

## ABSTRACT

Title of Dissertation: Understanding the Interpersonal Consequences of Paranoid Ideation and Sleep Problems in a Transdiagnostic Sample of Individuals with Psychosis

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**Background:** Paranoid ideation and sleep problems are both prevalent in samples with psychotic disorders, and each is associated with impairment in social functioning. We sought to determine how paranoid ideation and sleep problems manifest in social behaviors and if these behaviors lead to social rejection from others. **Methods:** This study examined the associations between paranoid ideation, sleep problems, social behaviors, and social rejection in a transdiagnostic sample of persons with psychosis and community members ( $N = 112$ ). Participants completed assessments related to paranoid ideation, sleep problems, and social functioning. We also examined behavioral ratings of social skills and displays of facial affect, and we assessed naive observers' reactions towards participants. **Results:** Greater paranoid ideation was related to observers reporting more negative reactions towards participants. Path analysis indicated that paranoid ideation was associated with observers reporting less willingness to interact with participants through poorer overall social skill. Sleep problems were also related to observers'

negative reactions towards participants, but this association was not related to social behaviors. Finally, paranoid ideation and sleep disturbance were associated with poorer real-world social functioning. **Conclusions:** Paranoid ideation may manifest in social behaviors that evoke social rejection from others, which may contribute to paranoid beliefs being exacerbated or maintained. Further, sleep problems are linked to some facets of social rejection. Clinical interventions for paranoid ideation should address problematic social behaviors and sleep problems because they may contribute to social rejection and poor real-world social functioning.

**Keywords:** paranoid ideation, sleep problems, social skill, displays of facial affect, social rejection

UNDERSTANDING THE INTERPERSONAL CONSEQUENCES OF PARANOID  
IDEATION AND SLEEP PROBLEMS IN A TRANSDIAGNOSTIC SAMPLE OF  
INDIVIDUALS WITH PSYCHOSIS

by

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# Table of Contents

Acknowledgements.....	ii
Table of Contents.....	iii
List of Tables.....	iv
List of Figures.....	v
Introduction.....	1
Why Is Paranoid Ideation Associated with Social Impairments?.....	3
Cognitive and Social Cognitive Factors.....	3
Behavior Related to Paranoid Ideation.....	4
Social Consequences of Paranoid-Related Behavior.....	5
Sleep Problems and Paranoid Ideation.....	8
Social Implications of Sleep Problems.....	9
Current Study.....	11
An RDOC Approach to the Current Study.....	13
Aims and Hypotheses.....	14
Methods and Materials.....	15
Participants.....	15
Measures and Materials.....	16
Diagnostic and Symptom Assessments.....	16
Sleep Problems.....	17
Social Functioning.....	18
Social Affiliation Task.....	18
Social Behavioral Coding.....	19
Thin Slice Methodology and Reactions from Others.....	20
Data Analytic Plan.....	23
Results.....	27
Sample Characteristics.....	27
Assessments Statistics.....	29
Interrater Agreement.....	30
Bivariate Correlations.....	30
Path Analysis.....	33
Multiple Regression.....	37
Ancillary Results.....	38
Discussion.....	40
Summary of Main Findings.....	40
Clinical Implications.....	45
Strengths and Limitations.....	47
Future Directions.....	50
Conclusion.....	52
Appendices.....	54
Bibliography.....	76

## List of Tables

Table 1. Sample Characteristics

Table 2. Descriptive Statistics of Assessments

Table 3. Correlations for Observers' Willingness to Interact and Negative Reactions from Others

Table 4. Correlations for Paranoid Ideation, Sleep Problems, and Negative Reactions from Others

Table 5. Correlations Between Paranoid Ideation, Sleep Problems, Social Behaviors, and Observers' Willingness to Interact

Table 6. Fit Indices for the Proposed and Respecified Models

Table 7. Bivariate Correlations of Non-Paranoid Positive Symptoms, Social Behaviors, and Observers' Willingness to Interact

## List of Figures

Figure 1. Conceptual Model of the Associations Among Paranoid Ideation, Sleep Problems, Social Behaviors, and Observers' Willingness to Interact

Figure 2. Proposed Integrative Model of the Associations Between Paranoid Ideation, Sleep Problems, Social Behaviors, and Observers' Willingness to Interact

Figure 3. Parameter Estimates of the Respecified Model



## Introduction

Paranoid ideation is the unsubstantiated belief that others intend to cause harm (Freeman & Garety, 2014, 2000). Paranoid ideation is experienced with varying degrees of frequency, duration, intensity, and conviction (Carvalho et al., 2017; Freeman, Garety, Bebbington, Slater, et al., 2005; Freeman, Garety, Bebbington, Smith, et al., 2005; M. J. Taylor et al., 2016). Indeed, prevailing models of paranoid ideation define this construct as dimensional ranging from mild interpersonal concerns to severe persecutory delusions (Freeman, 2007; Freeman et al., 2012, 2016; Freeman, Garety, Bebbington, Smith, et al., 2005; Freeman & Garety, 2014). Almost fifty percent of people with psychotic disorders experience paranoid ideation (Freeman, 2007; Freeman & Garety, 2014), which makes it the most commonly reported type of delusion in this population (Elahi et al., 2017). Paranoid ideation is also experienced by over fifty percent of individuals at clinical-high risk for psychosis (Addington et al., 2015; Salokangas et al., 2016).

Consistent with the dimensional conceptualization of this symptom, paranoid ideation extends to non-clinical samples (Bebbington et al., 2013; Carvalho et al., 2017; Freeman, 2007; Freeman, Garety, Bebbington, Smith, et al., 2005). In a general population study, Bebbington et al. (2013) reported that up to 28% of individuals endorsed some paranoid ideas. Further, 12% of individuals were described as falling within a class that perceives direct threats against their safety (Bebbington et al., 2013). Quantitative research on the latent structure of paranoid ideation has shown that it does not fit into a taxonomic framework and supports a dimensional model of paranoid ideation in non-clinical and clinical populations (Elahi et al., 2017; M. J. Taylor et al., 2016).

Paranoid ideation has important clinical implications because it is associated with greater social impairments. These impairments include decreased engagement in social activities (Hajdúk et al., 2019; Lincoln et al., 2014), decreased quality of interpersonal relationships (Hajdúk et al., 2019; Pinkham et al., 2016), and less perceived social support (Lamster et al., 2017). Research involving persons with schizophrenia spectrum disorders has found that greater paranoid ideation is related to more frequent engagement in socially unacceptable behaviors, such as demonstrating more physically and verbally aggressive behaviors in inpatient and community settings (Coid et al., 2013; Darrell-Berry et al., 2016; Hajdúk et al., 2019). Such impairments in social functioning do not appear to be simply due to general social difficulties related to psychosis. Compared to non-paranoid individuals with schizophrenia, those with schizophrenia and paranoid ideation showed significantly more impairment across multiple dimensions of social functioning, including poorer interpersonal relationships and more behaviors that are not socially acceptable (e.g., regularly arguing with or physically fighting others; Pinkham et al., 2016). From these findings, Pinkham et al. (2016) concluded that paranoid ideation exacerbates social impairments that characterize individuals with psychotic disorders.

The clinical significance of paranoid ideation extends to individuals without psychosis. Paranoid ideation or suspiciousness has been found to be a significant predictor of the development of psychosis in youth at clinical-high risk for psychosis (T. D. Cannon et al., 2008). Paranoid ideation in non-clinical samples has been associated with higher rates of violence after controlling for other psychotic symptoms, anxiety, and alcohol use disorder (Coid et al., 2016), which underscores the dimensional nature of paranoid ideation and its clinical importance in this population. Extending the impairments linked to paranoid ideation, paranoid personality disorder

is associated with lower rates of employment (McGurk et al., 2013). Similarly, paranoid traits in non-clinical samples are associated with lower educational attainment, social economic status, and social, familial, and marital functioning (e.g., Ahmed et al., 2012; Grant et al., 2004; Hengartner et al., 2014; Oltmanns et al., 2002; Stroud et al., 2010).

### *Why Is Paranoid Ideation Associated with Social Impairments?*

Given the above findings, it is critical to understand the factors that may link paranoid ideation to social impairments because this could inform clinical interventions. Below we review current conceptualizations of paranoid ideation that implicate various processes related to social impairment with a focus on behavioral deficits.

#### **Cognitive and Social Cognitive Factors**

Current theoretical models of paranoid ideation emphasize cognitive processes that may serve to link paranoid ideation to impaired social functioning. Freeman et al.'s threat anticipation model asserts that paranoid thoughts develop when individuals misinterpret ambiguous social situations as threatening (Freeman, 2007; Freeman & Garety, 2014). A recent meta-analysis has found support for this hypothesis in that a greater negative interpretation bias is associated with more severe paranoid ideation in clinical and non-clinical samples (Trotta et al., 2021). These results also align with the hypothesis that perceived personal vulnerability and increased social evaluative concerns play an essential role in the development and maintenance of paranoid ideation (Freeman et al., 2013, 2016; Freeman, Garety, Bebbington, Smith, et al., 2005; Freeman & Garety, 2014), which Meisel et al. (2018) confirmed in their recent review. These misinterpretations lead to cognitive and behavioral changes, such as heightened threat perception, engaging in behaviors to avoid threat (e.g., social withdrawal), and overlooking

information that challenges beliefs about the reality of the threat (Freeman, 2007, 2016; Freeman & Garety, 2014; M. J. Green & Phillips, 2004). In addition, social cognitive biases of hostile intentions from others and blaming others are related to greater levels of paranoid ideation (Buck et al., 2016; Pinkham et al., 2016). Further, the social cognitive bias of tending to blame others is modestly correlated with informant reports of less socially acceptable behavior (Buck et al., 2016).

### **Behavior Related to Paranoid Ideation**

As noted by past investigators (Combs & Penn, 2004; Haynes, 1986), there has been a strong emphasis on the social cognitive consequences of paranoid ideation but less emphasis on the behavioral implications of paranoid ideation. This research gap is important because understanding how paranoid ideation influences behavior would allow for the identification of proximal causes of social impairments and allow for targeted clinical interventions. As summarized above, past studies have often used assessments that examined broad summaries of social functioning and highlight impacts on aggregate indices, such as overall community functioning, employment, or socially acceptable behavior (e.g., Hajdúk et al., 2019; McGurk et al., 2013; Pinkham et al., 2016). However, little is known about how paranoid ideation impacts specific behaviors that contribute to social functioning. Performance-based measures can be used in clinical research to sample actual behavior in simulated interpersonal encounters (e.g., role-plays) to objectively evaluate participants' competency or social skill (Bellack et al., 1990; McKibbin et al., 2004). Such performance-based measures have been shown to identify social skill deficits in psychotic disorders (e.g., Mueser et al., 1991; Patterson et al., 2001), and these skill ratings are strongly associated with independent assessments of real-world social

functioning (Bellack et al., 2006; Bowie et al., 2010; Halford & Hayes, 1995; McKibbin et al., 2004; Pinkham et al., 2016).

It has been proposed that poor social functioning in samples with paranoid ideation may be partially related to social skill deficits (Combs et al., 2013; Haynes, 1986). However, research findings have been limited, and some studies have failed to find this association. In a non-clinical sample, paranoid ideation was not related to social skills (Riggio & Kwong, 2009). Importantly, Riggio and Kwong (2009) measured social skill with a self-report questionnaire and did not assess these behaviors directly. In a study of individuals with schizophrenia spectrum disorders, Pinkham et al. (2016) examined the hypothesis that paranoid ideation is associated with poorer social skill (using a role play assessment) and functional capacity (using the University of California, San Diego Performance-Based Skills Assessment-Brief (UPSA-B); Mausbach et al., 2007). Although individuals with elevated paranoid ideation had poorer social functioning compared to those without paranoid ideation, these groups did not differ in social skills or functional capacity (Pinkham et al., 2016). From these findings, Pinkham et al. (2016) proposed that paranoid individuals possess similar behavioral skills as non-paranoid individuals with schizophrenia but somehow the use of these skills is disrupted to a greater degree in those with paranoid ideation. Given the limited research examining social skill and related behaviors, more research is required to determine if these findings are replicable in future studies with psychosis.

### **Social Consequences of Paranoid-Related Behavior**

Another remaining question concerning paranoid ideation and its behavioral manifestations is how individuals high in this trait are perceived by, and reacted to, by others in their social environment. To date, few studies have examined how paranoid ideation influences behaviors and how these behaviors evoke reactions from others (Haynes, 1986; Scarr &

McCartney, 1983). This evocative effect of paranoid ideation may lead others to react in a rejecting or hostile manner and further maintain paranoid beliefs and behaviors (Haynes, 1986). Although paranoid ideation is related to perceptions that others are rejecting (Freeman & Garety, 2014), it is unclear whether this reflects actual interpersonal experiences or a negative interpretive bias (Freeman, Garety, Bebbington, Smith, et al., 2005). Research has shown that individuals with schizophrenia spectrum disorders demonstrate social behaviors that evoke negative reactions (e.g., less likability, more feelings of sadness) from social partners and independent observers (Boswell & Murray, 1981; Nisenson et al., 2001). Further, individuals with schizophrenia spectrum disorders are more likely to be socially rejected by others even when their psychiatric diagnosis is masked (e.g., Boswell & Murray, 1981; Riehle et al., 2018; Riehle & Lincoln, 2018). Specifically, raters perceived individuals with schizophrenia spectrum disorders as more strange, less warm, and less engaged in pleasant conversational topics, and these perceptions were associated with greater social rejection (Boswell & Murray, 1981; Nisenson et al., 2001).

Researchers have hypothesized that persons with paranoid ideation demonstrate problematic social behaviors (e.g., poorer social skills; Haynes, 1986) that evoke negative reactions from others, which subsequently maintain paranoid beliefs that one's social environment is hostile (Haynes, 1986; Salvatore et al., 2012). Repeated findings that people with elevated paranoid ideation behave with more hostility and aggression (Coid et al., 2013, 2016; Darrell-Berry et al., 2016) suggest that individuals in their social environment may respond negatively to such behavior. A recent study has examined this proposed reactivity in a non-clinical sample of undergraduate students and their new roommates (i.e., known for approximately five weeks; Springfield et al., 2021). Springfield et al. (2021) found that

individuals with greater paranoid ideation report greater dissatisfaction with the quality of their relationship with their roommate and described this relationship in more negative terms (e.g., boring, miserable, bad). Similarly, non-paranoid roommates reported greater dissatisfaction with their relationship with paranoid roommates and described this relationship in more negative terms (Springfield et al., 2021). Although they did not examine the behaviors that may contribute to such negative evaluations of these relationships, Springfield et al. (2021) concluded that paranoid ideation is related to aversive interpersonal interactions, which includes negative experiences for individuals with paranoid ideation and those who interact with them. They suggested that it is important to continue to examine the interpersonal interactions between persons with paranoid ideation and those in their social environment (Springfield et al., 2021). To the best of our knowledge, no study has directly explored this assumed reactivity or examined the specific social behaviors that might contribute to negative reactions from others during interpersonal interactions in samples with psychosis.

Although we are not aware of any study that has directly examined how paranoid ideation contributes to negative reactions from others, research on social anxiety may be informative. Social anxiety disorder and paranoid ideation are highly correlated (Huppert & Smith, 2005; K. N. Taylor & Stopa, 2013), and they demonstrate similar cognitive and behavioral characteristics (Horton et al., 2014; K. N. Taylor & Stopa, 2013). These findings are consistent with the conceptualization that social anxiety and paranoid ideation are on a continuum (Freeman, 2007; Freeman, Garety, Bebbington, Smith, et al., 2005). During dyadic interactions, persons with social anxiety disorder demonstrate specific behaviors (e.g., decreased smiles and eye contact) that are associated with negative reactions from others, such as being rated as less friendly and less likable (Pearlstein et al., 2019; Piccirillo et al., 2016). Dyadic partners and independent

observers also report less willingness to interact with persons with high levels of social anxiety (Plasencia et al., 2011), which is partially explained by less smiling (Pearlstein et al., 2019). Further, studies have found that independent observers report experiencing more negative emotions and view themselves as less similar to persons with social anxiety disorders (Voncken et al., 2008). Together, these results suggest that social anxiety may manifest in behaviors during interpersonal interactions that evoke negative reactions from others and contribute to greater social rejection. Thus, the current study aimed to extend these results by examining whether paranoid ideation is associated with social behaviors (i.e., social skills, displays of facial affect) that may similarly contribute to social rejection from others during interpersonal interactions.

### **Sleep Problems and Paranoid Ideation**

In considering the social and behavioral implications of paranoid ideation, it is important to consider that sleep problems (e.g., sleep deprivation, poor sleep quality, poor sleep efficiency) have been found to impact both paranoid ideation and social behaviors. Sleep problems have been proposed to be a transdiagnostic construct that contributes to different forms of psychopathology and functional impairment (A. G. Harvey et al., 2011; Laskemoen et al., 2019; McCallum et al., 2019). Freeman et al.'s threat anticipation model proposes that sleep problems contribute to the development and maintenance of paranoid ideation by increasing levels of negative affect (Freeman et al., 2009, 2012; Freeman & Garety, 2014), which then increases anxiety and threat perception (Freeman & Garety, 2014; Kasanova et al., 2020; Reeve, Nickless, et al., 2018). Consistent with this model, sleep problems are associated with the onset, persistence, and severity of paranoid ideation in non-clinical populations (e.g., general population, community members) and those diagnosed with psychotic disorders (e.g., first episode of psychosis, schizophrenia; Blanchard, Andrea, et al., 2020; Freeman et al., 2012;



Kasanova et al., 2020; Mulligan et al., 2016; Reeve et al., 2015; Reeve, Emsley, et al., 2018; Reeve, Nickless, et al., 2018). Longitudinal studies of individuals at clinical-high risk for psychosis have found that sleep problems predict positive symptoms and the transition to psychosis (Lunsford-Avery et al., 2015; Ruhrmann et al., 2010). A recent longitudinal study in a non-clinical general population sample found that sleep problems contribute to the development of paranoid ideation throughout adulthood (Saarinen et al., 2022). This study also found that sleep problems and paranoid ideation have a bidirectional association given that greater paranoid ideation also contributes to greater sleep disturbance (Saarinen et al., 2022). These findings support Freeman et al.'s proposal that sleep problems are another causal factor of paranoid ideation (Freeman, 2016; Freeman & Garety, 2014). However, research has not examined alternative ways that sleep problems may maintain paranoid ideation, such as its influence on social behaviors.

### **Social Implications of Sleep Problems**

Accumulating evidence from samples without psychosis indicates that sleep problems may contribute to problematic social behaviors. Beyond their relation to paranoid ideation, sleep problems appear to have a bidirectional influence on various social domains (Gordon et al., 2017, 2021). In samples without psychosis, sleep problems are associated with increased loneliness (Hom et al., 2020), misperception of social cues (Beattie et al., 2015), and decreased accuracy recognizing facial expressions of emotion (Killgore et al., 2017; van der Helm et al., 2010). A recent study has suggested that sleepiness is also associated with decreased motivation for social activities (Axelsson et al., 2020). Further, sleep problems adversely impact social behaviors, including increased aggression (Baglioni et al., 2010; Verona & Bozzay, 2017), less overall facial expressivity when viewing emotional stimuli (Minkel et al., 2011), and less vocal

expressivity of emotional words (McGlinchey et al., 2011). Research from romantic couples has shown that poor sleep quality is related to lower self-reported and observed ratios of positive to negative affect, less empathic accuracy between partners, and worse conflict resolution (Gordon & Chen, 2014). In another study of couples, individuals who endorsed worse sleep quality the night before also reported greater social rejection from their partner the next day (Gilbert et al., 2015). Finally, persons who were sleep deprived have imposed greater distance during in-person and computerized social approach tasks compared to when they were rested (Simon & Walker, 2018). Together, these findings demonstrate that sleep problems influence many social processes that may impact the quality of interpersonal interactions (Beattie et al., 2015; Gordon et al., 2017, 2021).

Similar to the above discussion on the social evocative effects of paranoid ideation and social anxiety, sleep problems may have a deleterious influence on interpersonal interactions through behaviors that evoke negative reactions from others (Axelsson et al., 2010; Simon & Walker, 2018). In studies involving non-clinical samples, independent observers rated sleep deprived participants as less attractive, less physically healthy, and less energetic compared to when these participants were rested (Axelsson et al., 2010; Simon & Walker, 2018; Sundelin et al., 2013). A recent experiment by Simon and Walker (2018) found that independent observers perceived sleep deprived participants as lonelier and reported less willingness to interact socially or collaboratively with them. The observers also reported that they felt lonelier after watching video of participants who were sleep deprived (Simon & Walker, 2018). Relevant to the current study, these findings suggest that sleep problems may contribute to negative reactions from others and adversely impact interpersonal interactions.

Despite evidence that sleep problems and paranoid ideation impact social behaviors in non-clinical samples, research has not explored how these constructs relate to social behaviors in samples with psychosis. Blanchard, Savage, et al. (2020) recently examined the contribution of sleep problems to social impairment in a transdiagnostic sample that included individuals with psychotic disorders. Results indicated that sleep disturbance and sleep-related impairment are associated with self-reports of more negative or problematic perceptions of social relationships (e.g., less social support, less companionship, greater distress), poorer real-world social functioning, smaller social networks, and poorer functional capacity as measured by the UPSA-B (Mausbach et al., 2007) (Blanchard, Savage, et al., 2020). However, these findings are limited because the UPSA-B only assesses social behaviors related to rudimentary communication skills (e.g., using a phone to reschedule an appointment or dialing for emergency services; Blanchard, Savage, et al., 2020). Another limitation of this study is that it did not examine if paranoid ideation is related to these findings of social behavior. Blanchard, Savage, et al. (2020) noted that future research should use broader interpersonal skill assessments to examine how sleep may impact behavior, including social skills and the expression of positive and negative affect. They also suggested that future studies examine whether sleep problems impact how interaction partners view and respond to an individual (Blanchard, Savage, et al., 2020). The current study seeks to address some of these gaps in the literature.

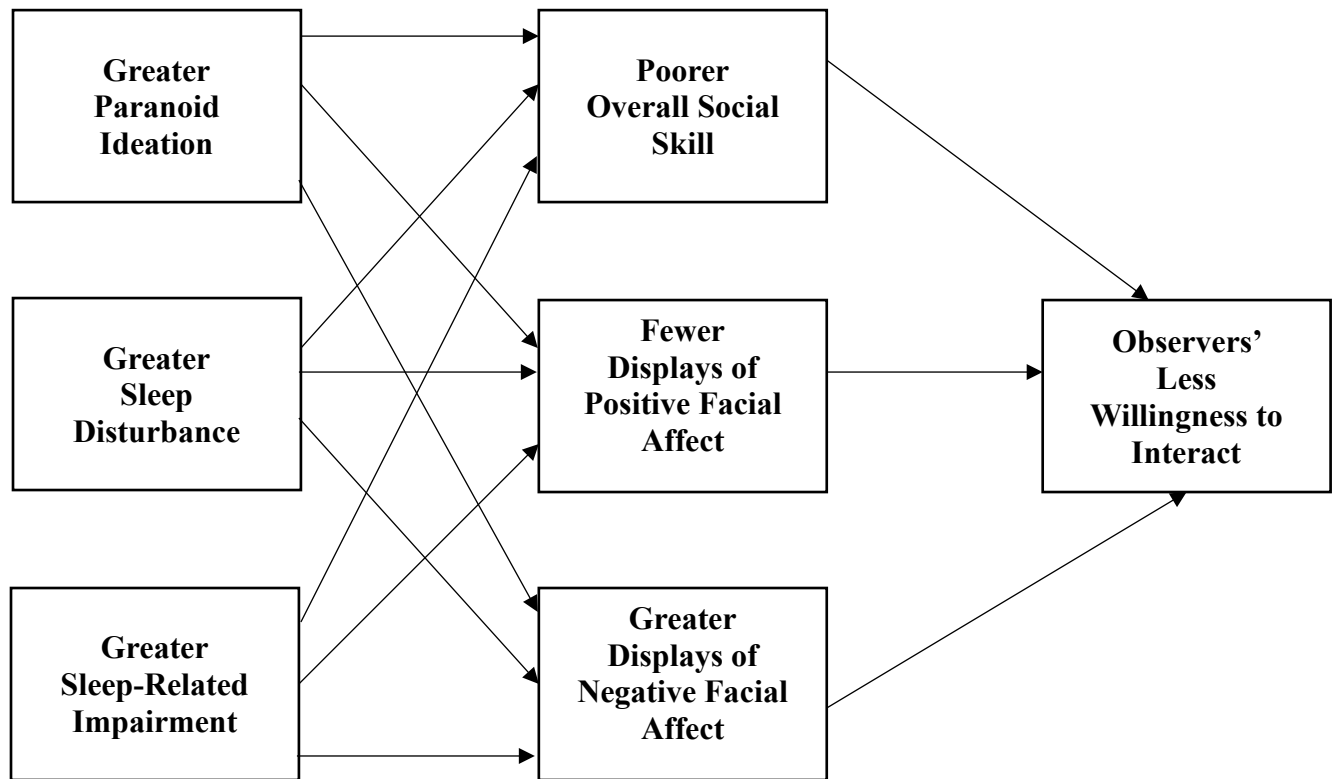
### *Current Study*

As shown in Figure 1, the current study extends previous research by examining the associations between paranoid ideation, sleep problems (i.e., sleep disturbance and sleep-related impairment), and social behaviors in a transdiagnostic sample of individuals with psychosis and community members. Assessment of social behavior included the use of a social skill assessment

to determine if paranoid ideation and sleep problems are related to diminished skills. Given the communicative importance of facial displays of affect in social relationships and psychopathology (Keltner & Kring, 1998), and the role of elevated negative affect in paranoid ideation (Freeman et al., 2009, 2012; Freeman & Garety, 2014) and sleep problems (Baglioni et al., 2010; Gordon et al., 2021; Konjarski et al., 2018), we also conducted behavioral ratings of facial displays of affect. Finally, we sought to examine the interpersonal consequences of paranoid ideation and sleep problems. Using thin-slice methodology, independent observers watched brief videos of participants and rated their subjective responses towards participants. We examined how paranoid ideation, sleep problems, and social behaviors are related to social rejection (e.g., observers reporting less willingness to interact with participants and more negative reactions towards participants). This research has the potential to inform current clinical interventions for paranoid ideation by suggesting that these treatments target problematic social behaviors and sleep problems.

**Figure 1**

*Conceptual Model of the Associations Among Paranoid Ideation, Sleep Problems, Social Behaviors, and Observers' Willingness to Interact*



*Note.* This figure illustrates the conceptual model that the current study evaluated. We examined the associations that paranoid ideation, sleep problems, and social behaviors had with observers' willingness to interact with participants.

### **An RDOC Approach to the Current Study**

Following the NIMH Research Domain Criteria (RDoC) framework (Cuthbert, 2014, 2022; Cuthbert & Insel, 2013; Insel, 2014; Insel et al., 2010), the current study adopted a symptom-oriented dimensional approach, which allowed us to assess levels of paranoid ideation and sleep problems from mild to clinically severe. The RDoC approach recommends that researchers implement an agnostic view of categorical diagnostic groups, because they are associated with substantial heterogeneity (Insel, 2014), and focus on the shared features of

psychopathology across groups (Cuthbert, 2014; Cuthbert & Insel, 2013). We followed this framework by assessing paranoid ideation and sleep problems across diagnostic groups with psychosis and community members. Specifically, we addressed the RDoC Social Processes constructs of *Affiliation and Attachment* and *Social Communication* by assessing the relation between paranoid ideation, social behaviors, and social rejection. We addressed the RDoC Arousal and Regulatory Systems construct of *Sleep-Wakefulness* by also examining the impact that sleep problems have on social behaviors that occur during interpersonal interactions. Finally, our study evaluated a theory-driven model to potentially inform clinical interventions for paranoid ideation and sleep problems in samples with psychosis, which is another RDoC research recommendation (Cuthbert, 2022).

### **Aims and Hypotheses**

We sought to evaluate a proposed integrative model that brings together paranoid ideation, sleep problems, and social behaviors to examine how they influence observers' willingness to interact with participants (see Figure 1). Specifically, we hypothesized that greater paranoid ideation and greater sleep problems would be indirectly associated with reductions in observers' willingness to interact with participants through poorer overall social skill, fewer displays of positive facial affect, and greater displays of negative facial affect. In addition, we examined the relation of paranoid ideation, sleep problems, and real-world social functioning. We hypothesized that greater paranoid ideation and greater sleep problems would jointly predict poorer social functioning.

## Methods and Materials

The current study used data collected as part of an ongoing National Institute of Mental Health neuroimaging study (R01MH110462; PI Blanchard) examining social affiliative deficits in a mixed transdiagnostic sample of individuals with psychotic disorders and community members. The parent study is currently in the process of data analysis.

### Participants

As a part of the parent study, clinical participants were recruited through outpatient mental health programs in the Baltimore and Washington DC metropolitan areas. Community participants were recruited via online advertisements. Clinical participants met the following inclusion criteria: (1) aged 18-60, (2) lifetime history of a psychotic disorder, (3) clinical stability as indicated by approval of clinician and medical record review, and (4) fluent in English. Community participants met the following inclusion criteria: (1) aged 18-60, (2) no current clinical disorder or psychiatric medications, (3) no lifetime history of a psychotic or mood disorder, (4) no avoidant, paranoid, schizotypal or schizoid personality disorder, and (5) fluent in English. Exclusion criteria for all participants included (1) alcohol or substance use disorder in the last 6 months, (2) neurological conditions (e.g., epilepsy, multiple sclerosis), (3) evidence of intellectual disability as determined by medical history or cognitive testing, (4) history of serious head injury, (5) any MRI contraindications, and (6) refusal to be videotaped during study participation.

## Measures and Materials

For the current study, we used video recordings and assessments related to clinical and symptom presentation, sleep problems, and social behaviors during an interpersonal interaction from the parent study. Measures that were collected as part of the parent study are designated below with an asterisk (\*).

### **Diagnostic and Symptom Assessments**

The Structured Clinical Interview for the Diagnostic and Statistical Manual of Mental Disorders, 5th edition (SCID-5) and SCID-5 Screener\* (First et al., 2015) were administered by trained master-level research staff to evaluate participants for psychiatric disorders. Clinical participants completed the SCID-5 mood and psychotic disorder modules. Those who reported items related to alcohol or substance use on the SCID-5 Screener were administered the corresponding module(s) to rule out alcohol or substance use disorder(s). Community participants completed relevant SCID-5 modules if they answered “Yes” to any SCID-5 Screener questions. See Appendix A.

The Revised-Green et al., Paranoid Thought Scale\* (R-GPTS; Freeman et al., 2021; C. E. L. Green et al., 2008) is an 18-item self-report scale that measures paranoid ideation over the past one month. One subscale assesses ideas of social reference and the other assesses ideas of persecution (C. E. L. Green et al., 2008). Total scores on the R-GPTS range from 0 to 72 with higher scores indicating more severe paranoid ideation (Freeman et al., 2021). A recent study of over 10,000 participants has shown that the R-GPTS demonstrates better psychometrics (e.g., internal consistency, sensitivity, specificity) compared to the original GPTS (Freeman et al., 2021). For the current study, the R-GPTS scale showed excellent internal consistency (Cronbach alpha = .93). See Appendix B.



## **Sleep Problems**

The Patient-Reported Outcomes Measurement Information System (PROMIS™) Sleep Disturbance and Sleep-Related Impairment Scales\* were utilized to assess sleep disturbance and sleep-related impairment over the past one week (Yu et al., 2012). The Sleep Disturbance Scale is an 8-item questionnaire that assesses various sleep disturbances, such as restlessness, difficulty falling asleep, and trouble staying asleep (Yu et al., 2012). It includes items like “I had difficulty falling asleep” and “I had trouble staying asleep” that are rated on a 5-point Likert scale. The Sleep-Related Impairment Scale is an 8-item questionnaire that assesses daytime challenges people experience due to sleep disturbance, including feeling sleepy and difficulty concentrating (Yu et al., 2012). It includes items like “I had a hard time getting things done because I was sleepy,” “I felt tired,” and “I had a hard time concentrating because of poor sleep” that are rated on a 5-point Likert scale. Higher scores indicate greater sleep disturbance or sleep-related impairment. The PROMIS sleep scales have shown better precision assessing the severity of sleep problems compared to traditional questionnaires (i.e., the Pittsburgh Sleep Quality Index and Epworth Sleepiness Scale; Yu et al., 2012). These scales have shown acceptable convergent, construct, and discriminant validity in healthy populations and those with clinical sleep disorders (Yu et al., 2012). Further, a recent study has found that the PROMIS sleep scales are appropriate to use in samples with psychosis (Savage et al., 2021). For the current study, the Sleep-Disturbance Scale showed excellent internal consistency (Cronbach alpha = .90), and the Sleep-Related Impairment Scale showed good internal consistency (Cronbach alpha = .87). See Appendix C.

## **Social Functioning**

The Specific Levels of Functioning Scale\* (SLOF; Schneider & Struening, 1983) assesses real-world social and community functioning. It consists of four subscales related to interpersonal relationships, social acceptability, involvement in activities, and work skills (Schneider & Struening, 1983). These subscales have shown excellent internal consistency (e.g., Cronbach alphas range from .92 to .98) in inpatient and outpatient psychiatric samples (Schneider & Struening, 1983). The SLOF is considered the best available measure of real-world functioning for samples with psychosis (P. D. Harvey et al., 2011), and it is associated with gold standard measures of functional capacity (e.g., UPSA-B; P. D. Harvey et al., 2011; Mausbach et al., 2007; Strassnig et al., 2015). Consistent with procedures used in a previous sample with schizophrenia (P. D. Harvey et al., 2011), participants self-reported their “typical level of functioning” on a 5-point Likert scale with higher total scores indicating better functioning. The current study used the Social Functioning Scale, which consists of the summed scores of the Interpersonal and Social Acceptability subscales. The Social Functioning Scale demonstrated good internal consistency (Cronbach alpha = .85) in this study. See Appendix D.

## **Social Affiliation Task**

The Social Affiliation Interaction Task\* (SAIT; Llerena et al., 2012) is designed to evaluate affiliative social behaviors. During this task, participants watched a video of a friendly, outgoing, White female discussing her social relationships and activities enjoyed with others, which lasted for two minutes and forty-three seconds. At the end of the video, the actor asked, “What do you like to do with your friends and family?” Participants were instructed to respond as though they were really interacting with the actor. They were not provided with any instructions about the amount of time they should speak. Participants were video recorded while

they watched the actor's introduction and while they responded to her. The SAIT has been used in previous studies to assess social behaviors, including displays of facial affect (Llerena et al., 2012), in samples with social anhedonia and schizophrenia (Blanchard et al., 2015; Garcia et al., 2018; Llerena et al., 2012). A recent study found that the SAIT was a more accurate measure of social affiliative skills than an in-vivo conversation task (Garcia et al., 2018). See Appendix E.

### **Social Behavioral Coding**

The Facial Expression Coding System\* (FACES; Kring & Sloan, 1991) was utilized to assess displays of facial affect that occurred during the SAIT (Llerena et al., 2012). FACES is an objective coding system that rates the valence (positive or negative) of displays of facial affect. Because our previous study found high multicollinearity between FACES frequency, intensity, and duration (Llerena et al., 2012), this study only included the frequency of displays of positive and negative facial affect in our analyses. This analytic approach has been implemented in previous studies involving individuals with schizophrenia and healthy controls (Aghevli et al., 2003; Kring & Neale, 1996). FACES has demonstrated high interrater agreement and acceptable convergent and discriminant validity (Kring & Sloan, 1991, 2007). In the parent study, undergraduate and master-level graduate students blind to psychiatric diagnoses coded participants' displays of facial affect as they verbally responded to the actor's question, "What do you like to do with your friends and family?" See Appendix F.

Similarly, undergraduate and master-level graduate students blind to psychiatric diagnosis objectively coded participant's social skills displayed during the response phase of the SAIT task. The social skills manual utilized in the parent study was adapted from the Maryland Assessment of Social Competence (MASC; Bellack et al., 1994; Sayers et al., 1995), and it has been validated in our previous studies (Blanchard et al., 2015; Llerena et al., 2012). Replicating

procedures from past research (Blanchard et al., 2015; Garcia et al., 2018; Llerena et al., 2012), each participant's social skills were coded based on four domains: 1) verbal and conversational content (e.g., content of speech), 2) non-verbal content (e.g., clarity, eye contact, fluency), 3) affiliation (the degree to which the participant demonstrates engagement and reciprocity to the actor), and 4) overall social skill. These ratings were based on a 5-point Likert scale ranging from 1 (*very poor*) to 5 (*very good*). Similar to past research (Blanchard et al., 2015; Llerena et al., 2012; Sayers et al., 1995), the current study used the overall social skill score, a global measure of one's ability to interact in a meaningful way across verbal and nonverbal domains, in data analyses. See Appendix G.

As a part of the parent study, lab members trained as coders for FACES and social skills participated in regular consensus meetings and were periodically assessed for coder drift. Lab members only completed one type of behavioral coding (social skills or displays of facial affect) for each participant to prevent ratings in one domain influencing rating in another. Of note, coders who provided these ratings did not complete assessments related to negative reactions from others (discussed below).

### **Thin Slice Methodology and Reactions from Others**

Thin slice methodology refers to any brief (e.g., five minutes or less) behavioral presentation that occurs while an individual is engaged in a specific task (Ambady et al., 2000; Oltmanns et al., 2004). This methodology has been commonly utilized to sample and assess social behaviors (Lindley & Monk, 2013). Thin slice video clips have been found to accurately provide information related to personality, affect, and verbal and non-verbal behaviors (e.g., nods and smiles), even in clips as brief as 30 seconds (Ambady & Rosenthal, 1992; C. J. Cannon et al., 2020; Friedman et al., 2007; Murphy et al., 2015; Oltmanns et al., 2004). Observer ratings

of behaviors displayed in thin slice stimuli have been associated with their reactions towards target participants (Ambady et al., 2000; Murphy et al., 2015; Oltmanns et al., 2004). Further, thin slice ratings of persons with schizoid and schizotypal personality disorder traits are associated with negative reactions from others (Friedman et al., 2007; Oltmanns et al., 2004), such as being rated as less likable and less attractive (Oltmanns et al., 2004).

For the current study, thirty second video clips of participants responding to the actor from the Social Affiliative Interaction Task (SAIT; Llerena et al., 2012) were utilized. The duration of the video clips was chosen because it allowed us to capture the largest proportion of participants including those who provided brief responses. In addition, research has shown that observers' ratings are not significantly different when using clips that are brief (i.e., thirty seconds) or longer (i.e., one to four minutes; Ambady & Rosenthal, 1992). The thin slice video clips for the current study included each participant's verbal and non-verbal behaviors starting immediately after the actor's prompt ("What do you like to do with your friends and family?"). During the SAIT recordings, participants were filmed from the waist up. From the parent study, 114 deidentified video clips were collected with 99 (80 clinical and 19 community) clips at least 30 seconds in length (range: 5 seconds to 6 minutes 37 seconds). The remaining 15 video clips ranging from 13 seconds to 28 seconds were also included. All video clips were saved on a password protected digital cloud through the University of Maryland.

The Willingness to Interact Scale (WIS; Coyne, 1976) was used to assess independent observers' reactions (i.e., rejection) to participants who completed the SAIT. This six-item scale asks observers how willing they are to interact with a target participant in various social situations, such as asking the target participant for advice, inviting them to the observer's house, and admitting them to the observer's circle of friends (Coyne, 1976). Higher total scores on the

WIS indicate greater social rejection (Boswell & Murray, 1981; Coyne, 1976; Joiner & Metalsky, 1995; Papsdorf & Alden, 1998; Voncken et al., 2008). The WIS has demonstrated good reliability, internal consistency and interrater reliability (Blanchard et al., 2015; Voncken et al., 2008; Winer et al., 1981), and it is strongly correlated with other measures of social rejection (Joiner & Metalsky, 1995). For this study, items were reverse scored so that higher scores reflect more willingness to interact. In addition, the WIS showed acceptable internal consistency (Cronbach alpha = .79) in the current study.

Consistent with past research (Friedman et al., 2007; Nisenson et al., 2001; Oltmanns et al., 2004; Simon & Walker, 2018), four single item ratings that asked about participants likability, friendliness, oddness, and loneliness were included. These additional items allowed us to measure observers' negative reactions towards participants and obtain a broader appraisal of social rejection. Because we intended to assess observers' subjective reactions towards participants, they did not receive training for this task and were not informed about the study design or hypotheses. See Appendix H.

The above ratings were completed by 10 undergraduate and master-level graduate students who served as independent observers. Each observer viewed a thin slice video clip of each participant in random order and then completed the Willingness to Interact Scale (WIS; Coyne, 1976) and the single item ratings of likability, friendliness, oddness, and loneliness. Before viewing each clip, observers were asked whether they had any prior contact with the target participant. None reported having previous contact with target participants. Thus, ratings used in analyses are based on the average rating of the 10 observers.

### Data Analytic Plan

Data analyses were completed using R version 4.1.1. The data were initially reviewed to check for missing values, multivariate outliers, and assumptions of normality. All participants had less than 5% of missing data; thus, none were excluded for this reason. We conducted a Mahalanobis distance test to assess for multivariate outliers (Kline, 2016). Two participants were identified as multivariate outliers; therefore, they were removed from data analyses.

Descriptive statistics of demographic information and total scores on study measures were calculated. Intraclass correlation coefficients (ICC) were computed to assess the interrater reliability for the Facial Expression Coding System (FACES), overall social skill, and Willingness to Interact Scale (WIS). Because raters for FACES and overall social skill were not consistent across all participants, we calculated the ICCs and the 95% confident intervals (CIs) based on a mean-rating, one-way random-effects model (Koo & Li, 2016; Shrout & Fleiss, 1979). For the WIS, the same 10 observers independently rated all participants. Therefore, we calculated the ICCs and 95% CIs for this assessment based on a mean-rating, absolute agreement, two-way random-effects model (Koo & Li, 2016; Shrout & Fleiss, 1979).

Bivariate correlations were conducted to examine the relation between observers' willingness to interact with participants and observers' negative reactions towards them (e.g., single item ratings of likability and friendliness). Correlations were calculated to examine the associations between paranoid ideation, sleep problems and observers' reactions towards participants. Correlations were also conducted to assess the relation between paranoid ideation, sleep problems, and mean ratings for overall social skill, frequency of displays of positive and negative facial affect, and observers' willingness to interact. Pearson  $r$  correlations were conducted when variables were normally distributed (skewness or kurtosis less than -1 or +1).

Spearman rho correlations were calculated when variables (i.e., R-GPTS, frequency of displays of positive and negative facial affect) were not normally distributed.

A path analytic approach was utilized to evaluate the proposed integrative model using R's lavaan 0.6-9 package (Rosseel, 2012). Path analysis conducts a series of regression equations simultaneously to assess the direct, indirect, and correlated effects between the observed variables in the model (Bauer & Curran, 2020; Schumacker & Lomax, 2016). Because our dataset contained missing data, we utilized the full information maximum likelihood algorithm for the path analysis (Bauer & Curran, 2020; Kline, 2016). This statistical approach allowed us to evaluate the model using the most available data (Bauer & Curran, 2020; Kline, 2016). We assessed model fit using several test statistics. First, we used the chi-square ( $\chi^2$ ) likelihood ratio test, which compares the means, variances, and covariances of the hypothesized model with a saturated model (Bauer & Curran, 2020). A non-significant chi-square test statistic suggests that the variance-covariances matrices between these models are similar; thus, the hypothesized model is a good model fit (Schumacker & Lomax, 2016). Because the chi-square test is sensitive to sample size (Schumacker & Lomax, 2016), we utilized additional fit statistics. We conducted two relative goodness of fit tests using the Comparative Fit Index (CFI) and the Tucker Lewis Index (TLI). These statistics compare the hypothesized model with a baseline model that assumes that all measured variables are uncorrelated (Kline, 2016; Schumacker & Lomax, 2016). CFI and TLI indices  $> .95$  suggest good model fit (Kline, 2016; Schumacker & Lomax, 2016). We also used two statistics of Absolute Relative Goodness of Fit Indices, which were the Root Mean Square Error of Approximation (RMSEA) and the Standardized Root Mean Square Residuals (SRMR) (Kline, 2016; Schumacker & Lomax, 2016). Unlike the CFI and TLI, these indices do not rely on an arbitrary baseline model to assess fit (Bauer & Curran, 2020). An



RMSEA of .05 to .08 and SRMR of < .08 are indicators of good model fit (Kline, 2016; Schumacker & Lomax, 2016).

To evaluate our proposed model, we first assessed the fit of the model. Because the model demonstrated a mix of good and poor fit indices, we used modification indices (MI) and standardized expected parameter changes (EPC) to respecify the model (Kline, 2016). Next, we compared the proposed model with the respecified model using the chi-square difference ( $\chi^2_{\text{diff}}$ ) test (Bauer & Curran, 2020). This test compares the differences in  $\chi^2$  values between the proposed model and the respecified model (Bauer & Curran, 2020; Kline, 2016). For this test, a significant value indicates that including an additional parameter to the proposed model significantly improves the fit of the model (Bauer & Curran, 2020; Kline, 2016). Given that the respecified model, compared to the proposed model, showed a significant improvement in model fit, we interpreted the unstandardized and standardized model parameter estimates of the respecified model (Bauer & Curran, 2020). Because significant individual parameter estimates that make-up a path do not indicate if the overall indirect effect is significant, we utilized inferential statistics to compute the direct, indirect, and total effects of the respecified model for parameter estimates of interest (Bauer & Curran, 2020). We calculated the standardized beta weights of these effects using biased corrected bootstrapped confidence intervals with 10000 bootstrapped samples, which is the gold standard method for evaluating these effects (Bauer & Curran, 2020). Post hoc RMSEA power analysis was conducted on the respecified model (Kline, 2016; Preacher & Coffman, 2006). This power analysis assesses the probability of correctly rejecting an incorrect model (Kline, 2016).

Finally, we conducted a multiple regression analysis to examine the association between paranoid ideation, sleep problems, and real-world social functioning. This analysis is different

from the path analysis described above because it examines whether paranoid ideation and sleep problems predict self-reported social functioning in the community.

## Results

### Sample Characteristics

After excluding the multivariate outliers ( $n = 2$ ), 112 participants who completed the SAIT task were included in the current study. Demographic and diagnostic characteristics of the sample are provided in Table 1. Overall, most participants self-identified as Black or African American (68%) and male (60%), and most were diagnosed with schizophrenia (33%).

**Table 1***Sample Characteristics (N = 112)*

	Mean ( <i>SD</i> ) or <i>n</i> (percent)
Age (years)	43.71 (12.17)
Sex	
Male	67 (60%)
Female	45 (40%)
Race	
Black or African American	76 (68%)
White	27 (24%)
Asian	3 (3%)
More than one race	5 (4%)
Prefer not to answer	1 (1%)
Ethnicity	
Non-Hispanic or Latino	102 (91%)
Hispanic or Latino	9 (8%)
Don't know	1 (1%)
Education (years)	12.93 (2.43)
Current Employment	
Yes	33 (29%)
No	79 (71%)
Diagnosis	
Schizophrenia	37 (33%)
Schizoaffective Depressive Type	18 (16%)
Schizoaffective Bipolar Type	15 (13%)
BP I with psychotic features	12 (11%)
MDD with psychotic features	9 (8%)
Delusional Disorder	1 (1%)
No diagnosis (community members)	20 (18%)
Antipsychotic Medication	
Atypical	59 (53%)
Typical	11 (10%)
Combined (typical and atypical)	10 (9%)
None	11 (10%)
Missing	1 (1%)

*Note.* BP = Bipolar; MDD = Major Depressive Disorder

### Assessments Statistics

Descriptive statistics of the assessments in the current study are shown in Table 2. The results showed that participants reported a wide range (0-66) of paranoid ideation. To understand this result more fully, we examined the scores for the R-GPTS Persecution ( $M = 6.02$ ,  $SD = 8.92$ ) and Ideas of Social Reference ( $M = 6.02$ ,  $SD = 7.18$ ) subscales. Based on cut-offs presented by Freeman et al. (2021), the current sample demonstrated elevated levels of ideas of persecution and average levels of ideas of social reference. As shown in Table 2, participants also reported a wide range of sleep disturbance (8-40) and sleep-related impairment (8-39). On average, they demonstrated few displays of positive ( $M = 2.15$ ,  $SD = 2.95$ ) or negative ( $M = 0.95$ ,  $SD = 1.76$ ) facial affect. Further, many participants showed zero displays of positive ( $n = 39$ ) or negative ( $n = 65$ ) facial affect.

**Table 2**

#### *Descriptive Statistics of Assessments*

	<i>N</i>	Mean ( <i>SD</i> )	Range
R-GPTS	109	12.04 (14.48)	0-66
PROMIS Sleep Disturbance	111	17.89 (7.53)	8-40
PROMIS Sleep-Related Impairment	112	17.63 (7.26)	8-39
Overall Social Skill	112	2.92 (0.81)	1-5
Displays of Positive Facial Affect	111	2.15 (2.95)	0-14
Displays of Negative Facial Affect	111	0.95 (1.76)	0-11
Willingness to Interact	112	17.88 (3.35)	8-26
SLOF Social Functioning	111	54.93 (7.49)	37-65

*Note.* R-GPTS = Revised-Green et al., Paranoid Thoughts Scale; PROMIS = Patient-Reported Outcomes Measurement Information System; SLOF = Specific Levels of Functioning Scale

### Interrater Agreement

The ICC for the frequency of displays of positive facial affect during the SAIT task was 0.94 with 95% confidence intervals of 0.91 to 0.96, which is considered excellent interrater agreement (Koo & Li, 2016). The interrater agreement for the frequency of displays of negative facial affect (ICC = 0.89, 95% CI [0.85, 0.93]) and overall social skill (ICC = 0.81, 95% CI [0.72, 0.87]) was also good (Koo & Li, 2016). The interrater agreement for the Willingness to Interact Scale (ICC = 0.68, 95% CI [0.55, 0.77]) was more modest, but acceptable (Koo & Li, 2016).

### Bivariate Correlations

First, correlations were conducted to assess the associations between observers' willingness to interact with participants and the single items related to negative reactions from others. As shown in Table 3, observers reported less willingness to interact with participants who they perceived as less likable, less friendly, more odd, and more lonely ( $r_s = -.71$  to  $-.90$ ,  $p_s < .001$ ). These results demonstrate that the Willingness to Interact Scale (Coyne, 1976) is associated with broader negative reactions towards participants.

**Table 3**

*Correlations for Observers' Willingness to Interact and Negative Reactions from Others*

	Willingness to Interact
(Less) Likable	-.90*
(Less) Friendly	-.71*
(More) Odd	-.85*
(More) Lonely	-.75*

*Note:* Likable, friendly, odd, and lonely refer to the additional single items that measure negative reactions from others.

\* $p < .001$

Correlations were conducted to examine the relation between paranoid ideation, sleep problems, social behaviors, and single items related to negative reactions from others. As shown in Table 4, greater paranoid ideation was associated with observers perceiving participants as less friendly, less likable, more odd, and more lonely ( $r_s = .29$  to  $.38$ ,  $p_s < .001$ ). Greater sleep disturbance and sleep-related impairment were related to observers' perceiving participants as less friendly and less likable ( $r_s = .21$  to  $.28$ ,  $p_s < .05$ ). Sleep-related impairment was also associated with observers rating participants as more lonely ( $r = .19$ ,  $p = .05$ ). These correlations indicate that paranoid ideation and sleep problems are broadly related to more negative appraisals by observers.

**Table 4**

*Correlations for Paranoid Ideation, Sleep Problems, and Negative Reactions from Others*

	R-GPTS	PROMIS Sleep Disturbance	PROMIS Sleep-Related Impairment
(Less) Likable	.38*	.21**	.28*
(Less) Friendly	.30*	.23**	.27*
(More) Odd	.29*	.10	.16
(More) Lonely	.33*	.18	.19**

*Note.* R-GPTS = Revised-Green et al., Paranoid Thoughts Scale; PROMIS = Patient-Reported Outcomes Measurement Information Systems. Likable, friendly, odd, and lonely refer to the additional single items that measure negative reactions from others. Conducted Spearman correlations for the R-GPTS.

\* $p < .001$ ; \*\* $p \leq .05$

Table 5 shows the correlations of all variables included in the path analysis. Observers' willingness to interact with participants was significantly correlated with most variables ( $r_s = -.34$  to  $.63$ ,  $p_s \leq .05$ ), except for sleep disturbance. Similarly, overall social skill was significantly correlated with most variables ( $r_s = -.33$  to  $.63$ ,  $p_s \leq .05$ ), except for sleep disturbance. Greater paranoid ideation was associated with greater sleep disturbance and sleep-

related impairment ( $r_s = .38$  and  $.48$ ,  $p_s < .001$ , respectively). Greater paranoid ideation was also related to poorer overall social skill and observers' reduced willingness to interact with participants ( $r_s = -.33$  and  $-.34$ ,  $p_s < .05$ , respectively). Of note, frequency of displays of positive and negative facial affect were only related with each other and overall social skill ( $r_s = .34$  to  $.43$ ,  $p_s < .05$ ).

**Table 5**

*Correlations Between Paranoid Ideation, Sleep Problems, Social Behaviors, and Observers' Willingness to Interact*

	R-GPTS	PROMIS Sleep Disturbance	PROMIS Sleep-Related Impairment	Overall Social Skill	Displays of Positive Facial Affect	Displays of Negative Facial Affect
PROMIS Sleep Disturbance	.38*	-				
PROMIS Sleep- Related Impairment	.48*	.63*	-			
Overall Social Skill	-.33*	-.12	-.22**	-		
Displays of Positive Facial Affect	.10	-.06	-.07	.34*	-	
Displays of Negative Facial Affect	.06	.05	.02	.34*	.43*	-
Willingness to Interact	-.34*	-.16	-.29*	.63*	.25**	.19**

*Note.* R-GPTS = Revised-Green et al., Paranoid Thoughts Scale; PROMIS = Patient-Reported Outcomes Measurement Information Systems. Conducted Spearman correlations for the R-GPTS and frequencies of displays of positive and negative facial affect because these variables were not normally distributed.

\* $p < .001$ ; \*\* $p \leq .05$



### Path Analysis

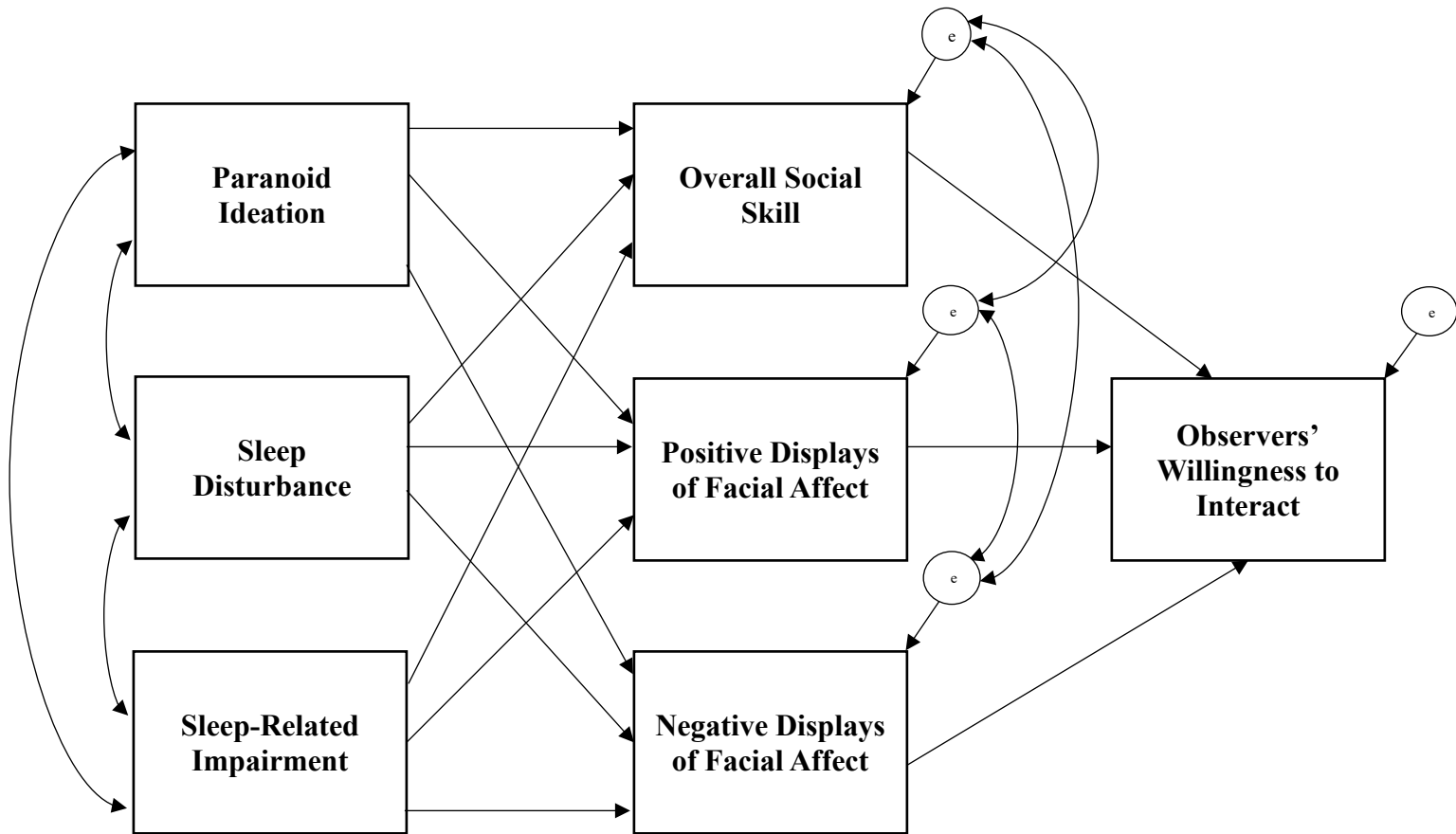
The proposed model that was initially evaluated is shown in Figure 2. As shown in Table 6, the fit of this model was mixed. Although the chi-square, CFI, and SRMR indicated good model fit, the TLI and RMSEA were outside of the recommended cut-offs (Kline, 2016; Schumacker & Lomax, 2016). Therefore, we examined modification indices to determine if adding another path would improve model fit. We chose to respecify the model by including a direct path from sleep-related impairment to observers' willingness to interact because it had the largest modification index (MI = 4.31, EPC = -0.07) (Bauer & Curran, 2020), and it was consistent with previous literature that suggests sleep problems contribute to social rejection (Simon & Walker, 2018). The chi-square difference test showed that the additional path included in the respecified model was a significant improvement to the proposed model ( $\chi^2_{\text{diff}}(1) = 4.39, p = .04$ ). Thus, we calculated goodness of fit indices for the respecified model (Bauer & Curran, 2020). As shown in Table 6, all fit indices for the respecified model were within their recommended cut-offs (Kline, 2016; Schumacker & Lomax, 2016).

Because the respecified model showed adequate model fit, we examined the parameters estimates for this model (Bauer & Curran, 2020). The final path diagram with unstandardized and standardized parameter estimates is shown below in Figure 3. Results showed that paranoid ideation was associated with overall social skill, and overall social skill was associated with observers' willingness to interact with participants ( $ps < .05$ ). In addition, sleep-related impairment was associated with observers' willingness to interact with participants ( $p < .05$ ). Sleep disturbance and sleep-related impairment were not significantly related to overall social skill, frequency of displays of positive facial affect, or frequency of displays of negative facial affect ( $ps > .05$ ). Based on these findings, we only utilized inferential statistics to calculate

bootstrapped confidence intervals for the total effects, direct effect, and indirect effect of the significant parameter estimates. The total effects, which consisted of the direct path of sleep-related impairment to observers' willingness to interact and the indirect effect of paranoid ideation to observers' willingness to interact through overall social skill, was significant ( $\beta = -0.10$ , 95% CI [-0.17, -0.03]). Also, sleep-related impairment had a significant direct effect on observers' willingness to interact ( $\beta = -0.07$ , 95% CI [-0.13, -0.01]). Further, paranoid ideation had a significant indirect effect on observers' willingness to interact through overall social skill ( $\beta = -0.03$ , 95% CI [-0.06, -0.001]). Finally, the post-hoc power analysis showed that the respecified model had an RMSEA of .17, which suggests that this model is underpowered to detect model misspecification (Bauer & Curran, 2020; Kline, 2016; Preacher & Coffman, 2006).

**Figure 2**

*Proposed Integrative Model of the Associations Between Paranoid Ideation, Sleep Problems, Social Behaviors, and Observers' Willingness to Interact*



*Note.* This figure illustrates the proposed model that was initially evaluated using path analysis.

**Table 6***Fit Indices for the Proposed and Respecified Models*

	$\chi^2$ <sup>a</sup>	CFI <sup>b</sup>	TLI <sup>c</sup>	RMSEA <sup>d</sup> (CI) <sup>e</sup>	SRMR <sup>f</sup>
Proposed Model	5.50, <i>df</i> = 3, <i>p</i> = .14	.98	.86	.09 (0.00 to 0.20)	.04
Respecified Model	1.10, <i>df</i> = 2, <i>p</i> = .58	1.00	1.00	.00 (0.00 to 0.16)	.01

*Note.* Table 6 shows the model fit indices for the proposed and respecified model.

<sup>a</sup>:  $\chi^2$  = Chi-square Likelihood Ratio Test

<sup>b</sup>: CFI = Comparative Fit Index

<sup>c</sup>: TLI = Tucker Lewis Index

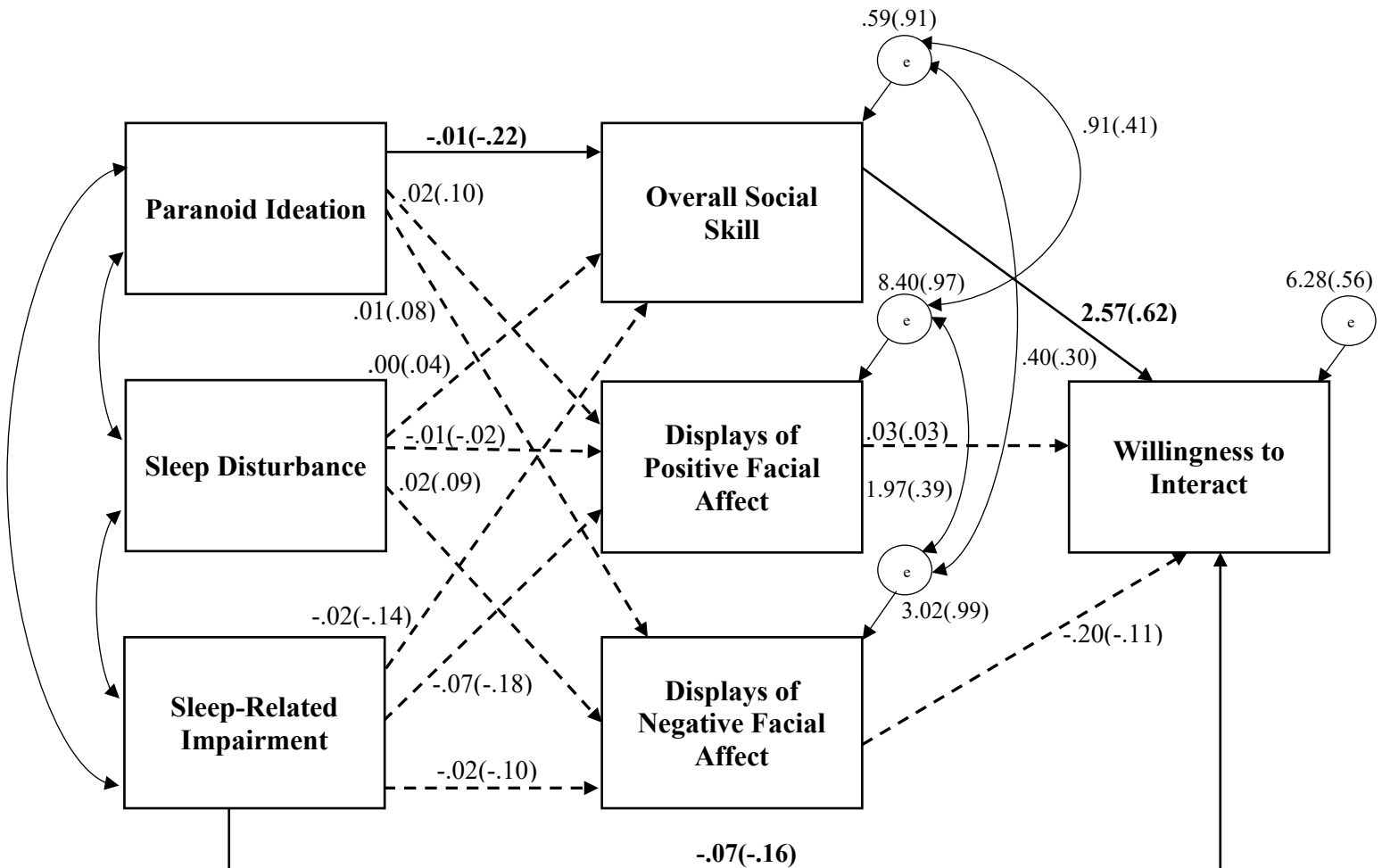
<sup>d</sup>: RMSEA = Root Mean Square Error of Approximation

<sup>e</sup>: CI = Confidence Interval

<sup>f</sup>: SRMR = Standardized Root Mean Square Residuals

**Figure 3**

*Parameter Estimates of the Respecified Model*



*Note.* Unstandardized (outside of the parentheses) and standardized (in parentheses) parameter estimates for the respecified model. Significant parameter estimates are in bold ( $ps \leq .05$ ). Dotted lines indicated non-significant paths ( $ps > .05$ ).

Multiple Regression

A multiple regression analysis was conducted to assess if paranoid ideation and sleep problems predict real-world social functioning. The results showed that the overall regression model was significant and accounted for 28% of the variance in social functioning,

$F(3, 103) = 13.09, p < .001, R^2 = .28$ . Specifically, sleep disturbance ( $\beta = -4.98, t(103) = -2.98, p = .001$ ) and paranoid ideation ( $\beta = -3.97, t(103) = -2.82, p = .001$ ) were significant predictors

of social functioning. Sleep-related impairment was not a significant predictor of social functioning ( $\beta = -.71, t(103) = -0.41, p > .05$ ). However, this finding must be interpreted with caution given that sleep disturbance and sleep-related impairment were highly correlated ( $r = .63, p < .001$ ).

### Ancillary Results

Given the above findings regarding paranoid ideation and observers' willingness to interact with participants, we sought to determine if these results were unique to paranoid ideation or if similar associations might be found for other positive symptoms, such as hallucinations. To address this question, we utilized items from the Brief Psychiatric Rating Scale-Expanded Version (BPRS; Overall & Gorham, 1962; Ventura et al., 1993), which is a clinician rated interview designed to assess psychopathology in samples with psychosis. Master-level graduate students administered this measure to all participants on the same day they completed the self-report measures and SAIT. Two studies have reported that four items on the BPRS (i.e., suspiciousness, hallucinations, grandiosity, unusual thought content) best represent the positive symptoms factor (Dazzi et al., 2016; Shafer et al., 2017). To create a positive symptom factor that did not reflect paranoid ideation, we excluded the BPRS suspiciousness item. Because the non-paranoid positive-symptoms factor was not normally distributed, we conducted Spearman correlations to assess the relation of non-paranoid positive symptoms, social behaviors, and observers' willingness to interact.

As shown in Table 7, non-paranoid positive symptoms were not significantly correlated with overall social skill or frequency of displays of positive or negative facial affect. Alternatively, greater non-paranoid positive symptoms were correlated with observers' reduced willingness to interact with participants ( $r = -.22, p = .02$ ). Follow-up partial correlation analyses

showed that non-paranoid positive symptoms were no longer related to observers' willingness to interact with participants after controlling for paranoid ideation ( $pr = -.06, p = .53$ ). On the other hand, paranoid ideation was associated with observers' willingness to interact with participants after controlling for non-paranoid positive symptoms ( $pr = -.27, p < .001$ ). Together, these results suggest that our main findings are not due to participants experiencing elevated levels of positive symptoms other than paranoid ideation.

**Table 7**

*Bivariate Correlations of Non-Paranoid Positive Symptoms, Social Behaviors, and Observers' Willingness to Interact*

	Overall Social Skill	Displays of Positive Facial Affect	Displays of Negative Facial Affect	Willingness to Interact
BPRS-Non-Paranoid Positive Symptoms	-.13	.00	.07	-.22*

*Note.* BPRS = Brief Psychiatric Rating Scale-Expanded Version. Conducted Spearman correlations because the BPRS-non-paranoid positive symptoms factor was not normally distributed.

\* $p = .02$

## Discussion

This study sought to provide a better understanding of how paranoid ideation and sleep problems are related, and how both may manifest in problematic social behaviors that ultimately lead to social rejection. Using a multimethod assessment approach, we examined behavioral ratings of social skills and displays of facial affect, and assessed observers' reactions towards participants. This research has the potential to inform clinical treatments for individuals with paranoid ideation by identifying problematic social behaviors that may contribute to social rejection and poor real-world social functioning.

### Summary of Main Findings

Correlational analyses showed that after watching a brief interpersonal interaction, naive observers reported greater social rejection towards individuals with higher levels of paranoid ideation. Notably, greater paranoid ideation was related to observers reporting less willingness to interact with participants and observers endorsing more negative reactions towards them (i.e., indicating that these individuals were less likable, less friendly, more odd, and lonelier). Observers also reported more social rejection towards individuals with greater sleep problems. Specifically, observers reported that individuals with greater sleep disturbance and sleep-related impairment were less likable and less friendly. Further, observers were less willing to interact with individuals with greater sleep-related impairment. As discussed below, these results extend past research involving samples with psychosis (e.g., Boswell & Murray, 1981; Nisenson et al., 2001; Penn et al., 2000; Riehle et al., 2018) and non-clinical samples with sleep problems (Gilbert et al., 2015; Gordon & Chen, 2014) by demonstrating that paranoid ideation and sleep



problems are related to different facets of social rejection in a mixed transdiagnostic sample of persons with psychotic disorders and community members.

Contrary to our expectations, paranoid ideation and sleep problems were not related to displays of positive or negative facial affect. However, these results should be interpreted cautiously because participants showed few displays of facial affect, which may have limited our ability to find significant associations. A possible reason that participants showed few displays of facial affect is that they may have demonstrated flat or blunted affect, which is a common negative symptom of schizophrenia (Kring & Elis, 2013). Further, the structure of the social interaction (responding to a video that has ended) may have removed ongoing social prompts that would have normally elicited greater facial displays of affect. We unexpectedly found that more displays of negative facial affect were associated with observers' increased willingness to interact with participants. A review of participants' video recordings from the Social Affiliation Interaction Task (Llerena et al., 2012) showed that participants often displayed negative facial affect when they described themselves (e.g., "I hate math.") and when they seemed to be contemplating their next comment (e.g., "Um, what else?"). This suggests that participants' displays of negative affect were linked to their own experiences and not to negative reactions towards the actor on the video recording, which may explain why observers did not report decreased willingness to interact with individuals that showed greater displays of negative facial affect.

Using path analysis, we evaluated a model that integrated paranoid ideation, sleep problems, and social behaviors to examine how these factors relate to observers' willingness to interact with participants. Consistent with our hypothesis, greater paranoid ideation, through poorer overall social skill, was associated with observers' reduced willingness to interact with

participants. These findings support the proposal that poor social functioning in those with paranoid ideation is partially explained by social skill deficits (Combs et al., 2013; Haynes, 1986). The current study also provides additional clarity related to the interpersonal consequences of paranoid ideation. A key component of the current theoretical model of paranoid ideation is that social cognitive biases, including negative beliefs about the self (e.g., I am vulnerable to harm) and negative beliefs about others (e.g., others will reject, criticize, or harm me) contribute to its development and maintenance (Freeman, 2016; Freeman et al., 2013; Freeman & Garety, 2014; Humphrey et al., 2021; Pinkham et al., 2016). However, researchers have indicated that it is difficult to ascertain if persons with paranoid ideation report social rejection because of these social cognitive biases or actual interpersonal experiences (Freeman, Garety, Bebbington, Smith, et al., 2005). Our study provides some insight into this issue as our results suggest that persons with paranoid ideation actually demonstrate problematic social behaviors that lead to social rejection (e.g., observers' reduced willingness to interact with them and observers perceiving them as less likable and more odd). These findings support researchers' proposal that paranoid ideation manifests in social behaviors that evoke negative reactions from others and leads to greater social rejection (Haynes, 1986; Salvatore et al., 2012). Our study also strengthens Springfield et al.'s (2021) suggestion that paranoid ideation unfavorably impacts interpersonal interactions by contributing to negative experiences for the individual with paranoid ideation *and* those who interact with them. Altogether, the current study extends previous literature by suggesting that paranoid ideation may be maintained by social cognitive biases *and* through negative interpersonal experiences of being socially rejected, which may confirm paranoid beliefs that one's social environment is indeed hostile.

Our results showed that paranoid ideation, but not overall positive symptoms, was related to social skill deficits. This result is inconsistent with Pinkham et al.'s (2016) finding that individuals with paranoid ideation did not differ from those without paranoid ideation in social skills. It is possible that these results are discrepant because we used different assessments of paranoid ideation and social skill. In the current study, we measured paranoid ideation as a dimensional construct and used an empirically validated assessment of paranoid ideation (i.e., Revised-Green et al., Paranoid Thoughts Scale; Freeman et al., 2021). On the other hand, Pinkham et al. (2016) measured paranoid ideation as a dichotomous construct and only used the suspiciousness item from the Positive and Negative Syndrome Scale (Kay et al., 1987). Regarding differences in social skill assessment, Pinkham et al. (2016) evaluated social skills using role-plays of participants meeting a new neighbor and asking a property owner to fix a leak. Our social affiliative task required participants to pretend to talk to an actor about their activities with friends and family. Thus, it is possible that social skills are differentially related to paranoid ideation in different interpersonal interactions. Future research may want to examine how these skills vary during different performance-based assessments and real-world interpersonal interactions.

Our ancillary results showed that non-paranoid positive symptoms of psychosis were not associated with poorer overall social skill or displays of facial affect. These results are consistent with past researchers who have found weak or non-significant relations between positive symptoms and social skills in samples with schizophrenia (e.g., Bellack et al., 1990, 1994; Bowie et al., 2010; Halford & Hayes, 1995). After controlling for non-paranoid positive symptoms, the association of paranoid ideation with observers' willingness to interact with participants persisted. This finding indicates that greater paranoid ideation is independently associated with

observers' reduced willingness to interact with participants. Further, it suggests that research focusing on the contribution that overall positive symptoms have on social skills or adverse interpersonal interactions may overlook the unique contributions that paranoid ideation has on these factors.

Our hypothesis that sleep problems would be associated with social behaviors was partially supported. Contrary to our expectations, sleep disturbance was not related to social behaviors. Considering that past studies have found significant associations between poor sleep and social behaviors (e.g., Baglioni et al., 2010; McGlinchey et al., 2011; Minkel et al., 2011; Verona & Bozzay, 2017), a possible interpretation of this finding is that our measure of overall social skill was unable to capture the precise influence that sleep disturbance has on social skills. Consistent with our expectations, and extending past findings that sleep-related impairment is linked to basic social behaviors (e.g., rudimentary communication skills; Blanchard, Savage, et al., 2020), our correlational analyses showed that sleep-related impairment was associated with poorer overall social skill. However, this result was not maintained in the path analysis indicating that when accounting for paranoid ideation and sleep disturbance, sleep-related impairment does not have a strong influence on this social behavior. These differing findings suggest that assessments of rudimentary communication skills may not produce similar results as assessment of social skills during an affiliative task. Therefore, it may be important for researchers to include multiple skill assessments in future studies to understand thoroughly various behavioral deficits in samples with psychosis.

The current study also found that sleep-related impairment, but not sleep disturbance, was related to observers' reduced willingness to interact with participants. One explanation for the association between sleep-related impairment and observers' willingness to interact is that

participants who reported greater sleep-related impairment may have appeared less energetic or less alert during the social affiliation task, which contributed to observers indicating less willingness to interact with them. This explanation is supported by past research that has shown that observers perceived non-clinical, sleep deprived adults as more tired and less energetic from photos and video recordings (Axelsson et al., 2010; Simon & Walker, 2018). Importantly, our findings are consistent with researchers' proposal that naive observers can detect sleep problems in others and sleep problems affect how observers view these individuals (Axelsson et al., 2020; Simon & Walker, 2018).

Finally, the multiple regression analysis showed that greater paranoid ideation and sleep disturbance was associated with poorer real-world social functioning. These findings replicate past studies that have independently shown that paranoid ideation (Pinkham et al., 2016) and sleep disturbance (Blanchard, Savage, et al., 2020) are related to real-world social functioning. Our results extend prior research by demonstrating that paranoid ideation and sleep disturbance jointly contribute to social functioning in the community. These results also highlight that it is important for clinicians to monitor and treat paranoid ideation and sleep disturbance in samples with psychosis because they are associated with real-world social functioning.

### *Clinical Implications*

Findings from the current study potentially inform clinical interventions. Currently, Freeman et al.'s cognitive behavioral therapy for paranoid ideation emphasizes addressing proposed causal factors of paranoid ideation, such as anxiety, worry, and reasoning biases (Freeman, 2011, 2016; Freeman et al., 2016). They also recommend that therapy includes in-vivo exposures to perceived threatening situations (e.g., going to a store, walking in one's neighborhood) because it places individuals in real-world situations that will challenge their

dysfunctional beliefs about threat, help them learn to tolerate symptoms of anxiety, and allow them to develop new beliefs about safety (Freeman, 2016; Freeman & Garety, 2014). Although interventions that target one (or more) causal factors of paranoid ideation have reported significant reductions in paranoid ideation (Freeman, 2016; Freeman et al., 2016; Garety et al., 2015, 2021), these interventions do not heavily focus on addressing problematic social behaviors. Because our findings showed that paranoid ideation is associated with poorer overall social skill and social rejection, we recommend that clinicians address behavioral deficits prior to in-vivo exposures. This recommendation is supported by previous research that has shown that individual and group social skills training are effective treatments for samples with schizophrenia spectrum disorders (Burlingame et al., 2020; Schroeder et al., 2022; Turner et al., 2018) and those with social anxiety disorder (Beidel et al., 2014; Herbert et al., 2005). We propose that if these behaviors are not targeted in treatment, individuals with paranoid ideation who participate in these types of in-vivo exposures are likely to demonstrate problematic social behaviors that will lead to more social rejection from others and reinforce their negative beliefs about themselves and those in their social environments.

Our finding that greater sleep disturbance was related to poorer real-world social functioning suggests that it may be important to assess if sleep interventions improve social functioning in samples with psychosis. Recent studies involving this population have found that cognitive behavioral therapy for insomnia (CBT-I) is associated with improvement in different facets of sleep, including reductions in sleep disturbance, fewer symptoms of insomnia, and better sleep quality (e.g., A. G. Harvey et al., 2021; Hwang et al., 2019; Waters et al., 2020). One study has reported that a modified CBT-I intervention consisting of a mixed sample of persons with severe mental illness (72% with current psychotic symptoms) is associated with reductions

in sleep disturbance, sleep-related impairment, overall psychiatric symptoms, hallucinations, and delusions up to six months later (Armstrong et al., 2022; A. G. Harvey et al., 2021). Further, two studies have found that sleep interventions are associated with improvement in daytime functioning (A. G. Harvey et al., 2021; Waters et al., 2020). These results suggest that sleep interventions are an effective treatment for those with psychosis and could contribute to improvements in clinical symptoms and daytime functioning. However, more research is needed to evaluate if these interventions improve real-world social functioning in clinical samples with paranoid ideation.

### *Strengths and Limitations*

To the best of our knowledge, this is the first study to examine if persons with paranoid ideation demonstrate specific social behaviors during an interpersonal interaction that contribute to social rejection from others (e.g., less willingness to interact with participants, negative reactions towards them). Another strength of our study is that we examined paranoid ideation, sleep problems, and social behaviors in a diverse, largely minority sample. In addition, we used a social affiliation task that has been previously validated in samples with psychosis (Blanchard et al., 2015; Garcia et al., 2018). Finally, we used a multimethod assessment approach consisting of clinical interviews, self-report measures, behavioral assessments, and thin slice stimuli.

Despite these strengths, our study had several limitations that constrain the interpretation of our results. First, characteristics of our sample may limit the generalizability of our findings to other groups. As a part of our recruitment criteria, clinical participants had to be from an outpatient mental health program with stable symptoms and medications. Thus, our results may not replicate in samples with more acute clinical symptoms or those in inpatient settings. In addition, we did not evaluate the influence that antipsychotic medications may have had on

participants' self-reported levels of sleep disturbance and sleep-related impairment. Previous research has shown mixed results regarding the impact that antipsychotic medications have on sleep patterns. Some studies have found that antipsychotic medications were associated with improved sleep (Cohrs, 2008; Monti et al., 2017; Reeve et al., 2015), while others have linked these medications to poorer sleep quality (Xiang et al., 2009) or no statistically significant relation (Kammerer et al., 2021). For our study, all clinical participants were prescribed medications based on their outpatient treatment providers' discretion; consequently, we are unable to examine the potential impact that medications may have had on our findings. Further, we did not assess the presence of clinical sleep disorders, which prevents us from being able to characterize the frequency or type of sleep disorders in the current sample.

Second, the design of the Social Affiliation Interaction Task (SAIT; Llerena et al., 2012) and our coding process may have impacted our results. During the SAIT, all participants watched a video recording of a White, female actor in her twenties. These demographic characteristics are different from most of our sample, which predominantly consisted of Black/African Americans, males, and individuals who were on average in their forties. Although the actor's descriptions of her social relationships and activities were designed to be generic (Llerena et al., 2012), it is possible that participants' responses during this task were influenced by the extent to which they perceived themselves as having similar identities and interests as the actor. Similarly, the demographic characteristics of the naive observers who completed thin-slice ratings were potentially different from our target participants and may have influenced observers' willingness to interact with them. This interpretation is informed by past social anxiety literature that has shown that raters' perceptions of how similar they are to participants is associated with their willingness to interact with them (Papsdorf & Alden, 1998; Voncken et al., 2008). Another



potential limitation is that the SAIT was designed to have participants respond to the actor who was not present in the room with them. This design prevents us from assessing for reciprocal behaviors that occur in dyadic interactions, such as reciprocal smiles and verbal exchanges that occur while one is listening or responding to a partner (e.g., Alden & Bieling, 1998; Heerey & Kring, 2007).

Third, it is possible that our choice to standardize video recordings to thirty seconds was too brief to capture fully all relevant social behaviors. Although past research has indicated that 30 second video clips are sufficient to assess social behaviors and social rejection (Carney et al., 2007), a recent study has suggested that 1.5 to 2 minutes is the optimal length for the valid assessment of social behaviors (Murphy et al., 2015). Because many participants spoke briefly, we were unable to standardize the video recordings of the SAIT task to longer lengths.

Fourth, the current study did not examine an exhaustive list of non-verbal or verbal behaviors that may occur during interpersonal interactions. Previous research involving samples with psychotic disorders has shown that other non-verbal behaviors, including whole body movements and interpersonal distance are related to social rejection (Riehle & Lincoln, 2017; Schoretsanitis et al., 2016). Because the camera for the SAIT focused on the upper half of participants' bodies, we were unable to assess whole body movements. We also did not assess for interpersonal distance due to the structure of the social affiliative task. Past studies have shown that persons with schizophrenia produce fewer words and more negative emotional words compared to controls in laboratory and real-world settings (Buck & Penn, 2015; Cohen et al., 2009; Minor et al., 2015). The current study did not examine whether the number or valence of words expressed was associated with social behaviors or social rejection; thus, researchers may want to explore this in future studies.

Finally, the study has some statistical limitations that are worth noting. Given that the current study was cross-sectional in nature, we are unable to make any causal claims about the relation between paranoid ideation, sleep problems, social behaviors, and social rejection. Although a path analytic approach examines the relations among variables, it cannot determine causality, which is based on the design of the experiment (e.g., temporality of the variables, evidence that the manipulation of the exogenous variable leads to change in the endogenous variable; Kline, 2016; Schumacker & Lomax, 2016). The results from the post-hoc RMSEA power analysis indicated that our model was underpowered, which may be due to the modest sample size, limited degrees of freedom, and floor effects (Bauer & Curran, 2020; Kline, 2016). Future studies may want to consider these limitations before replicating the current study.

### *Future Directions*

Our results highlight key areas of research to explore in the future. In a larger sample, future studies should evaluate our final model. If our finding that paranoid ideation is associated with reduced willingness to interact from others via poorer overall social skill is replicated, it would bolster our suggestion that clinical interventions for paranoid ideation include behavioral interventions that target social behaviors. Future research may consider exploring if paranoid ideation relates to other behaviors that have been linked to greater social rejection (e.g., decreased warmth, decreased use of positive emotional words; Boswell & Murray, 1981; McGlinchey et al., 2011). These studies will also need to investigate if other clinical symptoms, such as depression and negative symptoms (e.g., Boswell & Murray, 1981; Riehle et al., 2018), impact the relation between paranoid ideation and social rejection. Similarly, studies may want to examine the role that social cognitive biases (e.g., hostile attribution biases) have on social behaviors and social rejection from others. Because it is unclear whether paranoid ideation

precedes social rejection or vice versa (Hajdúk et al., 2019; Salvatore et al., 2012), longitudinal studies that examine temporal unfolding of these factors are necessary. Based on past findings that paranoid ideation influences everyone involved in dyadic interpersonal interactions (Springfield et al., 2021), future studies should explore the behavioral responses that others demonstrate when engaging with someone with high levels of paranoid ideation.

Regarding the limits of the SAIT as described above, future research should investigate if varying the actor's demographic characteristics is linked to participants' verbal and non-verbal responses during this task. Furthermore, it would be valuable to examine if variations in the demographic and personality characteristics between participants and observers are associated with social rejection. Such research should evaluate whether past findings that observers' personality traits influence their subjective ratings of target participants (Friedman et al., 2007) replicates in a transdiagnostic sample with psychosis.

Related to clinical interventions for paranoid ideation, future research should investigate if treatments that emphasize behavioral interventions for paranoid ideation will improve treatment outcomes. For example, studies should examine if social skills training will reduce experiences of social rejection or improve the quality of interpersonal interactions for this population. Past research has demonstrated that social skills training is an effective treatment in samples with schizophrenia spectrum disorders and these skills are applicable to real-world situations (Burlingame et al., 2020; Schroeder et al., 2022; Turner et al., 2018). Further, recent studies have shown that combining virtual reality technology with social skills training is associated with reductions in overall clinical symptoms, negative symptoms, positive symptoms, and better social performance in inpatient and outpatient samples with psychosis (Adery et al., 2018; Moe et al., 2021; Rus-Calafell et al., 2014; Schroeder et al., 2022). Therefore, future

research could examine if social skills training in virtual social situations directly contributes to reductions in paranoid ideation.

Finally, it is important for future research to explore other social behaviors that may impact the relation between sleep disturbance and real-world social functioning. Our study suggests that overall social skill and displays of facial affect do not account for this association. Because we examined a limited number of social behaviors, future studies should investigate the extent to which other social behaviors (e.g., aggressive behaviors, verbal expressions of emotional words; Baglioni et al., 2010; McGlinchey et al., 2011; Verona & Bozzay, 2017) link sleep disturbance to real-world social functioning. Our findings suggest that future studies should design longitudinal studies that examine the temporal unfolding of paranoid ideation and sleep disturbance to better understand how they develop and influence real-world social functioning.

### Conclusion

The current study examined the relations among paranoid ideation, sleep problems, and social behaviors, and their association with social rejection from others in a mixed transdiagnostic sample of persons with psychosis and community members. The results showed that paranoid ideation was indirectly associated with observers' reduced willingness to interact with participants through poorer overall social skill. Also, greater paranoid ideation was associated with negative reactions from others, such as participants being perceived as less likable and more odd. Paranoid ideation was not related to displays of positive or negative facial affect. Contrary to our expectations, sleep problems were not associated with overall social skill or displays of facial affect. However, sleep problems were linked with negative reactions from others. Further, sleep-related impairment was associated with observers' reduced willingness to interact with participants. Finally, paranoid ideation and sleep-disturbance were associated with

poorer real-world social functioning. Altogether, these findings indicate that paranoid ideation and sleep problems have unique associations with social rejection, and they may impact real-world social functioning. Clinical interventions for paranoid ideation should address problematic social behaviors and sleep problems because they may contribute to social rejection and poor real-world social functioning.

# Appendices

## Appendix A

### SCID-5-RV SCREENER

#### CRITERIA FOR CONTROLS:

Exclude if any Axis I disorder

\*\*\*Administer to all controls\*\*\*

#### CRITERIA FOR PATIENTS:

Exclude if no current or past psychotic symptoms outside of substance use

Exclude if any moderate or severe substance or alcohol use disorder in the past 6 months or mild substance or alcohol use disorder in the past month

Note- underlined items only need to be asked for controls, not patients.

Now I want to ask you some specific questions about problems you may have had. We'll go into more detail about them later.

	No	Maybe	Yes
1. Have you ever had a period of time when you felt depressed or down most of the day nearly every day?	1	2	3
2. Have you ever had a period of time when you lost interest or pleasure in things you usually enjoy?	1	2	3
3. Have you ever had a period of time when you we're feeling so good, "high," excited, or on top of the world that other people thought you were not your normal self or you got into trouble?	1	2	3
4. Have you ever had a period of time when you were feeling irritable, angry, or short-tempered for most of the day, every day, for at least several days?	1	2	3
5. In the past 6 months, have you missed work or school because you were intoxicated, high, or very hungover?	1	2	3
6. In the past 6 months, have you had trouble keeping your house clean or taking proper	1	2	3

care of your family or children because of drinking or drug use?

- |     |  |   |   |   |
|-----|--|---|---|---|
| 7.  | In the past 6 months, have you taken any drugs to get high or change your mood?  | 1 | 2 | 3 |
| 8.  | In the past 6 months, have you had a period of time when you were “hooked” on a prescribed medication or took a lot more of it than you were supposed to?  | 1 | 2 | 3 |
| 9.  | <u>In the past 6 months, have you had an intense rush of anxiety, or what someone might call a “panic attack,” when you suddenly felt very frightened, or anxious, or suddenly developed a lot of physical symptoms?</u>     | 1 | 2 | 3 |
| 10. | <u>In the past 6 months, have you been very anxious about or afraid of situations like going out of the house alone, being in crowds, standing in lines, or traveling on buses or trains?</u>                                | 1 | 2 | 3 |
| 11. | <u>In the past 6 months, has there been anything that you felt afraid to do or felt uncomfortable doing in front of other people, like speaking, eating, or writing?</u>   | 1 | 2 | 3 |
| 12. | <u>In the past 6 months, have you been especially nervous or anxious in social situations like having a conversation or meeting unfamiliar people?</u>   | 1 | 2 | 3 |
| 13. | <u>In the past 6 months, are there other things that have made you especially anxious or afraid, like flying, seeing blood, getting shot, heights, closed places, or certain kinds of animals/insects?</u>                   | 1 | 2 | 3 |
| 14. | <u>Over the past 6 months have you been feeling anxious and worried for a lot of the time?</u>   | 1 | 2 | 3 |
| 15. | <u>In the past 6 months, have you been bothered with thoughts that kept coming back to you even when you didn’t want them to, like being exposed to germs or dirt or needing everything to be lined up in a certain way?</u> | 1 | 2 | 3 |

- |   |   |   |   |
|---|---|---|---|
| 16. <u>In the past 6 months, have you had images pop into your head that you didn't want like violent or horrible scenes or something in a sexual nature?</u>           | 1 | 2 | 3 |
| 17. <u>In the past 6 months, have you had urges to do something that kept coming back to you even though you didn't want them to, like an urge to harm a loved one?</u> | 1 | 2 | 3 |

NOTE:

If a control participant has all NOs, the SCID does not have to be done again.

If a control participant has some MAYBEs or YESes, those sections of the SCID have to be done.



**SCID-5-RV SUMMARY SHEET**

1. Current Axis I Diagnosis (check all that apply)

- |  |  |
|--|--|
| <input type="checkbox"/> (1) Schizophrenia       | <input type="checkbox"/> (7) Bipolar I           |
| <input type="checkbox"/> (2) Schizoaffective BP  | <input type="checkbox"/> (8) Bipolar II          |
| <input type="checkbox"/> (3) Schizoaffective Dep | <input type="checkbox"/> (9) MDD                 |
| <input type="checkbox"/> (4) Schizophreniform    | <input type="checkbox"/> (10) Dysthymia          |
| <input type="checkbox"/> (5) Delusional Dx       | <input type="checkbox"/> (11) Other psychotic Dx |
| <input type="checkbox"/> (6) Brief Psychotic Dx  | <input type="checkbox"/> (12) PTSD/Anxiety       |
|  | <input type="checkbox"/> (-999) Missing          |

Which is the primary Axis I Diagnosis?

- |  |  |
|--|--|
| <input type="checkbox"/> (1) Schizophrenia       | <input type="checkbox"/> (7) Bipolar I           |
| <input type="checkbox"/> (2) Schizoaffective BP  | <input type="checkbox"/> (8) Bipolar II          |
| <input type="checkbox"/> (3) Schizoaffective Dep | <input type="checkbox"/> (9) MDD                 |
| <input type="checkbox"/> (4) Schizophreniform    | <input type="checkbox"/> (10) Dysthymia          |
| <input type="checkbox"/> (5) Delusional Dx       | <input type="checkbox"/> (11) Other psychotic Dx |
| <input type="checkbox"/> (6) Brief Psychotic Dx  | <input type="checkbox"/> (12) PTSD/Anxiety       |
|  | <input type="checkbox"/> (-999) Missing          |

Current Axis V GAF

Lifetime Axis I Diagnoses (check all that apply)

- |  |  |
|--|--|
| <input type="checkbox"/> (1) Schizophrenia       | <input type="checkbox"/> (7) Bipolar I           |
| <input type="checkbox"/> (2) Schizoaffective BP  | <input type="checkbox"/> (8) Bipolar II          |
| <input type="checkbox"/> (3) Schizoaffective Dep | <input type="checkbox"/> (9) MDD                 |
| <input type="checkbox"/> (4) Schizophreniform    | <input type="checkbox"/> (10) Dysthymia          |
| <input type="checkbox"/> (5) Delusional Dx       | <input type="checkbox"/> (11) Other psychotic Dx |
| <input type="checkbox"/> (6) Brief Psychotic Dx  | <input type="checkbox"/> (12) PTSD/Anxiety       |
|  | <input type="checkbox"/> (-999) Missing          |

History of substance use?  (0) No     (1) Yes     (-999) Missing

**Alcohol Use Disorders**

- |   |   |   |   |
|---|---|---|---|
| <b>Current Abuse</b>                    | <b>Current Dependence</b>               | <b>Lifetime Abuse</b>                   | <b>Lifetime Dependence</b>              |
| <input type="checkbox"/> (0) No         | <input type="checkbox"/> (0) No         | <input type="checkbox"/> (0) No         | <input type="checkbox"/> (0) No         |
| <input type="checkbox"/> (1) Yes        | <input type="checkbox"/> (1) Yes        | <input type="checkbox"/> (1) Yes        | <input type="checkbox"/> (1) Yes        |
| <input type="checkbox"/> (-999) Missing | <input type="checkbox"/> (-999) Missing | <input type="checkbox"/> (-999) Missing | <input type="checkbox"/> (-999) Missing |

**Drug Use Disorders**

- |   |   |   |   |
|---|---|---|---|
| <b>Current Abuse</b>                    | <b>Current Dependence</b>               | <b>Lifetime Abuse</b>                   | <b>Lifetime Dependence</b>              |
| <input type="checkbox"/> (0) No         | <input type="checkbox"/> (0) No         | <input type="checkbox"/> (0) No         | <input type="checkbox"/> (0) No         |
| <input type="checkbox"/> (1) Yes        | <input type="checkbox"/> (1) Yes        | <input type="checkbox"/> (1) Yes        | <input type="checkbox"/> (1) Yes        |
| <input type="checkbox"/> (-999) Missing | <input type="checkbox"/> (-999) Missing | <input type="checkbox"/> (-999) Missing | <input type="checkbox"/> (-999) Missing |
| If yes, which?                          | If yes, which?                          | If yes, which?                          | If yes, which?                          |

1 = Sedative, hypnotics, anxiolytics; 2 = Cannabis; 3 = Stimulants; 4 = Opioid; 5 = Cocaine; 6 = Hallucinogens, PCP; 7 = Poly; 8 = Other

---

### **Substance Use History**

\*regular is defined as once per week or more.

Age of first regular\* alcohol use:  (Never used = 0)

Age of first regular\* cocaine use:  (Never used = 0)

Age of first regular\* heroin use:  (Never used = 0)

Age of first regular\* marijuana use:  (Never used = 0)

Age of first regular\* other use:  (Never used = 0)

Specify other drug:

---

### **Psychiatric History**

Age of first psychiatric treatment:

Age of first inpatient psychiatric hospitalization:

Number of psychiatric inpatient hospitalizations:  (None = 0)

Number of suicide attempts:  (None = 0)

---

### **Family Psychiatric History**

Has any member of your family ever had a psychiatric problem?

(0) No     (1) Yes     (-999) Missing

If yes, who: :

**Appendix B**

**REVISED-GREEN PARANOID THOUGHT SCALE**

Please read each of the statements carefully. They refer to thoughts and feelings you may have had **about others over the last month**.

Think about the **last month** and indicate the extent of these feelings from **1 (Not at all)** to **5 (Totally)**.

**Please complete both Part A and Part B.**

<b>Part A. Social Reference</b>				
<b>1. I spent time thinking about friends gossiping about me</b>				
1	2	3	4	5
Not at all		Somewhat		Totally
<b>2. I often heard people referring to me</b>				
1	2	3	4	5
Not at all		Somewhat		Totally
<b>3. I have been upset by friends and colleagues judging me critically</b>				
1	2	3	4	5
Not at all		Somewhat		Totally
<b>4. People definitely laughed at me behind my back</b>				
1	2	3	4	5
Not at all		Somewhat		Totally
<b>5. I have been thinking a lot about people avoiding me</b>				
1	2	3	4	5
Not at all		Somewhat		Totally
<b>6. People have been dropping hints for me</b>				
1	2	3	4	5
Not at all		Somewhat		Totally
<b>7. I believed that certain people were not what they seemed</b>				
1	2	3	4	5
Not at all		Somewhat		Totally
<b>8. People talking about me behind my back upset me</b>				
1	2	3	4	5
Not at all		Somewhat		Totally

<b>Part B. Persecution</b>				
<b>1. Certain individuals have had it in for me</b>				
1	2	3	4	5
Not at all		Somewhat		Totally
<b>2. People wanted me to feel threatened, so they stared at me</b>				
1	2	3	4	5
Not at all		Somewhat		Totally

<b>3. I was sure certain people did things in order to annoy me</b>				
1	2	3	4	5
Not at all		Somewhat		Totally
<b>4. I was convinced there was a conspiracy against me</b>				
1	2	3	4	5
Not at all		Somewhat		Totally
<b>5. I was sure someone wanted to hurt me</b>				
1	2	3	4	5
Not at all		Somewhat		Totally
<b>6. I couldn't stop thinking about people wanting to confuse me</b>				
1	2	3	4	5
Not at all		Somewhat		Totally
<b>7. I was distressed by being persecuted</b>				
1	2	3	4	5
Not at all		Somewhat		Totally
<b>8. It was difficult to stop thinking about people wanting to make me feel bad</b>				
1	2	3	4	5
Not at all		Somewhat		Totally
<b>9. People have been hostile towards me on purpose</b>				
1	2	3	4	5
Not at all		Somewhat		Totally
<b>10. I was angry that someone wanted to hurt me</b>				
1	2	3	4	5
Not at all		Somewhat		Totally

## Appendix C

### Patient-Reported Outcomes Measurement Information System Sleep Disturbance Short Form (PROMIS SD)

Please respond to each item by indicating the degree to which you feel the statement is characteristic or true of you, in the last week.

In the past 7 days...

<b>1. My sleep was restless ...</b>				
1	2	3	4	5
Not at all	A little bit	Somewhat	Quite a bit	Very much
<b>2. I was satisfied with my sleep ...</b>				
1	2	3	4	5
Not at all	A little bit	Somewhat	Quite a bit	Very much
<b>3. My sleep was refreshing ...</b>				
1	2	3	4	5
Not at all	A little bit	Somewhat	Quite a bit	Very much
<b>4. I had difficulty falling asleep ...</b>				
1	2	3	4	5
Not at all	A little bit	Somewhat	Quite a bit	Very much

In the past 7 days...

<b>5. I had trouble staying asleep ...</b>				
1	2	3	4	5
Never	Rarely	Sometimes	Often	Always
<b>6. I had trouble sleeping ...</b>				
1	2	3	4	5
Never	Rarely	Sometimes	Often	Always
<b>7. I got enough sleep ...</b>				
1	2	3	4	5
Never	Rarely	Sometimes	Often	Always

In the past 7 days...

<b>8. My sleep quality was ...</b>				
1	2	3	4	5
Very poor	Poor	Fair	Good	Very good

**Patient-Reported Outcomes Measurement Information System  
Sleep-Related Impairment Short Form (PROMIS SRI)**

Please respond to each item by indicating the degree to which you feel the statement is characteristic or true of you, in the last week.

**In the past 7 days ...**

	<b>Not at all</b>	<b>A little bit</b>	<b>Somewhat</b>	<b>Quite a bit</b>	<b>Very much</b>
1. I had a hard time getting things done because I was sleepy ...	1	2	3	4	5
2. I felt alert when I woke up ...	1	2	3	4	5
3. I felt tired ...	1	2	3	4	5
4. I had problems during the day because of poor sleep ...	1	2	3	4	5
5. I had a hard time concentrating because of poor sleep ...	1	2	3	4	5
6. I felt irritable because of poor sleep ...	1	2	3	4	5
7. I was sleepy during the daytime ...	1	2	3	4	5
8. I had trouble staying awake during the day ...	1	2	3	4	5

## Appendix D

### SPECIFIC LEVELS OF FUNCTIONING SCALE

*Instructions:* Circle the number that best describes your typical level of functioning on each item below.

Mark only one number for each item. Be sure to mark all items.

*Typical* is defined as follows:

**Highly typical** = Very much describes your behavior or level of functioning

**Generally typical** = Usually describes your behavior or level of functioning

**Somewhat typical** = Occasionally describes your behavior or level of functioning

**Generally untypical** = Rarely describes your behavior or level of functioning

**Highly untypical** = Does not describe your behavior or level of functioning at all

#### Social Functioning

<b>A. Interpersonal Relationships</b>					
<b>1. Accept contact with others</b>	1 Highly untypical	2 Generally untypical	3 Somewhat typical	4 Generally typical	5 Highly typical
<b>2. Initiate contact with others</b>	1 Highly untypical	2 Generally untypical	3 Somewhat typical	4 Generally typical	5 Highly typical
<b>3. Communicate effectively</b>	1 Highly untypical	2 Generally untypical	3 Somewhat typical	4 Generally typical	5 Highly typical
<b>4. Engage in activities without prompting</b>	1 Highly untypical	2 Generally untypical	3 Somewhat typical	4 Generally typical	5 Highly typical
<b>5. Participate in groups</b>	1 Highly untypical	2 Generally untypical	3 Somewhat typical	4 Generally typical	5 Highly typical
<b>6. Form and maintain friendships</b>	1 Highly untypical	2 Generally untypical	3 Somewhat typical	4 Generally typical	5 Highly Typical

<b>7. Ask for help when needed</b>	1 Highly untypical	2 Generally untypical	3 Somewhat typical	4 Generally typical	5 Highly typical
------------------------------------	--------------------------	-----------------------------	--------------------------	---------------------------	------------------------

<b>B. Social Acceptability</b>					
<b>8. Regularly argue with others</b>	1 Always	2 Frequently	3 Sometimes	4 Rarely	5 Never
<b>9. Has physical fights with others</b>	1 Always	2 Frequently	3 Sometimes	4 Rarely	5 Never
<b>10. Destroys property</b>	1 Always	2 Frequently	3 Sometimes	4 Rarely	5 Never
<b>11. Physically abuses self</b>	1 Always	2 Frequently	3 Sometimes	4 Rarely	5 Never
<b>12. Is fearful, crying, clinging</b>	1 Always	2 Frequently	3 Sometimes	4 Rarely	5 Never
<b>13. Takes property from others without permission</b>	1 Always	2 Frequently	3 Sometimes	4 Rarely	5 Never

### Community Living Skills

<b>C. Activities</b>						
<b>1. Household responsibilities (house cleaning, cooking, washing clothes)</b>	1 Totally Dependent	2 Needs Substantial Help	3 Needs Some Physical Help or Assistance	4 Needs Verbal Advice or Guidance	5 Totally Self Sufficient	7 No Opportunity to Perform
<b>2. Shopping (selection of items, choice of stores, payment at register)</b>	1 Totally Dependent	2 Needs Substantial Help	3 Needs Some Physical Help or Assistance	4 Needs Verbal Advice or Guidance	5 Totally Self Sufficient	7 No Opportunity to Perform



<b>3. Handling personal finances (budgeting, paying bills)</b>					
1 Totally Dependent	2 Needs Substantial Help	3 Needs Some Physical Help or Assistance	4 Needs Verbal Advice or Guidance	5 Totally Self Sufficient	7 No Opportunity to Perform
<b>4. Use of telephone (getting number, dialing, speaking, listening)</b>					
1 Totally Dependent	2 Needs Substantial Help	3 Needs Some Physical Help or Assistance	4 Needs Verbal Advice or Guidance	5 Totally Self Sufficient	7 No Opportunity to Perform
<b>5. Traveling from residence without getting lost</b>					
1 Totally Dependent	2 Needs Substantial Help	3 Needs Some Physical Help or Assistance	4 Needs Verbal Advice or Guidance	5 Totally Self Sufficient	7 No Opportunity to Perform
<b>6. Use of public transportation (selecting route, using timetable, paying fares, making transfers)</b>					
1 Totally Dependent	2 Needs Substantial Help	3 Needs Some Physical Help or Assistance	4 Needs Verbal Advice or Guidance	5 Totally Self Sufficient	7 No Opportunity to Perform
<b>7. Use of leisure time (reading, visiting friends, listening to music)</b>					
1 Totally Dependent	2 Needs Substantial Help	3 Needs Some Physical Help or Assistance	4 Needs Verbal Advice or Guidance	5 Totally Self Sufficient	7 No Opportunity to Perform
<b>8. Recognizing and avoiding common dangers (traffic safety, fire safety)</b>					
1 Totally Dependent	2 Needs Substantial Help	3 Needs Some Physical Help or Assistance	4 Needs Verbal Advice or Guidance	5 Totally Self Sufficient	7 No Opportunity to Perform
<b>9. Self-medication (understanding purpose, taking as prescribed, recognizing side effects)</b>					
1 Totally Dependent	2 Needs Substantial Help	3 Needs Some Physical Help or Assistance	4 Needs Verbal Advice or Guidance	5 Totally Self Sufficient	7 No Opportunity to Perform
<b>10. Use of medical and other community services (knowing whom to contact, how, and when to use)</b>					
1 Totally Dependent	2 Needs Substantial Help	3 Needs Some Physical Help or Assistance	4 Needs Verbal Advice or Guidance	5 Totally Self Sufficient	7 No Opportunity to Perform

<b>11. Basic reading, writing, and arithmetic (enough for daily needs)</b>					
1	2	3	4	5	7
Totally Dependent	Needs Substantial Help	Needs Some Physical Help or Assistance	Needs Verbal Advice or Guidance	Totally Self Sufficient	No Opportunity to Perform

<b>D. Work Skills</b>					
<b>1. Has employable skills</b>					
1	2	3	4	5	
Highly untypical	Generally untypical	Somewhat typical	Generally typical	Highly typical	
<b>2. Works with minimal supervision</b>					
1	2	3	4	5	
Highly untypical	Generally untypical	Somewhat typical	Generally typical	Highly typical	
<b>3. Is able to sustain work effort (not easily distracted, can work under stress)</b>					
1	2	3	4	5	
Highly untypical	Generally untypical	Somewhat typical	Generally typical	Highly typical	
<b>4. Appears at appointments on time</b>					
1	2	3	4	5	
Highly untypical	Generally untypical	Somewhat typical	Generally typical	Highly typical	
<b>5. Follows verbal instructions accurately</b>					
1	2	3	4	5	
Highly untypical	Generally untypical	Somewhat typical	Generally typical	Highly typical	
<b>6. Completes assigned tasks</b>					
1	2	3	4	5	
Highly untypical	Generally untypical	Somewhat typical	Generally typical	Highly typical	

## **Appendix E**

### **Social Affiliation Interaction Task**

Instructions to participant:

"We are interested in studying how people get to know one another, especially when it comes to talking about things we like to do with our friends and family. On the computer screen, you will see a video of a person. She will introduce herself and tell you about what she likes to do. Please watch and listen closely just as you would if you were really meeting her. When she is done, she will ask you to talk about yourself and the video will turn off. You will then talk as though you are really speaking with her and letting her know about you. Just relax and be yourself. Be sure to convey enough information about yourself so that the other person feels like they know you. For example, you can talk about what you like to do in your free time and what you like about your friends and family. When you are done introducing yourself, let us know you have finished. Do you have any questions?"

## Appendix F

### FACES Coding Sheet

#### *Valence:*

Positive \_\_\_\_\_

(e.g., happy, delighted, glad, amused, pleased, content, satisfied, calm, serene, excited, astonished, cheerful, surprised, active, content)

Negative \_\_\_\_\_

(e.g., miserable, distressed, annoyed, jittery, nervous, angry, gloomy, anxious, afraid, tense, alarmed, frustrated, disgusted, depressed, hostile)

<i>Intensity:</i>	low	medium	high	very high
	1	2	3	4

Low: A mild expression involving predominantly one feature of the face (i.e. mouth, cheeks, eyes) and very little involvement of other features.

- Such as a smile where the corners of the mouth are slightly raised but no teeth are shown and very little eye movement
- Such as a mild frown where eyebrows are furrowed and corners of the mouth are slightly turned down

Medium: A moderate expression including clear movement of at least two facial features, but does not include involvement from all features.

- Such as a smile bordering on a laugh, with eyebrows slightly raised and the lips apart, showing teeth
- Such as a moderate frown or scowl with eyebrows furrowed, lips are flat/corners angled down, eyes narrowed

High: A fairly intense expression that involves most, if not all of the face.

- Such as laughing with an open mouth and raising the eyebrows and cheeks
- Such as a scowl with eyebrows significantly furrowed, mouth very tense or open, eyes squinted

Very high: Reserved for very intense expressions involving all facial features.

- Such as laughing with the mouth completely open with the eyebrows and cheeks substantially raised
- Such as a scowl with eyebrows significantly furrowed, mouth open, eyes squinted

PID: \_\_\_\_\_ Interviewer: \_\_\_\_\_ Rater: \_\_\_\_\_

---

Time start: \_\_\_\_\_ Time end: \_\_\_\_\_ Duration: \_\_\_\_\_ Item # \_\_\_\_\_

**Valence:** Positive \_\_\_\_\_ Negative \_\_\_\_\_

**Intensity:** low medium high very high  
1 2 3 4

---

Time start: \_\_\_\_\_ Time end: \_\_\_\_\_ Duration: \_\_\_\_\_ Item # \_\_\_\_\_

**Valence:** Positive \_\_\_\_\_ Negative \_\_\_\_\_

**Intensity:** low medium high very high  
1 2 3 4

---

Time start: \_\_\_\_\_ Time end: \_\_\_\_\_ Duration: \_\_\_\_\_ Item # \_\_\_\_\_

**Valence:** Positive \_\_\_\_\_ Negative \_\_\_\_\_

**Intensity:** low medium high very high  
1 2 3 4

---

Time start: \_\_\_\_\_ Time end: \_\_\_\_\_ Duration: \_\_\_\_\_ Item # \_\_\_\_\_

**Valence:** Positive \_\_\_\_\_ Negative \_\_\_\_\_

**Intensity:** low medium high very high  
1 2 3 4

---

Time start: \_\_\_\_\_ Time end: \_\_\_\_\_ Duration: \_\_\_\_\_ Item # \_\_\_\_\_

**Valence:** Positive \_\_\_\_\_ Negative \_\_\_\_\_

**Intensity:** low medium high very high  
1 2 3 4

---

Time start: \_\_\_\_\_ Time end: \_\_\_\_\_ Duration: \_\_\_\_\_ Item # \_\_\_\_\_

**Valence:** Positive \_\_\_\_\_ Negative \_\_\_\_\_

**Intensity:** low medium high very high  
1 2 3 4

PID: \_\_\_\_\_ Interviewer: \_\_\_\_\_ Rater: \_\_\_\_\_

Time start:	_____	Time end:	_____	Duration:	_____	Item #	_____
<b>Valence:</b>	Positive _____	Negative	_____				
<b>Intensity:</b>	low	medium	high	very high			
	1	2	3	4			

---

Time start:	_____	Time end:	_____	Duration:	_____	Item #	_____
<b>Valence:</b>	Positive _____	Negative	_____				
<b>Intensity:</b>	low	medium	high	very high			
	1	2	3	4			

---

Time start:	_____	Time end:	_____	Duration:	_____	Item #	_____
<b>Valence:</b>	Positive _____	Negative	_____				
<b>Intensity:</b>	low	medium	high	very high			
	1	2	3	4			

---

Time start:	_____	Time end:	_____	Duration:	_____	Item #	_____
<b>Valence:</b>	Positive _____	Negative	_____				
<b>Intensity:</b>	low	medium	high	very high			
	1	2	3	4			

---

Time start:	_____	Time end:	_____	Duration:	_____	Item #	_____
<b>Valence:</b>	Positive _____	Negative	_____				
<b>Intensity:</b>	low	medium	high	very high			
	1	2	3	4			

---

Time start:	_____	Time end:	_____	Duration:	_____	Item #	_____
<b>Valence:</b>	Positive _____	Negative	_____				
<b>Intensity:</b>	low	medium	high	very high			
	1	2	3	4			

**FACES Summary Sheet**

PID: \_\_\_\_\_ Interviewer: \_\_\_\_\_ Rater: \_\_\_\_\_

---

Please rate the degree to which the subject expressed each of the following emotions using the scale below:

Not at all = 1; Slightly = 2; Somewhat = 3; Moderately = 4; Quite a bit = 5; Very Much = 6

Interest \_\_\_ Sadness \_\_\_ Happiness \_\_\_ Anger \_\_\_ Fear \_\_\_ Amusement \_\_\_ Disgust \_\_\_

---

What is the overall level of expressiveness for this person?

Low	Fairly low	Medium	Fairly high	High
1	2	3	4	5

Low: none or few expressions all of which were short and low in intensity.

High: many highly intense and longer expressions

---

Total number of positive expressions \_\_\_\_\_

Total number of negative expressions \_\_\_\_\_

Total duration of positive expressions \_\_\_\_\_

Total duration of negative expressions \_\_\_\_\_

Mean duration of positive expressions \_\_\_\_\_

Mean duration of negative expressions \_\_\_\_\_

(Divide the total duration of expressions by the number of expressions)

Total positive intensity \_\_\_\_\_

Total negative intensity \_\_\_\_\_

Mean positive intensity \_\_\_\_\_

Mean negative intensity \_\_\_\_\_

(Total intensity ratings divided by the number of expressions)

---

What was the predominant emotion being expressed throughout the interview?

- A. Interest
- B. Sadness
- C. Anger
- D. Surprise
- E. Fear/Disgust
- F. Neutral/Indifferent
- G. Happiness

## Appendix G

### Understanding Social Affiliative Deficits (RDoC)

#### Social Skills Rating Scoresheet

1. Clarity	1	2	3	4	5
2. Spontaneous Conversation	1	2	3	4	5
3. Fluency	1	2	3	4	5
4. Meshing	1	2	3	4	5
5. Social Norm Violations	1	2	3	4	5
6. Positive Valence	1	2	3	4	5
7. Negative Valence	1	2	3	4	5
8. Eye Contact/Eye Gaze	1	2	3	4	5
9. Nonverbal Bodily Expression	1	2	3	4	5
10. Overall Affiliation	1	2	3	4	5
11. Overall Social Skill	1	2	3	4	5



## Appendix H

### Willingness to Interact Scale

PID: SAS

Rater ID:

Date:

#### Confidentiality Agreement

By typing my name below, I pledge to take all necessary precautions to maintain the privacy and confidentiality for the participant in this video. I confirm that I will view this video in a private setting free from any observer, and I will wear headphones during the duration of the video clip.

Rater Name:

Date:

#### Preliminary Question

Have you ever met the person in the video before?

YES

- If yes, please do not continue with the questionnaire. Please email Christina (csavage5@terpmail.umd.edu).

NO

- If no, please continue with the questionnaire below.

**Please watch the entire video clip only one time. Based on the video clip, please answer the following questions.**

1. How willing would you be to go to a movie with this person?

1 Definitely willing	2 Somewhat willing	3 Neutral	4 Somewhat unwilling	5 Definitely unwilling
-------------------------	-----------------------	--------------	-------------------------	---------------------------

2. How willing would you be to ask this person for advice?

1 Definitely willing	2 Somewhat willing	3 Neutral	4 Somewhat unwilling	5 Definitely unwilling
-------------------------	-----------------------	--------------	-------------------------	---------------------------

3. How willing would you be to go on a 3-hour bus trip with this person?

1 Definitely willing	2 Somewhat willing	3 Neutral	4 Somewhat unwilling	5 Definitely unwilling
-------------------------	-----------------------	--------------	-------------------------	---------------------------

4. How willing would you be to invite this person to your home?

1 Definitely willing	2 Somewhat willing	3 Neutral	4 Somewhat unwilling	5 Definitely unwilling
-------------------------	-----------------------	--------------	-------------------------	---------------------------

5. How willing would you be to invite this person to a social event?

1 Definitely willing	2 Somewhat willing	3 Neutral	4 Somewhat unwilling	5 Definitely unwilling
-------------------------	-----------------------	--------------	-------------------------	---------------------------

6. How willing would you be to admit this person into your circle of friends?

1 Definitely willing	2 Somewhat willing	3 Neutral	4 Somewhat unwilling	5 Definitely unwilling
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7. How much do you like this person?

1 Definitely dislike	2 Somewhat dislike	3 Neutral	4 Somewhat like	5 Definitely like
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8. How attractive do you think this person is?

1 Definitely not attractive	2 Somewhat not attractive	3 Neutral	4 Somewhat attractive	5 Definitely attractive
--------------------------------	------------------------------	--------------	--------------------------	----------------------------

9. How friendly do you think this person is?

1 Definitely unfriendly	2 Somewhat unfriendly	3 Neutral	4 Somewhat friendly	5 Definitely friendly
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10. How odd do you think this person is?

1 Definitely odd	2 Somewhat odd	3 Neutral	4 Somewhat not odd	5 Definitely not odd
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11. How lonely do you think this person is?

1 Very lonely	2 Quite lonely	3 Neutral	4 Somewhat lonely	5 Not lonely at all
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