PTSD and Control groups had significantly more years of education than did either of the schizophrenia groups. Finally, differences in IQ were also present among the groups with the schizophrenia groups obtaining lower IQ scores than the PTSD and control groups, who did not differ from each other. Group differences on the categorical variables of gender and ethnicity were examined using Chi-square analyses. There were significant differences between the groups for both of these variables, which was primarily accounted for by the schizophrenia group having

significantly fewer female and significantly more African American participants than the other groups. In considering whether or not to control for these demographic differences in the main analyses through covariance procedures, age was included as a covariate. However, we did not control for differences in education and IQ because, as anticipated, the schizophrenia groups were significantly lower than the PTSD and control groups and these lower scores reflect a component of the disorder, so to control for the differences would be controlling for our independent variable of interest (i.e., diagnosis).

Clinical data for the groups is presented in Table 3. Univariate ANOVAs with Tukey-B post hoc comparisons indicated a number of significant differences among the groups. As can be seen from the table, the schizophrenia groups had significantly more positive and negative symptoms as compared to the control and PTSD groups. The control group and the SZ group had significantly lower scores on the PCL compared to the PTSD group and the SZ+PTSD group. There were significant group differences on the BPRS affect factor where the control group scored lower than the SZ and PTSD group, who scored lower than the SZ+PTSD group. On the BPRS measures of anergia, disorganization, and thought disturbance, both schizophrenia groups had significantly higher scores than the PTSD group, who in turn had significantly higher scores than the control group.

Descriptive statistics for the Inverted Faces and Affect Matching tasks are presented in Table 5. Univariate ANOVA's indicated significant differences among the groups on each of these tasks. Significant differences were present between the groups on the Inverted Faces and Affect Matching tasks which were included as control conditions for the Affect Labeling task. The general pattern of results suggested that the schizophrenia groups had greater difficulty with these tasks than the control or PTSD group. Based on between group differences in

demographic, clinical data, Affect Matching, and Inverted Faces, the primary analyses were accomplished with and without covariates in order to determine the impact that these group differences might have on emotion labeling. In these analyses, a mixed model ANOVA was conducted which included group as the between subjects factor (C, P, S, SP) and emotion labeling as the within subjects factor (anger, surprise, sadness, happy, neutral, and fear). Covariates included in the analyses included age, Inverted Faces, and Affect Matching tasks. We did not include IQ, years of education, or symptoms data as covariates because these variables are associated with core features of schizophrenia and so to control for them would result in controlling the independent variable of interest (i.e., diagnosis). Descriptive statistics for percentage correct on the Affect Labeling task are presented in Table 6.

Results of the mixed model ANOVA indicated there was a significant main effect for emotion, $F(5,104) = 55.07$, $p < .001$, partial eta squared = .73, and group, $F(3,108) = 13.60$, $p < .001$, partial eta squared = .27, as well as a significant emotion by group interaction effect, $F(15,318) = 2.36$, $p < .01$, partial eta squared = .10. When Age, Inverted faces, and Affect matching were included as covariates in the analyses, results indicated a significant main effect for group, $F(3,105) = 6.98$, $p < .001$, partial eta squared = .16, as well as a significant interaction effects for age by emotion, $F(5,101) = 2.78$, $p < .05$, partial eta squared = .12, affect matching by emotion, $F(5,101) = 2.60$, $p < .05$, partial eta squared = .11, and emotion by group, $F(15,309) = 1.77$, $p < .05$, partial eta squared = .08. The main effect for emotion was not significant, $F(5,101) = 2.28$, $p = .052$, partial eta squared = .10, nor was the inverted faces by emotion interaction effect, $F(5,101) = 1.16$, $p = .336$, partial eta squared = .05.

The emotion by group interaction effects are presented in Figure 1 without covariates (frame A) and with covariates (frame B). As can be seen from the figure, addition of the

covariates did not substantially alter the overall patterns of group performance or groups differences for each of the specific emotion. Based on this consideration, contrasts examining group differences on each emotion were conducted without covariates in order to maintain power. The results of the descriptive statistics and post hoc analyses for the affect labeling task are presented in Table 6. Results of these analyses suggest a significant difference in total percentage correct $F(3,108) = 13.6$, $p < .001$. Results demonstrated significant differences for each of the emotions: Anger = $F(3,108) = 5.9$, $p < .001$; Surprise = $F(3,108) = 8.2$, $p < .001$; Happy = $F(3,108) = 4.6$, $p < .01$; Fear = $F(3,108) = 3.9$, $p < .01$; Neutral = $F(3,108) = 6.7$, $p < .001$; and Sad = $F(3,108) = 9.2$, $p < .001$. The univariate ANOVAs were followed up with contrast comparisons. Contrasts indicated significant differences between the control group and the SZ and SZP groups. The PTSD group performed better than the SZ and SZP groups on anger, sadness, fear, and neutral. A significant difference was also present between the PTSD and SZP group on sadness. There was no significant difference between PTSD and SZ and SZP on happy. No significant differences were present between the C and PTSD groups, or between the SZP and SZ groups.

CHAPTER 5

DISCUSSION

Facial affect identification is a basic and important element for social cognition. Research indicates that individuals affected by mental illness, such as SZ and PTSD, have difficulty labeling facial emotions. Prior literature examining facial affect naming deficits in individuals with either SZ or PTSD indicate that there is general impairment in SZ such that for most emotions, individuals with SZ preform worse the normal controls, and there are selective deficits in identifying the emotions of sadness and fear. In PTSD, performance is typically more comparable to normal controls although the literature has identified selective deficits in emotion identification for fear and sadness. The extent to which PTSD when comorbid with SZ compounds severity of emotion identification deficits, particularly for the emotions of fear and sadness, has not been directly examined although it would be anticipated that those with both disorders would have more severe deficits in emotion identification due to the deficits identified in PTSD being superimposed on those already present in SZ. Given that there is no literature which has evaluated the effect of comorbid SZ+PTSD and affect labeling, the purpose of this study was to gain insight into the facial affect processing abnormalities in individuals with comorbid SZ and PTSD.

Hypothesis 1

It was expected that participants with SZ or SZ+PTSD would have more difficulty accurately identifying facial affect expression than healthy controls and those with PTSD. Results of the study supported this hypothesis and results demonstrated a significant difference of overall affect labeling scores as well as labeling percentages for each of the six individual emotions. These results advance the literature by demonstrating that SZ is associated with more

severe impairment of face affect identification than occurs in PTSD. The generalized deficits found here are consistent with numerous studies of other aspects of emotion processing and cognitive abilities that suggest an overall decrease in affective and cognitive abilities associated with SZ. For example, Duke et al. (2010) found that on a battery of neuropsychological measures, individuals with SZ or SZ+PTSD exhibited significantly worse performance than the control group and those with PTSD on most of the cognitive domains assessed, including executive function, working memory, attention, verbal and nonverbal memory, and motor function. There were no cases in which the schizophrenia groups in that study performed at levels comparable to controls or PTSD. The current findings are somewhat different in that while there was generalized impairment observed for most emotions, the SZ, SZ+PTSD and PTSD groups did not differ on identification of happiness, and the difference between the groups with schizophrenia and the controls was generally smaller than that observed for other emotions. Happiness was also the most accurate identified emotion by the schizophrenia groups with an average accuracy of 91.2%. The next most accurately identified emotion was anger, which was identified with 79.7% accuracy. A number of reasons may account for this finding. First, of all emotions, happiness is the most readily and accurately identified. In the current study, controls performed at near perfect levels when identifying happiness, which has been observed in other studies using similar experimental procedures (Venn,Watson, Gallegher, & Young, 2006). The ease of the task for controls may suggest the presence of ceiling effects and so if the task were made more difficult by, for example, presenting faces with less intense expressions of happiness, more differences between the groups may have been present. It also may be the case that positive emotion identification and positive emotion processing is well preserved in schizophrenia. Strauss and Gold (2012) and others have suggested that individuals with

schizophrenia experience levels of positive emotion similar to that of controls, and so the current results regarding happiness are consistent with this conclusion in as much as the experience of positive emotion must be based on accurate perception of positive events, in this cases faces displaying the emotion of happiness.

Hypothesis 2

We hypothesized that individuals with SZ+PTSD and PTSD would have specific deficits in identifying the emotions of sadness and fear when compared to the control group and SZ group, respectively. Consistent with previous research, the emotions fear and sadness had the lowest recognition rate compared to other emotions within each group (Feinberg et al., 1986). Examination of findings comparing the SZ and SZ+PTSD groups using contrasts demonstrated that individuals with SZ and SZ+PTSD did not differ significantly across any of the emotions. For surprise and sadness, group differences approached significance and there was a significant emotion by group interaction effect, which appears to be primarily accounted for by differences in group performances for the emotion sadness, fear, and surprise. It may also be that the cognitive and emotion recognition deficits associated with schizophrenia overshadow any additional deficit that might be associated with a diagnosis of PTSD. Across a wide range of cognitive domains, research indicates large effect sizes in neurocognitive functioning in individuals with SZ, as compared to research with individuals with a PTSD diagnosis only achieving small to moderate effect sizes of impaired functioning (Reichenberg & Harvey, 2007). Thus, the findings from this study seem to demonstrate that the compounding effects of PTSD on SZ are minimal in emotion recognition. To be certain, this finding is not entirely distinct from other research which has reported other comorbid diagnoses that occur in SZ (i.e. alcoholism), where the cognitive deficits associated with SZ surpass those that result from the secondary

diagnosis (Allen et al., 1999; Goldstein et al., 2002; Thoma et al., 2007). Finally, given that the current groups were psychiatrically stable and exhibited relatively low levels of symptoms, difference results may have been obtained if more symptomatic groups were included.

The PTSD group had lower scores than controls on sadness; however, the PTSD group performed more accurately than controls on fear. Neither of these findings were statistically significant. To determine whether these non-significant findings were attributable to decreased statistical power, GPower was used to conduct post hoc power analyses (Faul & Erdfelder, 1992). Result of the power analysis indicated that based on the sample size and group differences, there was a 99% chance of detecting a medium effect size at the .05 level (two tails).

Generally speaking, previous research has demonstrated emotion processing deficits in PTSD which are usually attributed to hyperactivity in the amygdala. Some studies suggest that the over-exaggerated threat-sensitivity response seen in individuals with PTSD could result in a state of heightened responsivity to negative emotional cues or threats (Garfinkel & Liberzon, 2009). This hyperactivation of the pathways could account for the increased accuracy in the recognition of fear thereby facilitating cognitive processing, not interfering with it. Moreover, the lack of statistically significant differences between the control group and PTSD group is akin to relatively small effect sizes reported in other neurocognitive domains where deficits are present, such as learning and memory. Some studies have suggested that neurocognitive deficits may only be experienced in individuals with PTSD based on the individual's age at the time the trauma occurred (Bremner & Vermetten, 2001) or even more generally that only certain subgroups of individuals with PTSD will demonstrate cognitive dysfunction (Sutker, Vasterling, Brailey, & Allain, 1995; Twamley, Hami, & Stein, 2004). Johnsen and Asbjornsen (2008) conducted a meta-analysis of memory function in individuals with PTSD. Their research

included 28 studies with a total of 822 controls and 667 individuals with a PTSD diagnosis and the results demonstrated medium effect sizes overall when comparing the two groups. Furthermore, there were no effects when comparing individuals who were diagnosed with PTSD due to sexual trauma and controls. Thus, because our groups were heterogeneous in trauma type, we are not able to directly examine the potential impact of type of trauma on facial affect recognition deficits. Nonetheless, the results of this study suggest that if deficits in facial affect identification occur in individuals with PTSD, the impact is minimal, especially when compared to other psychiatric disorders, such as schizophrenia.

The results of this study were inconsistent with finding reported by Poljac et al. (2011) who found specific impairments in individuals with PTSD in recognizing fear and sadness in terms of accuracy and intensity. That particular study examined perceptual sensitivity by presenting emotional expressions beginning at 20% intensity and increasing to 100%. Although, it should be noted that participants for the PTSD group were recruited from a self-help war veterans group and no clinical or diagnostic assessments were completed to confirm diagnosis.

Strengths of the Study

This study advances the current research literature because it is the first study to investigate facial affect identification in schizophrenia with comorbid PTSD. The present study utilized rigorous and comprehensive assessments to determine clinical symptomatology with all participants thus strengthening the internal validity of the study. Another strength of this study was using four groups in the study design, which allowed for a normal control group, as well as a PTSD alone and SZ alone group to compare to the comorbid SZ+PTSD group. This allowed for psychiatric controls and allowed for a SZ subgroup comparison, although there were no differences in performance on emotion identification accuracy.

The facial affect paradigm used in this study was a critical component of the study design as suggested by Edwards et al. (2002). The inverted faces and affect matching tasks were important control tasks utilized to assess for impairments in complex perception and control for potential difficulties in visuoperceptual skills. The three facial affect tasks were counterbalanced in presentation across participants and required the same stimulus presentation and response format (i.e. computer screen and microphone). Furthermore, practice items were used in two of the three tasks.

Limitations of the Study

The individuals in the PTSD group were relatively high functioning. In comparison to the PCL cut-score of 30, they had a mean score was 33.2. This possible self-selection bias for higher functioning individuals is relatively common in PTSD research that relies on university subject pool samples and with the observation that those with mild to moderate levels of PTSD are more likely to participate in research studies (Newman & Kaloupek, 2004). Future research should consider using more severe PTSD populations.

While the Matsumoto and Ekman (1988) stimulus set is widely used in emotion studies, it only contains extreme displays of facial emotions, as compared to other facial emotion stimulus sets which offer high and low intensity emotions. Due to the presentation of intense facial expressions could create ceiling effects for certain emotions, such as happiness. Future research could benefit from examining the differences in emotion intensity.

Conclusion

Notwithstanding limitations, the results of this study is among the first that examined facial affect labeling in schizophrenia with comorbid PTSD. Current results suggest that there is an emotional processing deficit in individuals with a schizophrenia diagnosis, although a

comorbid diagnosis of PTSD does not seem to have substantial impairment in affect identification. Further investigation is needed to better understand whether the nuances and subtleties that often occur in human facial expressions, such as emotion intensity, are impaired in individuals with PTSD. Additionally, future research should consider whether there is a negative bias in facial affect identification in these psychiatric populations.

While this study does not allow for us to make suggestions about underlying neural pathways, we can speculate that consistent with previous research, impairment in the limbic system, including the amygdala, basal ganglia, as well as the hippocampus, has led to emotion perception impairments in the psychiatric groups (Frewen et al., 2008; Dolan, 2009; Phillips et al., 1999). From a clinical perspective, this research demonstrates the need for facial affect identification remediation in schizophrenic populations, and likely in individuals with PTSD. Research is needed to determine whether facial affect interventions could remediate these deficits and improve social cognitive abilities.

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Appendix I

Tables and Figure

Table 1. Demographic variables.

Variable	C		P		S		SP		*F (3,108)*	Tukey-B
	Mean	SD	Mean	SD	Mean	SD	Mean	SD		
Age	35.3	12.7	27.6	11.9	42.1	12.8	43.2	9.3	8.69***	P<C,S,SP
Education	13.5	1.5	13.4	1.3	12.4	1.5	11.4	2.2	8.61***	SP<P,C; SP,S; S,P,C
IQ Est	96.6	10.8	96.2	12.4	77.4	12.7	77.5	12.0	22.03***	S,SP<P,C
	N	%	N	%	N	%	N	%	Chi Square	*p*
Female	21.0	75.0	13.0	65.0	12.0	31.6	16.0	61.5	14.22	<.005
Race									28.00	<.01
White	17	60.7	9	45.0	14	36.8	14	53.8		
Black	1	3.6	2	10.0	18	47.4	6	23.1		
Hispanic	2	7.1	1	5.0	3	7.9	1	3.8		
Asian/PI	3	10.7	2	10.0	2	5.3	0	0.0		
Other	5	17.9	6	30.0	1	2.6	5	19.2		

Note. * $p < .05$, ** $p < .01$, *** $p < .001$. C = Control group; P = PTSD group; S = Schizophrenia group; SP = Schizophrenia + PTSD group; IQ Est = Wechsler Adult Intelligence Scale Estimate.

Table 2. Traumatic events experienced by each group.

	Groups									
	C		PTSD		S		SZP		*Total*	
Type of trauma	*N*	*%*	*N*	*%*	*N*	*%*	*N*	*%*	*Mean*	*%*
Natural disaster	8	28.6	4	20.0	17	44.7	5	19.2	8.5	7.6
Fire or explosion	3	10.7	2	10.0	15	39.5	10	38.5	7.5	6.7
MVA	12	42.6	6	30.0	17	44.7	15	57.7	12.5	11.2
Serious accident	3	10.7	2	10.0	6	15.8	2	7.7	3.3	2.9
Exposure to toxins	1	3.6	1	5.0	3	7.9	1	3.8	1.5	1.3
Physical assault	5	17.9	8	40.0	20	52.6	21	80.8	13.5	12.1
Assault w/a deadly weapon	4	14.3	2	10.0	16	42.1	12	46.2	8.5	7.6
Sexual assault	2	7.1	3	15.0	6	15.8	8	30.8	4.8	4.3
Unwanted sexual experience	0	0.0	4	20.0	7	18.4	7	27.0	4.5	4.0
Exposure to war zone	0	0.0	1	5.0	1	2.6	1	3.8	0.8	0.7
Captivity	1	3.6	1	5.0	5	13.1	1	3.8	2.0	1.8
Life-threatening illness	2	7.1	0	0.0	7	18.4	3	11.5	3.0	2.7
Severe human suffering	1	3.6	0	0.0	4	10.5	2	7.7	1.8	1.6
Sudden violent death	3	10.7	5	25.0	7	18.4	4	15.4	4.8	4.3
Sudden unexpected death	12	42.6	8	40.0	14	36.8	9	34.6	10.8	9.6
Serious injury	2	7.1	4	20.0	2	5.3	5	19.2	3.3	2.9
Other traumatic event	3	10.7	6	30.0	6	15.8	5	19.2	5.0	4.5

Note. Participants may experience multiple traumatic events so appear in more than one column. C = Control group; P = PTSD group; S = Schizophrenia group; SP = Schizophrenia + PTSD group. MVA=motor vehicle accident.

Table 3. Clinical data for the groups.

Variable	C		P		S		SP		*F(3,108)*	Tukey-B
	Mean	SD	Mean	SD	Mean	SD	Mean	SD		
SANS	0.1	0.8	2.9	4.6	10.8	6.1	9.4	4.7	35.48***	P,C<S,SP
SAPS	0.0	0.0	1.4	2.5	7.8	3.1	8.0	3.7	64.50***	P,C<S,SP
PCL	7.4	15.2	33.2	17.3	14.5	21.7	39.5	28.6	13.40***	C,S<P,SP
BPRS AF	0.2	0.6	2.0	1.4	2.0	0.9	2.9	1.3	31.12***	C<S,P<SP
BPRS AN	0.1	0.5	1.1	0.8	2.4	1.4	2.0	1.3	26.91***	C<P<SP,S
BPRS DI	0.1	0.4	1.1	0.9	1.9	0.9	2.2	1.0	37.33***	C<P<SP,S
BPRS TD	0.1	0.3	1.0	0.7	2.7	1.1	3.1	1.5	56.92***	C<P<SP,S

Note. *$p < .05$, **$p < .01$, ***$p < .001$. C = Control group; P = PTSD group; S = Schizophrenia group; SP = Schizophrenia + PTSD group; SANS = Scale for Assessment of Negative Symptoms; SAPS = Scale for Assessment of Positive Symptoms; PCL = Post-Traumatic Stress Disorder Checklist; BPRS = Brief Psychiatric Rating Scale; BPRS AF = Affect; BPRS AN = Anergia; BPRS DI = Disorganization; BPRS TD = Thought Disturbance

Table 4. Correlations among Face Affect Identification Tasks.

	Age	Education	SANS	SAPS	Inverted Faces	Affect Matching	Affect Labeling
Age	--	-.152	.24**	.23**	-.24**	-.25**	-.28**
Education		--	-.29**	-.42**	.13	.27**	.33**
SANS			--	.63**	-.49**	-.51**	-.40**
SAPS				--	-.22*	-.37**	-.46**
Inverted Faces					--	-.52**	.14
Affect Matching						--	.40**
Affect Labeling							--

Notes. *$p < .05$, **$p < .001$

Table 5. Percentage correct for the inverted faces and affect matching tasks.

Variable	C		P		S		SP		*F (3,108)*	Tukey-B
	Mean	*SD*	Mean	*SD*	Mean	*SD*	Mean	*SD*		
Inverted	95.0	5.9	90.0	8.6	83.9	13.2	87.9	11.4	6.1***	S<C; S,SP,P; SP,P,C
Matching	86.4	7.5	84.3	8.0	75.9	12.1	76.3	10.4	8.3***	S,SP<PC

Note. *$p < .05$, **$p < .01$, ***$p < .001$. C = Control group; P = PTSD group; S = Schizophrenia group; SP = Schizophrenia + PTSD group; Inverted = inverted faces total score; Matching = Affect matching total score

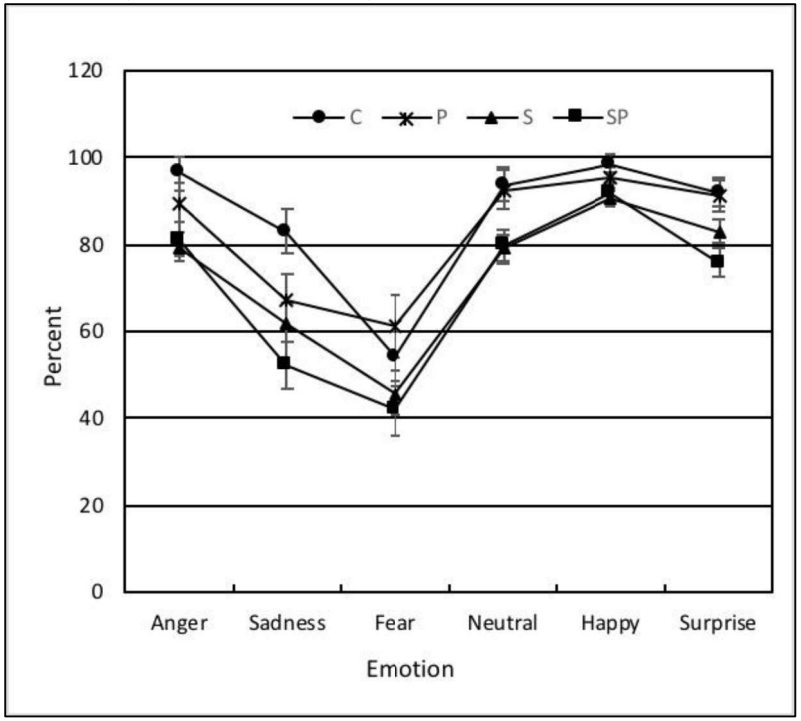
Table 6. Percentage correct for the affect labeling task.

Variable	C		P		S		SP		*F (3,108)*	LSD
	Mean	*SD*	Mean	*SD*	Mean	*SD*	Mean	*SD*		
Total	87.6	6.3	85.5	9.7	72.3	16.1	68.6	16.3	13.6***	SP,S<P,C
Anger	96.3	7.7	91.4	14.2	79.1	24.0	80.3	21.0	5.9***	S,SP<C; S,SP,P; P,C
Surprise	92.9	10.5	82.2	10.7	74.2	18.0	85.0	21.5	8.2***	SP<P,C; SP,S; S,P,C
Happy	99.1	3.3	95.4	8.9	90.6	11.7	91.7	12.1	4.6**	S,SP<C; S,SP,P; P,C
Fear	58.0	35.9	64.6	27.2	43.0	29.4	39.2	28.9	3.9**	SP,S<P; SP,S,C; C,P
Neutral	95.1	12.8	94.4	13.7	78.5	23.1	77.9	22.3	6.7***	SP,S<P,C
Sad	83.9	19.7	74.2	29.7	60.2	28.8	48.5	27.4	9.2***	SP<P,C; SP,S; S,P; P,C

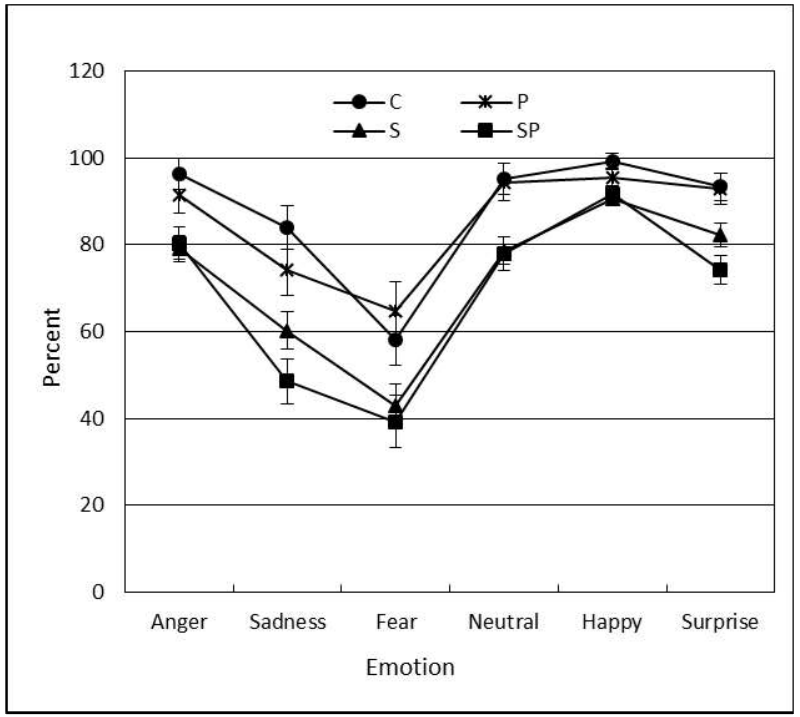
Note. *$p < .05$, **$p < .01$, ***$p < .001$. C = Control group; P = PTSD group; S = Schizophrenia group; SP = Schizophrenia + PTSD group.

Figure I. Emotion by group interaction effects.

Frame A (without covartiates)



Frame B (with covariates)



CIRRICULUM VITAE

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EDUCATION

Ph.D., Clinical Psychology (in progress) 08/2014 – *Anticipated Graduation: 08/2020*
University of Nevada, Las Vegas *(APA Accredited)*
Dissertation: Development and initial validation of the Veterans Educational Transition (VET) Scale: A brief assessment to predict student veteran success
Anticipated defense date: 07/2019

M.A., Clinical Psychology 08/2014 – 06/2018
University of Nevada, Las Vegas *(APA Accredited)*
Thesis: Face affect perception in individuals with schizophrenia and posttraumatic stress disorder

B.A. (Summa cum Laude), Human Development 01/2010 – 05/2014
Minor: Psychology
Metropolitan State University of Denver
Senior Thesis: The effects of religion on health and well-being in late adulthood

CLINICAL TRAINING

Sandstone Psychological Practice 8/2018 - present
Private Practice
Doctoral Practicum Student, Supervisor: Dr. Christina Aranda

UNLV Counseling and Psychological Services (CAPS) 8/2017-5/2018
University Campus Counseling Center
Doctoral Practicum Student, Supervisor: Dr. Prachi Sharma

-Provided individual, short-term cognitive-behavior and interpersonal process therapy
- Clients presented with PTSD, depression, anxiety, adjustment disorder, panic q disorder
-Conducted weekly psychodiagnostic intakes for services
-Participant/Observer of an 8-week didactic mindfulness and yoga group
-Participated in campus-wide outreach services during orientation and tabling events

-Provided psychological first aid/trauma response following mass-shooting incident near campus
-Participated in weekly interdisciplinary consultation meeting to discuss treatment disposition

Veteran's Affairs Southern Nevada Healthcare System 7/2016-6/2017
Northwest Primary Care Clinic
Doctoral Practicum Student, Supervisor: Dr. Jeffrey Gilliland

- Provided evidence-based individual psychotherapy (primary modalities: CBT, ACT, CPT) with client who served in wars ranging from Vietnam era to present
    - Clients presented with a wide range of presenting problems including: PTSD, grief, depression, bipolar I disorder, chronic pain, substance use, schizoaffective, and schizotypal
- Completed intake assessments
- Attended didactic seminars on treatment modalities
- Administered psychodiagnostic assessments and wrote comprehensive assessment reports
- Co-created and implemented a short-term Acceptance and Commitment (ACT) therapy group
- Participated in weekly multidisciplinary team meetings
- Consulted with health professionals on a primary care treatment team

The P.R.A.C.T.I.C.E. at UNLV 8/2015-6/2016
Interdisciplinary Community Mental Health Clinic, Department-Sponsored
Doctoral Practicum Student, Dr. Andrew Freeman

- Provided short term and long term psychotherapy to children, adolescents, and adults using evidence-based practice (primarily CBT)
    - Clients presented with PTSD, OCD, borderline personality disorder, ADHD, anger management, and depression
- Conducted psychodiagnostic and psychoeducational assessments for children and adolescents with concerns about ADHD, learning disabilities, and memory functioning
- Wrote comprehensive assessment reports, standardized testing accommodation forms, provided recommendations, and delivered feedback to clients
- Participated as a process group observer in a weekly group for adults with depression
- Attended weekly case rounds
- Presented and attended student case conferences

THERAPY GROUPS FACILITATED

Mindfulness/Yoga Group 8/2017-11/2017
UNLV CAPS; observer
Didactic group focused on teaching meditation and mindfulness skills
Closed group: 8 sessions

Depression and Anxiety Group for Adults 5/2017-8/2017
The P.R.A.C.T.I.C.E. at UNLV; process observer
Process group focused on interpersonal dynamics
Open group

Life Paths: An Acceptance and Commitment Group (ACT) 1/2017-6/2017
VASNHS; co-facilitator
Skills based group focused on mindfulness, acceptance, and meaning-making
Closed group: 4 sessions (total groups = 3)

CLINICAL TRAINING

ACT I – Introduction to Acceptance and Commitment Therapy October 2018
Dr. Steven C. Hayes

This workshop focused on setting a foundation and beginning skill set for ACT including the six basic processes, including flexible contact with the present, cognitive defusion, acceptance, self-as-context, values, and committed action. Other topics covered included ways to assess and influence client processes during session, how to use the model for case conceptualization, and ways to foster client openness and willingness to change.

The Center for Deployment Psychology (CDP) June 2017
The Summer Institute

Applied and was invited to attend a 5-day training at the Uniformed Services University of the Health Sciences (USU). Training included didactics, experiential exercises, and panel and group discussions regarding assessment and intervention with active duty service members and veterans, deployment cycle stress, military culture, and ethical dilemmas working with service members/veterans.

Interprofessional Education Day (IPE) March 2014, March 2015, March 2016
University of Nevada, Las Vegas

This training was aimed at increasing the ability for mental health and other health providers to work collaboratively to promote, protect, and increase the health of the people in Nevada. Seven degree programs from the university participated in a series of didactics, group learning projects, simulations, and discussions. In addition to this one day per year training, a semester-long course was completed (*Integrated Behavioral Health Care*) to develop and reinforce critical skills of collaboration and consultation in health care delivery.

RESEARCH EXPERIENCE

HEALTH RESEARCH SPECIALIST

Veteran's Affairs Southern Nevada Healthcare System (VASNHS) 7/2016-8/2017
PACT to Improve Health Care in People with Serious Mental Illness (SMI-PACT); NCT01668355

Supervisor: Dr. Olaf Fallye

A non-randomized clinical trial designed to transform the Patient Aligned Care Team (PACT) model based on Patient Center Medical Home (PCMH) concept. The goal was to improve quality, efficiency, and access to healthcare for individuals with severe mental illness (SMI), including schizophrenia, bipolar disorder, and posttraumatic stress disorder. Duties included screening potential participants, obtaining patient referrals from psychiatrists, and conducting structured assessment interviews, including neuropsychological assessments.

GRADUATE RESEARCH LAB ASSISTANT

Neuropsychology Research Program 1/2016-present
University of Nevada, Las Vegas
Research primarily focuses on neuropsychological functioning in individuals with neuropsychiatric disorders such as schizophrenia and bipolar disorder. Duties include administering neuropsychological assessments and disseminating research through peer-reviewed manuscripts and professional conferences.
Supervisor: Dr. Daniel N. Allen

Stressful Transitions and Aging Research Laboratory 8/2014-12/2016
University of Nevada, Las Vegas
Research primarily focused on stressful life experiences and psychopathology during late adulthood. Duties included co-authoring manuscripts, assisting with literature reviews and data analyses, supervising undergraduate research assistants, and attending didactic seminars on a variety of topics (e.g., related to data analysis, APA style writing).
Supervisor: Dr. Jason M. Holland

UNDERGRADUATE RESEARCH LAB ASSISTANT

Relationships Studies Laboratory 8/2013-12/2014
University of Colorado, Denver
Supervisor: Dr. Elizabeth Allen

Child Health and Development Lab 5/2012-12/2012
University of Denver
Supervisors: Drs. Lisa Badanes and Sarah Watamura

Learning and Cognition Lab 1/2012-6/2014
Metropolitan State University of Denver
Supervisor: Dr. Bethany Fleck-Dillen

PUBLICATIONS

Nunez, A., Holland, J. H., **Beckman, L.M.**, Kirkendall, A., Luna, N. (2017). A qualitative study of the emotional and spiritual needs of Hispanic families in hospice. *Palliative & Supportive Care,* 1-9. doi: 10.1017/S1478951517000190

Fleck, B.K.B., Richmond, A.S., Rauer, H.M., **Beckman, L.M.,** Lee, A. (2017). Active reading questions as a tool to support college student's textbook reading. *Journal of the Scholarship of Teaching and Learning, 3*(3), 220-232.

Holland, J.M, Rozalski, V., **Beckman, L.M.,** Rakhkovskaya, L.M., Klingspon, K.L., Donohue, B., … Gallagher-Thompson, D. (2015). Treatment preferences of older adults with substance use problems. *Clinical Gerontologist, 39,* 15-24.

Fleck, B.K.B., **Beckman, L.M.,** Sterns, J.L., & Hussey, H.D. (2014). YouTube in the classroom: A look at student preferences and learning outcomes. *Journal of Effective Teaching, 14*(3), 21-37.

CONFERENCE PRESENTATIONS

Emami, A.S., Paul, N.B., **Beckman, L.M.,** Favela, S., Mayfield, J.W., & Allen, D.N. (October 2016). *Complex Sequencing Predicts Broad Reading and Broad Math Achievement in Children and Adolescents with Traumatic Brain Injury.* Poster presentation at the 2016 Annual Conference of the National Academy of Neuropsychology, Seattle, WA.

Beckman, L.M., Rozalski, V., & Holland, J.M. (November, 2015). *Difficulties in Making Meaning of Health-Related Stressors as a Unique Predictor of Hopelessness.* Poster presentation at the 2015 Annual Scientific Meeting of the Gerontological Society of America, Orlando, FL.

Holland, J. M., Klingspon, K. L., **Beckman, L.M.,** Plant, C., Rakhkovskaya, L., Rozalski, V., & Williams, C. D. (May 2015). *Family behavior therapy for substance abuse problems in later life.* Poster presentation at the 2015 National Veterans Administration Research Week Poster Presentation, Las Vegas, NV.

Beckman, L.M., Holland, J.M., & Currier, J.M. (April, 2015). *Bereavement and complicated grief among Veterans returning from Iraq/Afghanistan.* Oral presentation at the Western Psychological Association's Annual Meeting, Las Vegas, NV.

Fleck, B.K.B., Hussey, H.D., & **Beckman, L.M**. (April, 2015). *Belly flop or pencil dive? How to create a successful flipped course.* Oral Presentation, Terman Teachning Conference at the Western Psychological Association's Annual Meeting, Las Vegas, NV.

Hussey, H.D., & **Beckman, L.M**. (April, 2015). *Integrating Social Media into the Classroom.* Oral Presentation, Terman Teachning Conference at the Western Psychological Association's Annual Meeting, Las Vegas, NV.

Beckman, L.M., Bookhardt, S., Hopkins, A., Mann, T., Oliver, P., Rauer, H, … Fleck, B.K.B. (April, 2014). *Predictive variables in homelessness in Colorado*. Poster presentation at the Rocky Mountain Psychological Association's Annual Meeting, Salt Lake City, UT.

Fleck, B.K.B, Rauer, H., Richmond, A.S., & **Beckman, L.M.** (April, 2014). *Tools to promote Reading Comprehension vs. Powerpoint Lecture Notes.* Oral presentation at the Rocky Mountain Psychological Association's Annual Meeting, Salt Lake City, UT.

Becknell, J., Whitmyre, J., **Beckman, L.M.,** & Wright, A., (April, 2014). *Building Resiliency and Facilitating Growth through Trauma.* Poster presentation at the Rocky Mountain Psychological Association's Annual Meeting, Salt Lake City, UT.

Beckman, L.M., Fleck B.K.B., & Sterns, J. (April, 2013). *Getting Class Started with YouTube Video Clips*. Poster presentation presented at the Rocky Mountain Psychological Association's Annual Meeting, Denver, CO.

Beckman, L.M., Broussard, K., Rutledge-Ellison, L., Stamps, A., Wharton, S., Wolf, M., & Fleck, B.K.B. (April, 2013). *Promoting Academics and Character Education (PACE) Outcome Data Analysis*. Poster presentation presented at the Rocky Mountain Psychological Association's Annual Meeting, Denver, CO.

Fleck, B.K.B., & **Beckman, L.M.** (April, 2013). *Experiential Learning Explored: Practical Applications and Outcomes of Service Learning.* Oral presentation presented at the Rocky Mountain Psychological Association's Annual Meeting, Denver, CO.

Fleck, B.K.B., Richmond, A.S., **Beckman, L.M.,** Sterns, J., & Brown, R. (April, 2013). *The Effects of Active Reading Questions on Student Learning.* Poster presentation presented at the Rocky Mountain Psychological Association's Annual Meeting, Denver, CO.

Beckman, L.M., Fleck B.K.B., & Sterns, J. (May, 2013). *Getting Class Started with YouTube Video Clips*. Poster presentation presented at the 2nd Annual MSU Undergraduate Research Conference, Denver, CO.

Beckman, L.M., Broussard, K., Rutledge-Ellison, L., Stamps, A., Wharton, S., Wolf, M., & Fleck, B.K.B. (May, 2013). *Promoting Academics and Character Education (PACE) Outcome Data Analysis.* Poster presentation presented at the 2nd Annual MSU Undergraduate Research Conference, Denver, CO.

Fleck, B.K.B., Richmond, A.S., **Beckman, L.M.,** Sterns, J., & Brown, R. (May, 2013). *The Effects of Active Reading Questions on Student Learning.* Poster presentation presented at the 2nd Annual MSU Undergraduate Research Conference, Denver, CO.

TEACHING EXPERIENCE

INSTRUCTOR

Introduction to Psychology
University of Nevada, Las Vegas
Teaching evaluation average = 4.53; Department average = 4.41

Fall 2018 (3 sections: two distance education, one in person); Average class size: 35 students
Spring 2018 (2 sections); Average class size: 40 students
Fall 2018 (2 sections); Average class size: 35 students
Spring 2017 (2 sections); Average class size: 40 students
Fall 2017 (2 sections); Average class size: 40 students

TEACHING ASSISTANT

University of Nevada, Las Vegas
2015-2016 Introduction to Statistical Methods

Metropolitan State University of Denver
Fall 2015 Introduction to Statistical Methods
Fall 2013 Senior Thesis in Human Development
Fall 2012 Developmental Research Methods
Spring 2012 Developmental Educational Psychology

PROFESSIONAL SERVICE

Council Representative, College of Liberal Arts 08/2017-06/2018
Graduate and Professional Student Association (GPSA)
University of Nevada, Las Vegas

AD HOC REVIEWER

Death Studies 2015-present
Palliative & Supportive Care 2018-present

VOLUNTEER EXPERIENCE

PACE Program, Boys and Girls Club **08/12-6/14**
Statistical Consultant Denver, CO

PROFESSIONAL MEMBERSHIPS

- American Psychological Association (APA)
- Gerontological Society of America (GSA)
- National Academy of Neuropsychology (NAN)
- Rocky Mountain Psychological Association (RMPA)
- Western Psychological Association (WPA)