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Multiple Risk Factors for Schizotypy in a Non-Clinical Population : Exploring the Continuum of Psychosis Two Years Later

Jill Del Pozzo

Multiple Risk Factors for Schizotypy in a Non-Clinical Population:

Exploring the Continuum of Psychosis Two Years Later

A DISSERTATION

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DISSERTATION APPROVAL

We hereby approve the Dissertation

Multiple Risk Factors for Schizotypy in a Non-Clinical Population:

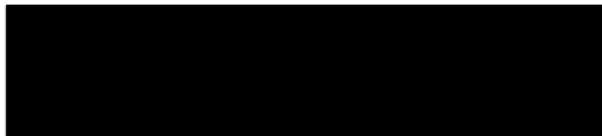**Exploring the Continuum of Psychosis Two Years Later**

of

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Abstract

Schizotypy is a multidimensional construct that refers to a collection of cognitive and personality traits, impairments, and experiences thought to lie on a continuum for psychosis, which place an individual at increased risk for developing schizophrenia spectrum disorders. The expression of schizotypy varies along this continuum of psychosis (i.e., from healthy, to subclinical and prodromal symptomatology, to clinical and severe psychosis) and is dependent on several biopsychosocial factors and their interactions. Accordingly, it is important identify factors that correlate with higher levels of schizotypy over time, toward ascertaining knowledge about developmental pathways of risk and resilience for psychotic disorders. To date, a limited number of studies have examined the stability of schizotypy over time, or the prospective predictive validity of a wide range of risk factors concurrently for schizotypy.

Accordingly, the present study consisted of a prospective exploratory investigation of schizotypy and candidate psychosocial predictor variables at two time points—baseline (T1) and two-year follow up (T2) to determine the stability of schizotypy and relevant psychosocial variables between T1 and T2, examine whether cross-sectional predictor variables for schizotypy at T1 continued to be significant predictor variables at T2, and whether T1 schizotypy predicted increased schizotypy at T2. Participants consisted of a non-clinical sample of undergraduate and graduate students, and individuals from the community ($N_{T1} = 660$), 406 of whom consented to be recontacted for follow up after completing the baseline assessment between September and December 2018, and who completed the follow up assessment ($N_{T2} = 103$). The study utilized an online survey delivered via the Qualtrics platform from October 2020 to December 2020 and was comprised of the same set of self-report questionnaires used at baseline.

As hypothesized, partial support for the stability of overall schizotypy, schizotypy dimensions (positive, negative, and disorganized), and psychosocial risk factors was found over the two-year period for most variables. Several baseline factors were significantly related to and significantly predicted higher levels of overall schizotypy and schizotypy dimensions at follow up, lending partial support to another hypothesis. Depressive symptoms predicted positive schizotypy, anxiety symptoms predicted negative schizotypy, and negative urgency predicted disorganized schizotypy. Moreover, negative urgency, depressive symptoms, a history of one or more head injuries, and experiences of emotional abuse during childhood were significantly correlated with higher levels of overall schizotypal traits. However, there were also numerous baseline predictor variables that did not significantly predict overall schizotypy and schizotypy dimensions at follow up. A third hypothesis was also partially supported, as several baseline variables predicted significantly increased follow up schizotypy scores. However, both dimensional and overall schizotypal traits decreased over a two-year period.

The current study expands understanding of the association between schizotypy and multiple candidate risk factors and suggests that a constellation of several psychosocial factors have utility for predicting schizotypy over time. Early intervention efforts can target these factors, as they may hold particular promise for decreased risk of conversion to psychosis given their consistent association with increased schizotypal traits over time. Future research could address key limitations of this study, including the use of a convenience sample, self-report measures versus diagnostic assessments, and a longer follow up period with additional assessment timepoints. Additional study implications, limitations, and future directions are discussed.

Keywords: schizotypy, risk, psychosis, schizophrenia, trauma, nonclinical

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Chapter 1: Introduction

Background

Schizotypy is a multidimensional construct that refers to a constellation of cognitive and personality symptoms, impairments, and experiences thought to lie on a dynamic continuum for psychosis, which place an individual at increased risk for developing schizophrenia spectrum disorders (Barrantes-Vidal et al., 2015; Claridge, 1997; Raine, 2006). As such, it has been suggested that schizotypy is a normal, latent dimension of personality found in non-clinical populations that manifests in a variety of ways and is related to a particular vulnerability or predisposition for the development of psychosis and related disorders (Raine, 2006; Siddi et al., 2017). Schizotypy is believed to occur in approximately 10% of the general population and about 10% of those individuals will convert to a schizophrenia spectrum disorder (Lenzenweger, 2006; Meehl, 1990). The expression of schizotypy varies along a continuum of psychosis from non-clinical; to subclinical, prodromal, and high clinical risk levels; to clinical and severe psychosis—which is dependent on a number of biopsychosocial factors and their interactions (Kwapil & Barrantes-Vidal, 2015). The assumption is that these states on the continuum share similar underlying etiologies and that their differences and potential progression are indicative of the degree or severity of symptomatology, rather than qualitative changes (Barrantes-Vidal et al., 2020).

For over three decades, schizotypy has been conceptualized as having etiological similarities and presenting a similar factor structure to schizophrenia, which include positive (e.g., hallucinations, delusions, odd beliefs, magical thinking, unusual perceptual experiences, suspiciousness, paranoia, emotional dysregulation); negative (e.g., anhedonia, social withdrawal, constricted affect, absence of intimate personal relationships); and disorganized dimensions (e.g.,

disinhibition, disturbances in comprehensible thinking processes, eccentric, erratic, or bizarre

behavior and speech; American Psychiatric Association, 2013; Barrantes-Vidal et al., 2013;

Fonseca-Pedrero et al., 2018; Kwapil et al., 2018; Kwapil & Barrantes-Vidal, 2015). The

positive and negative facets have been the most reliably replicated in the literature. For example,

Kwapil et al. (2008) found that in a sample of university students, both positive and negative

schizotypy dimensions were distinctively related to overall schizotypy symptomatology,

schizophrenia spectrum psychopathology, and other types of impairment (e.g., social

functioning, substance abuse, mood disorders). Since all three dimensions have variable patterns

of both symptoms and impairment, it is crucial to consider the multidimensionality of schizotypy

to determine the developmental pathways of risk and resilience for psychotic disorders (Debbané

& Barrantes-Vidal, 2015).

Conceptual Models of Schizotypy

Beginning with Bleuler (1911), schizophrenia-like but non-psychotic subclinical

symptoms were observed in relatives of individuals with schizophrenia (Lenzenweger, 2006).

Following this, Rado (1953) introduced the term schizotype to not only illustrate the

schizophrenic phenotype, but also to acknowledge that impairments could be observed across a

continuum of schizophrenic-like symptomatology related to a vulnerability towards

schizophrenia spectrum disorders. Influenced by these continuum theories of psychosis, Meehl

(1962, 1990) developed a model of schizotypy where persons with a latent genetic vulnerability

for schizophrenia spectrum disorders exhibit schizotypal traits along a progressive continuum of

increasing severity (e.g., healthy, subclinical, prodromal, to fully developed schizophrenia

spectrum disorders) depending on the interaction between both their developmental history and

numerous psychosocial risk factors (e.g., age, biological sex, trauma, substance use).

The "fully dimensional" view of schizotypy was similar to Meehl's model (1962, 1990) in that it too emphasized a continuum of psychosis; however, it largely emerged from Eysenck's (1960) theory where clinical psychotic disorders are at the extreme point of a continuum of normal personality traits, which embodies an underlying dimensional vulnerability for schizophrenia spectrum disorders. Influenced by Eysenck's (1960) theory, Claridge's (1985) model of schizotypy recognized an array of stable personality characteristics that are commonly found in the general population and related to risk for psychosis (Grant et al., 2018). In this model, Claridge (1985) suggested a threshold between theoretically healthy and afflicted persons along a schizotypy–schizophrenia continuum where schizotypal traits signify both adaptive and dysfunctional alterations in personality, which renders them necessary but not sufficient on their own for the development of schizophrenia spectrum disorders (Claridge, 1985; 1997). This model emphasized how extreme psychopathology, such as schizophrenia spectrum disorders, reflects exaggerated self-regulatory systems, which arise from basic human characteristics. As such, schizotypy serves as a midpoint, or bridge, to the more severe psychotic disorders.

Schizotypy and Schizophrenia: What's the Connection?

Schizotypy has its origins rooted in the observations of relatives of individuals with schizophrenia spectrum disorders, as some family members display psychotic symptomatology themselves to a lesser degree (Kwapil & Barrantes-Vidal, 2015). The conclusion that schizotypy and schizophrenia spectrum disorders often occur within the same family unit suggests that the conditions are mutually inheritable (Baron et al., 1983; Kendler et al., 1996; Mata et al., 2003). These characteristics are viewed as phenotypic indicators associated with a genetic vulnerability to schizophrenia spectrum disorders (Meehl, 1962). Further, schizotypy is assumed to reflect an inherited vulnerability to psychopathology generally, which is represented across a wide-ranging

continuum, from subclinical manifestations to severe mental illness (Kwapil et al., 2018;

Lenzenweger, 2010). Additionally, individuals with elevated levels of schizotypy share the same

demographic, clinical, social, environmental, and personality risk factors as those found in

persons with schizophrenia spectrum disorders (e.g., trauma, substance use, biological sex;

Linscott & van Os, 2013).

Research suggests that persons with elevated scores on measures of schizotypy and who

present with significant schizotypal traits appear similar to individuals with clinical psychosis,

although their symptomatology is less severe or dysfunctional, rather than being qualitatively

different (Barrantes-Vidal et al., 2020; Laurens et al., 2007; Myin-Germeys et al., 2002). Some

of the earliest research on schizophrenia spectrum disorders indicates that the impairment that

individuals with psychotic disorders experience leading up to the first episode of psychosis

closely resembles that of schizotypy (Bleuler, 1911; Kraeplin, 1919). Moreover, studies have

demonstrated that having schizotypal traits increases the probability of converting to a psychotic

disorder (Debbané & Barrantes-Vidal 2015). As such, schizotypy offers a valuable and unifying

construct to explore the underlying etiology, development, expression, and course of

schizophrenia spectrum psychopathology (Kwapil & Barrantes-Vidal, 2015; Kwapil et al., 2018)

in general, nonclinical populations, which are free of the common confounds associated with

persons suffering from clinical psychotic disorders (e.g., impact of medications, hospitalizations,

symptom severity, duration of illness, comorbidities, stigma; Barrantes-Vidal et al., 2015; 2020;

Cohen et al., 2015; Denovan et al., 2020; Nelson et al., 2013). Importantly, investigating the

similarities and differences between schizotypy and schizophrenia spectrum disorders may

improve our understanding of the pathways associated with nonclinical and psychopathological

results (e.g., multifinality; Cicchetti & Rogosch, 1996), as well as the risk and protective factors

related to those pathways (Barrantes-Vidal et al., 2015). Moreover, when considering the developmental pathways of schizophrenia spectrum disorders, schizotypal traits typically appear during adolescence, which is similarly true for the timing of the early manifestation of symptoms seen in psychosis (e.g., prodromal symptoms) and may render schizotypy a distal, yet significant indicator of psychosis risk (Debbane & Barrantes-Vidal, 2015). Still, the majority of persons with schizotypy will not transition to a schizophrenia spectrum disorder (e.g., 30% or less convert to psychosis within two years; Barrantes-Vidal et al., 2020; Zhang et al., 2020).

Schizophrenia spectrum disorders place a burden not only on the individual suffering from psychosis, but also on their family and society as a whole (American Psychiatric Association, 2013; Tandon et al., 2008). Thus, it is vital to determine new avenues to detect those at risk for psychosis early in order to intervene prophylactically. An understanding of the etiology of schizotypy allows for the potential identification of the underlying mechanisms associated with liability for psychosis (e.g., risk and resilience factors, developmental pathways), including those that may be responsive to treatment, particularly if identified in the earliest stages (Debbane & Barrantes-Vidal, 2015). Therefore, research on schizotypy can inform prevention efforts, risk assessment, and targeted treatments for both subclinical and clinical psychosis.

Psychosocial Risk Factors Associated with Schizotypy

Demographic Risk Factors

Age and Biological Sex. The psychosis phenotype appears to exist on a continuum, with subclinical psychotic experiences observed in schizotypy being similarly associated with the same risk factors that are seen in schizophrenia spectrum disorders. Age and biological sex are significant variables correlated with the presentation of psychosis in clinical populations

(Linscott & van Os, 2013). There is evidence that biological sex and age are related to the

expression of psychotic symptomatology at both subclinical (e.g., schizotypal traits) and clinical

levels (i.e., schizophrenia spectrum disorders), the former including non-clinical populations

(Linscott & van Os, 2013; McGrath et al., 2015; Spauwen et al., 2003; van Os et al., 2000). In

studies examining age and schizotypal traits, researchers have found that younger age (18 to 29

years old) is associated with higher schizotypy scores and psychotic like experiences,

particularly for positive schizotypy, as these traits are more prevalent in childhood and

adolescence, rather than in adulthood (Fonseca-Pedrero et al., 2011; Goulding et al., 2009;

Linscott & van Os, 2013; Mata et al., 2005). Further, in non-clinical samples specifically, age

has been found to correlate positively with the negative dimension of schizotypy and negatively

with the positive dimension (Mason & Claridge, 2006). Additionally, several studies have

consistently found that schizotypal traits tend to decrease with age (Bora & Arabaci, 2009;

Goulding et al., 2009; Mata et al., 2005; Verdoux & van Os, 2002). The relationship between age

and schizotypy is important because age is one of the most critical factors related to the onset of

psychosis in schizophrenia spectrum disorders. Importantly, psychotic symptomatology tends to

have a differential effect of age on biological sex, such that clinical psychosis occurs at a

younger age for males than females—the onset of psychotic symptoms is often observed during

childhood and adolescence for males, versus later in young adulthood for females (Bora &

Arabaci, 2009), with a second peak (e.g., late-onset) in women between ages 40 and 50 (Folsom

et al., 2006).

Relatedly, biological sex is also an important element in the development of schizotypal

traits in nonclinical populations. Biological sex differences have been reported in several prior

studies and there is consistent evidence demonstrating that schizophrenia spectrum disorders are

associated not only with younger age, but also male sex (McGrath et al. 2004; van Os et al., 2009; Walker et al., 2002), with similar associations found at the subclinical level of schizotypy (van Os et al., 2009). Predominantly, the prevalence of subclinical psychosis (e.g., schizotypal traits) is greater among males in non-clinical populations (van Os et al., 2009). Generally, females tend to score higher than males on the positive schizotypy dimension, specifically hallucinatory experiences, while males experience higher scores on both negative and disorganized schizotypy dimensions (Bora and Arabaci, 2009; Fonseca-Pedrero et al., 2011; Fossati et al., 2003; Kwapil et al., 2008; Linscott & van Os, 2013; Maric et al., 2003; Mason & Claridge, 2006; Miettunen & Jääskeläinen, 2010). Additionally, in a study by Nordentoft et al. (2006), being male and having negative schizotypal traits increased the risk of conversion to a psychotic disorder. These findings are important to highlight because a similar pattern between biological sex and psychotic symptoms is also observed in schizophrenia spectrum disorders. Further, an interaction between age and biological sex in schizotypy exists and is similarly seen in clinical psychosis. Specifically, males have an earlier age of onset (e.g., early adulthood) of schizophrenia spectrum disorders and a poorer prognosis compared to females (van Os et al., 2009). Schizotypal traits have also been reported to occur more frequently in younger males (Bora and Arabaci, 2009). Additionally, a study by Voglmaier et al. (2005) found that females with schizotypal traits had less severe cognitive impairment compared to males. Overall, these observed age and biological sex similarities between schizotypy and schizophrenia spectrum disorders are consistent with the continuum model of psychosis; however, the differences suggest that the severity of and pathways leading to schizophrenia spectrum disorders may differ somewhat between males and females.

Race, Ethnicity, Immigration, and Culture. Country of origin, race, ethnicity, migrant status, and culture have all been identified as risk factors associated with schizotypy (Fonseca-Pedrero et al., 2018; Goulding et al., 2009; Linscott & van Os, 2013; McGrath et al., 2015). These factors also appear to relate to schizophrenia spectrum disorders (Cantor-Graae & Selten, 2005; van Os et al., 2004; 2010). However, the rates of subclinical psychotic symptomatology (e.g., schizotypy) differ across ethnic groups, cultures, and countries of origin (McGrath et al., 2008, 2015; Nuevo et al., 2012). The results from previous studies on race and schizotypy, while relatively rare, have yielded mixed results. Goulding and colleagues (2009) found that race was a significant predictor for the disorganized dimension of schizotypy and that Black/African Americans scored the lowest out of all other racial/ethnic groups on all schizotypy dimensions. Whereas in a study by Chavira et al. (2003) that compared schizotypal traits across three racial/ethnic groups, the highest rates of schizotypal traits were observed in Black/African Americans (28%), followed by White/Caucasians (16%), and Latino/Latinas (11%). It was suggested that the higher prevalence of schizotypal traits observed in this study may indicate that schizotypal pathology manifests differently across various racial/ethnic groups (Anderson, 2020). Furthermore, the likelihood of having at least one psychotic experience or symptom (e.g., hallucinations) worldwide ranges from 0.8% in Vietnam to 31.4% in Nepal, with an average of 12.52% for the total 52 country sample size (Nuevo et al., 2012). Scores on schizotypy measures and the associated dimensions also vary based on country of origin (Fonseca-Pedrero et al., 2015), specifically amongst American and Spanish samples (Fonseca-Pedrero et al., 2017; Kwapil et al., 2012), and within regions with populations comprised of several ethnic groups (Kwapil et al., 2008).

Furthermore, some studies have focused on immigration status as a risk factor for schizotypal traits. In several studies examining psychotic symptoms along the continuum of psychosis, minority position and immigration/migrant status have been found to significantly increase risk for schizotypy and clinical psychosis, and psychotic experiences were also more common among persons belonging to either group (Barrantes-Vidal et al., 2015; Bourque et al., 2011; Linscott & van Os, 2013; van Os et al., 2009). More specifically, first- and second-generation immigrants are at particularly increased risk for the development of a schizophrenia spectrum disorder, which suggests the stress of immigration is not the culprit, rather the adjustment and hardships after migration (e.g., discrimination) may be responsible for increased risk and symptom onset (Bourque et al., 2011; van Os, 2012). Similarly, van Os et al. (2008) found that migrants and ethnic minorities experienced greater levels of subclinical psychosis. Analogously, migrants reported significantly less hallucinatory experiences compared to individuals native to a country in the general population (McGrath et al., 2015). Moreover, van Os and colleagues (2009) conducted a meta-analysis and found that individuals who identified as migrants or ethnic minorities tended to report more psychotic experiences.

Consideration of and awareness to how culture influences the expression and experiences of schizotypal traits—and particularly the emotional attributes/negative schizotypy dimension—is important, as the cultural norms, beliefs, and values across cultures all play a significant role in schizotypy (Cohen et al., 2015). In several studies conducted in the United States, Asian Americans reported higher scores on the negative schizotypy dimension (e.g., no close friends, anhedonia, constricted affect) compared to Caucasian Americans, and Black/African Americans reported lower levels of negative schizotypy compared to Caucasian Americans (Cohen et al., 2009; Kwapil et al., 2002). To explain these findings, Cohen et al. (2015) took a cultural

perspective and proposed that in Asian cultures, peace, adjustment to the environment, and low emotional arousal are highly regarded and expected qualities for a person to have, and a contrast to Western culture which prioritizes emotional expression and an individualistic way of life.

Social, Ecological, and Biological. Further support for a continuum model of schizotypy has been found in research examining social, ecological, and biological risk factors similarities between psychosis and schizotypal traits. Risk factors related to the two constructs include socioeconomic status (Cohen et al, 2008; Linscott & van Os, 2013; McGrath et al., 2015; Nuevo et al., 2012; Read, 2010; Saha et al., 2013); urbanicity (Barrantes-Vidal et al., 2015; Kelly et al., 2010; Krabbendam & van Os, 2005; 2010 Linscott & van Os, 2013; Scott et al., 2009; Stefanis et al., 2004); lower educational attainment (Linscott & van Os, 2013; McGrath et al., 2004;); employment status (Linscott & van Os, 2013; McGrath et al., 2004; 2015); relationship status (Goulding et al., 2009; Linscott & van Os, 2013; McGrath et al., 2004; 2015; Miettunen et al., 2010); birth complications (e.g., nutritional deficiencies, diabetes, infection, low birth weight; Markham & Koenig, 2011; Nelson et al., 2013; Zammit et al., 2009); and a history of mental illness (Linscott & van Os, 2013).

More specifically, the relationship between schizophrenia spectrum disorders and low socioeconomic status have been explored in previous studies (Kelleher & Cannon, 2011; Scott et al., 2006). In several studies, poverty has been observed to be more strongly related to psychotic disorders and schizotypal traits than mental health problems (Hengartner et al., 2013; Read, 2010). Individuals originating from lower/disadvantaged socioeconomic backgrounds reported higher levels of schizotypy and a greater number of psychotic experiences (Ettinger et al., 2015; Linscott & van Os, 2013; McGrath et al., 2015; Nuevo et al., 2012) and were at greater risk for delusional experiences rather than hallucinatory ones (Saha et al., 2013). Higher rates of

urbanicity (e.g., urban residence, urban birth, or urban upbringing) have been found to be strongly associated with schizophrenia spectrum disorders (Krabbendam & van Os, 2005; Vassos et al., 2012) and exhibit a dose-response relationship, in addition to increasing risk for psychosis and psychotic experiences (Binbay et al., 2012; Ettinger et al., 2014; Kelleher & Cannon, 2011; Linscott & van Os, 2013; Pedersen et al., 2001). The urban environment is believed to have the most influence during childhood and adolescence, peak developmental stages, which increase the risk for later manifestations of subclinical psychosis (e.g., schizotypy) and schizophrenia spectrum disorders (Spauwen et al. 2004; van Os et al., 2008). Further, individuals who experience lower educational attainment; who are unemployed (e.g., disabled, homemaker); and who are single/unmarried, divorced, or widowed (versus married) exhibit higher schizotypal symptomatology (Ettinger et al., 2015; Goulding et al., 2009; Kelleher & Cannon, 2011; McGrath et al., 2015; Miettunen et al., 2010; Nuevo et al., 2012; van Os et al., 2008). Additionally, a history of mental illness and treatment have been found to be significant predictors of all three dimensions of schizotypy, with 28.4% of participants indicating such historical factors (Goulding et al., 2009). It was also found that a history of mental illness and treatment were associated with relationship status specifically, where participants in a relationship were less likely to have a history of mental illness or treatment (32.7%) compared to participants who were not in a relationship (e.g., single, divorced, widowed; 23.1%; Goulding et al., 2009). Moreover, Nuevo et al. (2012) found that participants with a previous psychiatric history had significantly more subclinical and psychotic symptoms than participants without a mental health history.

Regarding biological risk factors, prior genetic studies have estimated the heritability rate of schizophrenia spectrum disorders to be approximately 66–83% for biological relatives

(Cardno et al., 1999) and the inherited rate of schizotypy to be about 30–50% (Claridge & Hewitt, 1987; Kendler & Hewitt, 1992; Linney et al., 2003), with the remaining variance explained by psychosocial factors. Evidence for the genetic continuities and shared heritability between schizotypal symptoms and clinical psychotic disorders originates in family studies, which have found that persons with first-degree relatives with a schizophrenia spectrum disorder exhibit more schizotypal traits (Tarbox & Pogue-Geile, 2011), and especially the negative schizotypy dimension, than individuals without a family history of psychosis (Calkins et al., 2004; Goulding et al., 2009; Kendler et al., 1995). Additionally, Vollema and colleagues (2002) found that the positive symptoms of family members with a schizophrenia spectrum disorder were correlated with higher positive schizotypal traits in relatives, similar to the findings of Hanssen et al. (2006) and Mata et al. (2003). Fanous et al. (2001) found a similar pattern for negative symptoms. More generally, Linscott & van Os (2013) found that a family history of mental illness was the "most potent of risk factors" (p. 5) and predicted an increased risk for subclinical psychotic experiences.

Numerous birth complications have also been found to be risk factors for schizophrenia spectrum disorders, as well as for schizotypy (Clarke et al., 2006, 2009; Ettinger et al., 2014; Markham & Koenig, 2011; Nelson et al., 2013; Zammit et al., 2009). These complications include maternal viral/influenza infections during pregnancy, nutritional deficiencies, diabetes, low birth weight, obstetrical complications, elevated stress hormones, and advanced parental age (Lahti et al., 2009; Matheson et al., 2011; Schmitt et al., 2014). These factors have been examined in numerous studies. For example, Machón and colleagues (2002) conducted a study on a large birth cohort in Finland and found that exposure to maternal influenza during the sixth month of pregnancy resulted in offspring experiencing higher levels of schizotypy in adulthood.

Additionally, several retrospective studies found that both obstetric complications and low birth weight were correlated with schizotypal symptomatology (Bakan & Peterson, 1994; Lahti et al., 2009), particularly during childhood and adolescence in adults with schizophrenia spectrum disorders (Foerster et al., 1991). Zammit and colleagues (2009) conducted a longitudinal study on children of mothers who experienced infection, diabetes, and obstetric complications during their pregnancy and found that their children demonstrated increased rates of psychotic experiences. There is also evidence for biological sex effects: males, and particularly those with a schizophrenia spectrum disorder, appear to be more negatively affected by and to have had higher rates of birth complications than females with and without a psychotic disorder (Verdoux et al., 1997; Walker et al., 2002). On the other hand, maternal viral and influenza infections during pregnancy are more strongly associated with schizophrenia spectrum disorders in females than males (Murray et al., 1992).

Socio-Environmental Risk Factors

Trauma and Adversity. One of the most widely researched risk factors for subclinical psychosis is childhood trauma and adversity, and by extension, lifetime traumatic experiences (for reviews, see Matheson et al., 2013, and Varese et al., 2012). Trauma and adversity have been found to have a significant impact on the development and course of schizophrenia spectrum disorders (Gibson et al., 2016; Read et al., 2005; Rössler et al., 2014; Sheinbaum et al., 2020). This is especially true for individuals with a predisposition to psychosis, where childhood trauma and adversity may initiate or worsen the development of psychotic symptoms (Quidé et al., 2021; Tonini et al., 2021; van Os et al., 2008). Specific traumas, and especially sexual abuse, have been found to increase the probability of developing a psychotic disorder over time (Bechdolf et al., 2010; Cutajar et al., 2010). Moreover, individuals with schizophrenia spectrum

disorders have demonstrated an increased prevalence rate of lifetime trauma (Bendall et al., 2008).

In a recent meta-analysis, Varese and colleagues (2012) determined that childhood trauma and adversity—which commonly refer to experiences of physical, emotional, and sexual abuse, physical and emotional neglect, being bullied, or parental loss or separation—significantly influence the risk of developing both subclinical (e.g., schizotypy) and clinical (e.g., schizophrenia spectrum) levels of psychosis. The researchers reported a mean odds ratio of 2.78 for exhibiting psychotic symptomatology after controlling for other variables such as genetics, substance use, and psychiatric comorbidities (Varese et al., 2012; see also Barrantes-Vidal et al., 2015). A cumulative trauma exposure effect (i.e., total number of traumatic experiences) has also been observed for the probability of exhibiting psychotic symptomatology in these and other studies (Shevlin et al., 2007; Van Winkel et al., 2008). Additionally, a study by Kelleher et al. (2013) found that ongoing traumatic experiences increased the risk for emergent psychosis among young adults, whereas an end to cumulative trauma exposure predicted few to no psychotic experiences. Relatedly, several studies have found repeated exposure to childhood trauma and adversity to have overwhelming and often enduring impacts on mental health in the general population, which can have supplementary effects for persons with additional vulnerabilities related to schizophrenia spectrum disorders, such as biological risk factors (e.g., genetics/heritability, birth complications; Anda et al., 2006; Dvir et al., 2013). For instance, the results reported by Varese et al. (2012) suggested that a range of undesirable outcomes in adulthood are associated with childhood trauma and adversity, including an increased risk for psychiatric disorders, escalated lawbreaking and delinquency, and lower levels of educational attainment.

Prior research has also found that increased rates of childhood trauma and adversity are reported by persons with schizotypy compared to control participants (e.g., Berenbaum et al., 2003, 2008; Campbell & Morrison, 2007; Kline et al., 2016; Merckelbach & Giesbrecht, 2006; Rössler et al., 2014; Steel et al., 2009; Quidé et al., 2021). For example, Rössler and colleagues (2014) explored the impact of childhood trauma and adversity on subclinical psychotic symptoms in a general population sample over a 30-year period. The researchers found that those who experienced various trauma and adversities, and especially sexual abuse, were more likely to experience distress over time and schizotypal symptomatology, and particularly during early adulthood, compared to those with no or a single experience of trauma or adversity. Childhood abuse in general has been found to yield a three-fold increase in positive schizotypal traits (Janssen et al., 2004) and physical abuse has been associated with an almost five-fold increase in schizotypy symptomatology (Johnson et al., 2000). Similarly, when considering the dimensions of schizotypy, persons who experienced childhood trauma were 4.82 times more likely to exhibit positive schizotypal symptomatology (e.g., paranoia), with those who reported any type of abuse (e.g., physical, emotional, sexual) being at greatest risk (Velikonja et al., 2015). Further, a history of exposure to childhood trauma and adversity was significantly associated with the positive symptom dimension (e.g., suspiciousness, grandiosity), though affective dysregulation, social withdrawal, and cognitive disorganization (i.e., negative, and disorganized symptoms) have also been observed to correlate with traumatic experiences (Kline et al., 2016; Thompson et al., 2009). In recent studies, researchers found that disorganized schizotypy was positively associated with childhood experiences of physical neglect and sexual abuse, whereas positive schizotypy was associated with physical, emotional, and sexual abuse, and negative schizotypy with emotional neglect. (Dizinger et al., 2022; Thomas et al., 2022).

Merckelbach and Giesbrecht (2006) discussed how a history of trauma may promote the odd perceptions and beliefs experienced by individuals with higher levels of schizotypy and how post-traumatic stress disorder (PTSD) may make a person more vulnerable to psychotic symptomatology, as PTSD can lead to a failure in a person's ability for reality testing. Relatedly, common symptoms associated with PTSD and trauma experiences more generally, such as increased trauma-related intrusions, heightened hypervigilance, pronounced avoidance, and depressed mood have been related to the positive schizotypy dimension for persons with a history of childhood trauma and adversity (Mason, 2015). Kline and colleagues (2016) studied the influence of childhood trauma exposure in a young adult community sample and found that 75% of the sample experienced some type of childhood trauma in their lifetime, and 28% of participants met diagnostic criteria for PTSD.

In a systematic review by Velikonja and colleagues (2015), the researchers identified 25 studies that explored the relationship between childhood trauma and schizotypal traits. The researchers found that all of the included studies provided support for the correlation between schizotypy and at least one type of childhood traumatic experience (ORs of 2.01–4.15; Afifi et al. 2011; Lentz et al. 2010; Velikonja et al., 2015). Furthermore, when exploring how different traumatic experiences impacted the expression of schizotypal traits, the most sizable associations were seen for physical abuse, sexual abuse, and neglect, with ORs that ranged from 1.35 to 6.7 (Afifi et al. 2011; Lentz et al. 2010; Rössler et al. 2007; Steel et al. 2009; Velikonja et al., 2015). Additionally, bullying (both perpetration and victimization) and emotional abuse were found to be strongly related to schizotypy (Afifi et al. 2011; Raine et al. 2011; Velikonja et al., 2015). Further, Berenbaum and colleagues (2008) found that higher levels of schizotypal traits were

more common among males and individuals who experienced emotional abuse or physical neglect.

A primary mechanism thought to connect childhood maltreatment with psychotic symptoms is an individual's attachment style, as this theory suggests both insecure and disorganized styles of attachment are responsible for increased susceptibility from subclinical to clinical psychosis presentations (Korver-Nieberg et al., 2014; Read and Gumley, 2008; Sheinbaum et al., 2020; Williams et al., 2018). Consistent with this theory, several studies have found that physical and emotional childhood maltreatment, which can disrupt secure attachment, related to schizotypy and paranoia, and the positive schizotypy dimension in general (Pearce et al., 2017; Sheinbaum et al., 2014, 2020).

Social Functioning. Impairments in social functioning are an enduring, hindering characteristic of schizophrenia spectrum disorders and often include difficulties in areas such as communication, employment, interpersonal relationships, leisure activities, and involvement in the community (Addington et al., 2008; Pinkham et al., 2007). The impact of social functioning, especially in adolescence, is well established and has been shown to be a significant predictor of adult-onset psychotic disorders (Couture et al., 2006; Schiffman et al., 2015; Tsuji et al., 2013). Miller and colleagues (2002) conducted a study on a clinically high-risk sample (e.g., individuals with first- or second-degree relatives with a schizophrenia spectrum disorder) and found social deterioration to be the factor most strongly associated with conversion to schizophrenia spectrum disorders. Relatedly, among clinically high-risk individuals, 40% evidence poor social outcomes over a three-year period (Carrion et al., 2013).

A significant body of literature has demonstrated that various social and interpersonal deficits are related to both schizophrenia spectrum disorders and schizotypy, and specifically

positive and negative symptom or trait dimensions (Barrantes-Vidal et al., 2015; Kwapil et al., 2008; 2013; McCleery et al., 2016; Minor et al., 2020; Wang et al., 2013b). Social-occupational impairments are also observed in persons with schizotypy (Cohen & Davis, 2009; Fonseca-Pedrero et al., 2010; Jahshan & Sergi, 2007). Kwapil and colleagues (2008) found that both positive and negative dimensions of schizotypy were associated with impaired social functioning and adjustment, and fewer social activities, and that the negative dimension was associated with a decreased probability of having close relationships. Similarly, Kwapil et al. (2013) reexamined data from a 10-year longitudinal study and found that the negative symptoms dimension of schizotypy was associated with poorer social functioning over time (see also Blanchard et al., 2011; Henry et al., 2008). Further, in studies that utilized experience sampling methodology (ESM) to capture daily data from participants, negative schizotypy was associated with reduced social contact and competence in day-to-day life (Barrantes-Vidal et al., 2013; Chun et al., 2017; Kwapil et al., 2012). Several prior studies have found that both positive and negative schizotypy dimensions were correlated with the desire to be alone when with other people, and with reduced social contact (Barrantes-Vidal, 2013; Brown et al., 2008; Kwapil et al., 2012). Additionally, Racioppi et al. (2018) found that higher negative schizotypy at baseline predicted increased levels of social impairment over a three-year period.

Geng and colleagues (2013) explored the trajectory of schizotypal traits in college students over a two-year period and found that individuals high in schizotypy demonstrated significant impairment in both social interaction and social functioning, similar to previous studies (Pagano et al., 2004; Skodol et al., 2005). They also identified trait-level risk factors that predicted a decline in social functioning across time, which included paranoia, anhedonia, lack of emotional expression, and difficulty with prospective memory. Rössler and colleagues (2007)

explored how schizotypal symptoms related to poor social functioning and achievement over a

20-year period. They found that schizophrenia symptoms and schizotypal traits were both

associated with negative social functioning (Rössler et al., 2007). More specifically, schizotypal

traits significantly correlated with interpersonal problems and persons who experienced

persistent, high levels of symptomatology evidenced substantial impairments in social

functioning (Rössler et al., 2007; see also Johns et al., 2004; van Os et al., 2000). Thus, the social

deficits seen in schizotypy may be related to diminished positive, and increased negative, affect

regarding engagement in social activities and situations (Chun et al., 2017; Minor et al., 2020;

Statucka & Walder, 2017; Wastler & Lenzenweger, 2018).

Clinical Risk Factors

Depression and Anxiety. It has been suggested that persons with schizotypy experience

much of the same symptomatology and comorbidities as individuals with schizophrenia

spectrum disorders, including higher rates of both mood (e.g., depression) and anxiety

psychopathology (Campellone et al., 2016; Fekih-Romdhane et al., 2021; Kocsis-Bogar et al.,

2013; Lewandowski et al., 2006; Nelson et al., 2013; Wang et al., 2018). For example, Pulay and

colleagues (2009) found that the prevalence of schizotypal traits for individuals with mood or

anxiety disorders was between 10.7 and 33.1%. Affective dysregulation is well documented

across the psychosis continuum, and particularly for the negative dimension of psychosis, with

symptoms of depression (e.g., anhedonia, blunted affect, avolition, asociality) and anxiety (e.g.,

worry, irritability, difficulty sustaining attention) overlapping with schizotypy and psychotic

disorders, as well as being significant risk factors in the prediction of both schizotypy and

clinical psychosis (Fisher et al., 2013; Kelleher et al., 2014; Schimanski, et al., 2017). Najolia

and colleagues (2012) examined the role of both social anxiety and negative affective states in a

non-clinical sample and found that persons in the high schizotypy group reported increased

social anxiety, levels of depression, increased cannabis use, and trait anxiety than the control

group (see also Brown et al., 2008; Lewandowski et al., 2006). Yet in a study by Barrantes-Vidal

and colleagues (2013), positive schizotypy was found to be significantly associated with both

anxiety and depression, which suggests that the positive dimension of schizotypy may relate to

affective dysregulation and greater negative affect, whereas the negative dimension may relate

specifically to reduced positive affect (see also Barrantes-Vidal et al., 2009; Krabbendam et al.,

2002; Lewandowski et al., 2006).

In longitudinal studies, Racioppi and colleagues (2018) followed a young adult sample

from Barrantes-Vidal et al.'s (2013) study for three years and found that the positive dimension

of schizotypy was associated with and predicted depression, negative affect, and social anxiety.

Chapman and colleagues (1994) also observed an association between affective symptoms and

schizotypy over a 10-year period in a nonclinical sample, finding specifically that individuals

with higher levels of positive schizotypal traits reported higher rates of clinical depression at

baseline and at the 10-year follow up. Further, psychotic symptoms progressed along a

continuum of psychosis and persisted over time as rates of affective dysregulation increased

(Chapman et al., 1994). In another longitudinal study, Wang and colleagues (2018) explored

emotional functioning in schizotypy over an 18-month period. The researchers found that

individuals who experienced chronically high levels of schizotypal traits also had greater

depression and anxiety. Additionally, Bogren et al. (2010) examined schizotypal traits in a

general population sample during a 50-year follow-up study and found that schizotypy, anxiety,

and affective dysregulation were associated with conversion to a psychotic disorder. However,

most recently, Sun and colleagues (2022) found that depression and anxiety were most

associated with disorganized schizotypy, which was demonstrated in several previous studies

that established that the disorganized dimension was a stronger predictor of negative affect than

the positive dimension of schizotypy (Dodell-Feder et al., 2019; Kemp et al., 2018; Kwapil et al.,

2020; Rbeiz et al., 2022).

Depression and anxiety have also been observed in the premorbid and prodromal phases

leading up to schizotypy, both of which seem to increase an individual's risk of converting to a

psychotic disorder (Yung et al., 2003). This finding is important because it suggests that

affective dysregulation and anxiety symptomatology may cause significant distress for an

individual, which can accelerate decompensation and progression along the continuum of

psychosis (Lewandowski et al., 2006). Moreover, in non-clinical individuals who experienced

schizotypal symptomatology, 89% reported comorbid anxiety and depressive symptoms

(Breetvelt et al., 2010). Given evidence of the interplay among schizotypal traits, depression, and

anxiety, and evidence of an association between these symptoms and impaired social functioning

(particularly for depressive disorders), low mood and depression may be vulnerability factors for

both schizotypy and poorer social functioning (Campellone et al., 2016; Hirschfeld et al., 2000;

Lewandowski et al., 2006; McCleery et al., 2012; Wang et al., 2018). Several researchers also

suggest that a "shared variance," or causal relationship, exists amongst depression, anxiety, and

schizotypy (Caspi & Moffitt, 2018; Garety et al., 2001; Sun et al., 2022).

Stress. Schizophrenia spectrum disorders have been conceptualized using a vulnerability-

stress model where an individual's biological makeup creates a vulnerability which may increase

one's sensitivity to stressors (e.g., life events, daily troubles, unfavorable environments, and

situations) that, in turn, increase the risk of manifested psychosis (Bebbington et al., 1993; Day

et al., 1987; Myin-Germeys et al., 2001; Nuechterlein, 1987; Yank et al., 1993; Zubin & Spring,

1977; Zubin et al., 1985). Myin-Germeys and colleagues (2002) proposed a stress-sensitivity model where an atypical sensitivity to stress contributes to a pathway to clinical psychosis. Further, Neuchterlein and Dawson (1984) indicated that both stressful experiences and transient hassles may function as precipitating factors for psychotic symptoms in persons at risk for clinical psychosis. Psychotic symptomatology may develop when an individual's threshold for stress surpasses their coping vulnerabilities (van Winkel et al., 2008). Many studies have found results to suggest that psychosocial stress and everyday life stressors may increase schizotypal traits (Barrantes-Vidal et al., 2013a; Cohen et al., 2008; Geng et al., 2013; Horan et al., 2007; Pagano et al., 2004; Wang et al., 2018), as well as the expression of psychotic symptomatology, including paranoia (Barrantes-Vidal et al., 2013a; Myin-Germeys et al., 2001; 2002; van Winkel et al., 2008).

Barrantes-Vidal and colleagues (2013a) proposed that persons with schizotypy may not only be vulnerable to persistent or extreme stress, but also to the brief effects stress can have. Using ESM in a non-clinical sample, the researchers found that stressful circumstances and social stress were associated with and predicted psychotic and paranoid symptomatology for respondents with high levels of positive schizotypy, and that social stress alone was related to the negative schizotypy dimension and predicted momentary psychotic-like symptoms (Barrantes-Vidal et al., 2013a). These findings were both replicated and expanded upon in a more recent study by Monsonet and colleagues (2021) who also used ESM and found that negative emotions, social appraisals, and stress were predictive of higher levels of psychotic symptomatology and paranoia. Further, daily life stressors were correlated with the concurrent experience of psychotic-like symptoms and paranoia for persons with both high positive and negative schizotypy (Barrantes-Vidal et al., 2013a). For individuals with low levels of schizotypy, stress

may trigger impairment, distress, and psychological symptoms other than psychotic-like symptoms (Barrantes-Vidal et al., 2013a). The finding that positive schizotypal traits are associated with increased moment-to-moment stress sensitivity is similar to results of studies using other methodologies (Barrantes-Vidal et al., 2010; Chun et al., 2017; Kwapil et al., 2008a), and suggests a "psychosis-prone/stress-sensitivity pathway" for the positive schizotypy dimension (Barrantes-Vidal et al., 2013a, p. 1078; Myin-Germeys et al., 2002).

In a study by Horan and colleagues (2007), the researchers found that individuals in the high negative schizotypy group were especially vulnerable to stress, which included perceived stress. Similarly, Grant and Hennig (2020) found that persons with high negative and disorganized schizotypy exhibited increased psychotic symptoms depending on levels of stress. Myin-Germeys and van Os (2007) conducted a study on a general population twin sample and found that higher schizotypy scores were related to increased levels of emotional sensitivity to everyday stressors. van Winkel et al. (2008) suggested that emotional and psychotic reactions to psychosocial stress may come about as a result of previous exposure to cumulative or persistent stressors, which lead to increased sensitivity to minor, daily life stressors. In a study conducted by Wang and colleagues (2018), it was found that individuals in a stable high schizotypy group had fewer constructive coping strategies when they were faced with stress, which may also be associated with the higher levels of depression and anxiety in persons with chronically high schizotypy scores.

Substance Use. Studies have consistently found high rates of substance use in persons with schizophrenia spectrum disorders, with some studies observing nearly 50% of such individuals having a comorbid substance use disorder (Dinzeo & Thayasivam, 2021; Nesvåg et al., 2015; Regier et al., 1990; Toftdahl et al., 2016). Researchers have also explored relationships

between schizotypy and substance use (Barrantes-Vidal et al., 2013b; Kwapil et al., 2008a; 2013). Increased levels of schizotypy have been found to be significantly associated with increased tobacco, alcohol, and cannabis use in non-clinical populations (e.g., Esterberg et al., 2009; Kolliakou & Joseph 2000; Larrison et al., 1999; McGlashan et al., 2000; Nunn et al. 2001; Schiffman et al., 2005; Spriggens & Hides, 2015). For example, Kwapil and colleagues (2013) found that the positive dimension of schizotypy best predicted substance use in a 10-year follow-up study, a finding consistent with several other studies (Barrantes-Vidal et al., 2010; 2013; Kwapil et al., 2008). Additionally, Esterberg and colleagues (2009) examined schizotypy and substance use in a sample of college students and found that higher levels of disorganized schizotypy related to both a greater probability of engaging in substance use (e.g., use of nicotine, alcohol, and cannabis) and initiating substance use at a younger age.

Prior studies have found that individuals who smoke cigarettes report higher levels of schizotypal traits compared to persons who do not smoke (Allan et al., 1995; Joseph et al., 2003; Larrison et al., 1999; Wiles et al., 2006). In one of the few studies examined the association between schizotypy and cigarette use in a college sample, Esterberg and colleagues (2009) found that persons with greater levels of disorganized schizotypy had an increased likelihood of reporting not only use of cigarettes, but also to have smoked cigarettes, within the past 90 days and have smoked more often during the preceding three months. This relationship between higher levels of disorganized schizotypy and increased cigarette smoking has also been confirmed in more recent studies (Dinzeo & Thayasivam, 2021; Stewart et al., 2010), as it may serve as a form of self-medication to decrease the cognitive difficulties individuals high in disorganized schizotypy may face (Kumari & Postma, 2005).

Schizotypy has also been examined with specific regard to alcohol use. Esterberg et al.'s (2009) study found that disorganized schizotypy was predictive of lifetime alcohol use, use in the last 90 days, and increased average daily use over the previous three months. Other researchers have found mixed relationships between alcohol use and schizotypy. In a college sample, Nunn and colleagues (2001) found that alcohol use was correlated with higher positive schizotypy (e.g., delusional experiences), and lower negative schizotypy (e.g., anhedonia). However, Larrison et al. (1999) and Najolia et al. (2012) found that alcohol use was associated with lower positive schizotypy scores. More recently, Dinzeo and Thayasivam (2021) found that alcohol use was decreased in persons with negative schizotypy, possibly due to the nature of having high negative schizotypal traits and subsequently, fewer social interactions.

Although researchers have repeatedly found evidence for an association between cannabis use and schizophrenia spectrum disorders, finding are mixed as to whether cannabis use is related to the onset of psychosis, particularly for individuals at higher risk for the development of psychotic disorders (e.g., persons with schizotypy; Barkus et al., 2006; Bowers et al., 2001; Cohen et al., 2011; O'Tuathaigh et al., 2020; Najolia et al., 2012; Schiffman et al., 2005). Although it is possible that higher levels of schizotypy may increase an individual's risk of cannabis use, cannabis use may in turn increase schizotypal symptomatology. For example, Schiffman and colleagues (2005) explored the direction of the relationship between schizotypy, and cannabis use and found that schizotypal symptoms were a precursor to cannabis use for individuals who indicated cannabis use. Similarly, it was found that individuals who use cannabis and are high in schizotypy are more likely to experience psychotic symptoms and/or transition to full-blown psychosis (Barkus et al., 2006; Kraan et al., 2016; McHugh et al., 2017; Stirling et al., 2008).

Numerous studies have established associations between cannabis use and positive and disorganized schizotypy in nonclinical samples, and especially students (Cohen et al., 2011; Earleywine, 2006; Fridberg et al., 2011; Mass et al., 2001; Nunn et al. 2001; Schiffman et al., 2005; Skosnik et al., 2001). For example, in Najolia and colleagues' (2012) study on cannabis use and schizotypy in an undergraduate sample, the researchers found that individuals high in the positive and disorganized dimensions of schizotypy reported significantly increased cannabis use and cannabis-related problems compared to control participants (see also Cohen et al., 2011). Additionally, both greater use (Cohen et al., 2011; Compton et al., 2007; Esterberg et al., 2009) and longer durations of cannabis use (Fridberg et al., 2011) have been found in persons high in schizotypy. For example, Cohen and colleagues (2011) found that approximately one in four young adults identified as having schizotypy reported cannabis use at least once per week, which was nearly four times that of the comparison group without schizotypal traits. Similarly, Najolia and colleagues (2012) also found that college students high in schizotypy, and specifically positive and disorganized, were significantly more likely to use cannabis and use more frequently (i.e., at least weekly), and had three times the number of cannabis-related problems than students in the control group. Persons high in schizotypy also reported significantly increased rates of social anxiety, depression, and general anxiety disorder relative to controls (Najolia et al., 2012; see also Brown et al., 2008; Lewandowski et al., 2006).

The increased rates of cannabis use and cannabis-related problems in individuals with schizotypy are compatible with the "supersensitivity model" (Najolia et al., 2012, p. 1) of substance use in schizophrenia spectrum disorders. This model suggests that persons with schizophrenia spectrum disorders are more likely to manifest substance use issues as a result of the impaired cognitive functioning and sensitivity to stress inherent in psychotic disorders

(Gregg et al., 2007; Mueser et al., 1998; Najolia et al., 2012). Considering the fundamental similarities and overlap in symptomatology between schizotypy and schizophrenia spectrum disorders, including impairments in cognition, social functioning, and emotion-processing, individuals with schizotypal traits are more likely to experience increased cannabis-related problems (e.g., Aguirre et al., 2008; Brown & Cohen, 2010; Kerns, 2006; Najolia et al., 2012).

Antisocial Behavior. Many studies have observed an association between schizophrenia spectrum disorders and antisocial behavior (Douglas, Guy, & Hart, 2009; Fazel et al., 2009; Schug et al., 2007; Silverstein et al., 2015; Swanson et al., 1990). However, studies exploring the associations between schizotypy, and antisocial behavior are fewer, and the causal factors of this relationship remain uncertain (Lam et al., 2015; Serper, 2011). In the few available studies using college, adolescent, or sex offender samples, higher scores on self-report measures of criminality, violence, and aggression have been observed for individuals with schizotypy, and particularly for the positive dimension (e.g., paranoid ideation; Fonseca-Pedrero et al., 2018; Jung & Jamieson, 2012; Mason et al., 2012; Raine, 1991, 2006; 2013; Schaub et al., 2006; Stefanis et al., 2004). Subclinical psychotic experiences have also been observed to be associated with increased rates (1.4 to 15.2 times) of contact with law enforcement and imprisonment (Mojtabai, 2006; Rössler et al., 2007; Silverstein et al., 2015).

In a recent study within two prisons by Apostolopoulos and colleagues (2018), the researchers found that males with schizotypal traits were ten times more likely to have formerly been charged with a violent crime (e.g., murder) than males without or lower in schizotypal traits. Dolan and colleagues (1995) earlier found increased rates of schizotypal traits among forensic samples (29%) compared to general population samples. Similarly, an increased rate of schizotypal traits, and specifically the positive and disorganized dimensions, have been observed

in violent and nonviolent offender groups (Mason et al., 2012). Siever et al. (1991) reported a median prevalence rate of 19% for antisocial behavior among persons exhibiting schizotypal traits across seven studies. Dinn et al. (2002) explored antisocial personality traits in college students and found that individuals with positive schizotypy also had higher antisocial behavior ratings. Raine (2013) found that individuals exhibiting schizotypal traits encompass a small group, yet one with an increased risk for committing crimes and perpetrating violence and aggression.

Personality Risk Factors

Impulsivity. Several schizotypy conceptualizations also include impulsivity as an element, specifically "impulsive nonconformity," which represents issues with emotional and impulse control (Mason et al., 1995; 2005; 2012; Ragsdale et al., 2013). Prior research has found that schizotypy relates to a number of risk-taking behaviors (Burch et al., 2006; Gooding et al., 1999; Smyrnis et al., 2003), urgency (i.e., emotional impulsivity; Denovan et al., 2020), and impaired inhibitory control (Breeze et al., 2011; Ettinger et al., 2015; Rosell et al., 2014). Smith and Cyders (2016) defined urgency as "rash, impulsive actions when highly emotional" (p. 11). There is both positive and negative urgency—i.e., impulsivity that occurs under experiences of positive affect or negative affect, respectively (Howard & Khalifa 2016; Lynam et al. 2006). Denovan and colleagues (2020) found the positive and disorganized schizotypy dimensions related to risk-taking behavior and that total schizotypy scores were positively associated with measures of urgency, an association found in previous studies (Few et al., 2015).

Dinn et al. (2002) found associations among impulsivity, empathy, and schizotypy in college students, where persons with schizotypy had higher scores on impulsivity measures and lower scores on measures of empathy compared to a matched control group. Furthermore, higher

disinhibition, impulsivity, and antisocial behavior scores predicted positive schizotypal traits

(Dinn et al., 2002). A study by Smyrnis and colleagues (2003) found that persons high in

schizotypy found it difficult to control their impulsivity during a behavioral task, as an

individual's amount of urgency may prompt risk-taking behavior (see Cyders et al., 2015;

Wardell et al., 2016).

Impulsivity is also a commonly observed trait in psychopathy, and impulsivity has been

observed to relate to violent and aggressive behavior among persons with schizophrenia

spectrum disorders (Anderson, 2020; Hoptman, 2015; McDermott & Holoyda, 2014; Nolan et

al., 1999). Raine (1992) suggested that impulsivity may explain the shared variance between

psychopathy and schizotypy with respect to aggression (see also Chapman et al., 1984; Kendler

& Hewitt, 1992; Raine, 2006). Ragsdale and Bedwell (2013) found that total scores on measures

of psychopathic and schizotypal traits were associated, but especially the self-centered

impulsivity characteristic of psychopathy. Anderson (2020) suggested that both paranoia and

impulsivity—which have been consistently associated with schizotypy, schizophrenia spectrum

disorders, and psychopathy (Hoptman, 2015; Hoptman et al., 2014; Krakowski & Czobor, 2017;

Raine, 2013)—may further explain aggression and violent among these groups.

Empathy. Global disturbances in empathy have frequently been observed among

individuals with schizophrenia spectrum disorders (e.g., lower cognitive empathy; Cohen et al.,

2015; Henry et al., 2008; Montag et al., 2007; Smith et al., 2012; Yang et al., 2020). Cohen and

colleagues (2015) describe empathy as "interpreting and reacting to the experiences of others"

(p. 429), in addition to highlighting how empathy is essential to social functioning. Empathy is a

multidimensional concept that includes both cognitive and emotional elements, and which

involves having both basic mental models of the self and others and the ability to properly

distinguish between the two (Cohen et al., 2015). Affective empathy refers to an individual's ability to respond with a fitting emotion to the mental or emotional state of another person, whereas cognitive empathy describes a person's capability to understand another's mental state and take their perspective (Henry et al., 2008). Henry and colleagues (2008) emphasized that deficits in either or both types of empathy can result in the social idiosyncrasies commonly found in persons with schizophrenia spectrum disorders. Further, Smith and colleagues (2012) noted that disruptions in empathy allow for the study of the mechanisms related to social cognition and the effects these deficits may have on the social functioning of persons with psychosis, particularly because the development of social skills and positive experiences tend to be contingent on one's empathic capacity and skills (Henry et al., 2008). Persons with schizophrenia spectrum disorders have been shown to have lower levels of cognitive empathy compared to healthy controls (Brüne, 2005; Henry et al., 2008; Montag et al., 2007; Smith et al., 2012).

Previous studies have also found a relationship between schizotypy and deficits in empathy (Henry et al., 2008; Thakkar & Park, 2010). Henry and colleagues (2008) found that positive schizotypy was related to lower reports of cognitive empathy. Additionally, in non-clinical samples, persons with increased negative and disorganized schizotypy yielded lower levels of empathy generally—both cognitive and affective—as well as increased negative affect and impaired social functioning (Henry et al., 2008; Thakker & Park, 2010; see also Bedwell et al., 2014; Wang et al., 2013a, 2015). Yang and colleagues (2020) found similar patterns between schizotypy and empathy. Both cognitive and affective empathy were found to be negatively associated with the negative dimension of schizotypy (e.g., difficulty expressing feelings; Yang et al., 2020), findings also confirmed by a recently conducted network analysis in the general population (Wang et al., 2020).

Aggression and Violence. An association between schizophrenia spectrum disorders and aggression and violent behavior have been well documented (Fazel et al., 2009; Silverstein et al., 2015; Swanson et al., 1990; Volavka & Citrome, 2011). For example, Douglas and colleagues (2009) conducted a meta-analysis and discovered that psychosis was associated with a 49% to 68% increase in the odds of aggressive and violent behavior, in comparison to individuals without any psychopathology, for whom the overall rate of aggression and violence was much lower (2.1% to 5.3%; Fazel et al., 2009; Swanson et al., 1990). A significant portion of the research on the relationship between schizophrenia spectrum disorders and aggression and violent behavior has focused on positive psychotic symptoms (McGregor et al., 2012). However, the relationship between schizotypal traits and aggression and violence has been less often studied.

Though the literature is limited, researchers have begun to explore whether the aggressive-violence relationships found in schizophrenia spectrum disorders extend downward to the nonclinical level of schizotypy in samples of both youth and adults (Chung et al., 2016; Lam et al., 2016; Raine et al., 2011; Seah & Ang, 2008). Subclinical experiences, such as schizotypy, are associated with a fivefold increase in risk for interpersonally aggressive or violent behavior—manifesting in increased rates of such behaviors (1.4 to 15.2 times) relative to individuals without a psychiatric diagnosis (Mojtabai, 2006; Rössler et al., 2007; Silverstein et al., 2015). In a study by Raine et al. (2006), the researchers found that both reactive (irritant-prompted) and proactive (planned) aggression related to schizotypy in a sample of adolescent males. Seah and Ang (2008) found that only reactive aggression predicted schizotypy in adolescents. Raine and colleagues (2011) found that schizotypy was positively associated with both total and reactive aggression in a sample of Asian youth, though the association was

strongest for reactive aggression (Raine et al., 2011). The researchers also found that peer victimization partially mediated the schizotypy-aggression relationship.

Similar findings have been reported in studies conducted with undergraduate students (Chung et al., 2016; Lam et al., 2016), which suggests that individuals with schizotypy are not only at an increased risk for experiencing peer victimization (e.g., individuals with schizotypal traits may be more prone to feel and discern being victimized by others, as well as attract victimization due to their unusual behavior), but also at increased risk for reactive aggression as a result of such victimization. Chung and colleagues (2016) found that the relationship between schizotypal traits and reactive aggression was strongest for the positive and disorganized dimensions of schizotypy. Similarly, Le et al. (2018) found that the disorganized dimension of schizotypy was related to higher aggressive urges and that individuals with high levels of negative affect also experienced increased aggressive urges if they had elevated negative schizotypal traits. Anderson (2020) reported that the effect sizes observed in primary studies ranged from small to large and depended in part how psychosis was measured. For example, Mason et al. (2012) predicted aggression and violence with measures of unusual experiences ($d =$ 0.92) and cognitive disorganization ($d = 1.16$), whereas Raine et al. (2006), Seah and Ang (2008), Raine et al. (2011), Chung et al. (2016), and Lam et al. (2016) used schizotypy measures (ds = 0.23–.87).

Psychopathy. It has long been suggested that psychopathy and schizophrenia spectrum disorders may not only be related, but lie on the same spectrum (Cleckley, 1941), even if two separate diagnostic constructs (Bonogofsky, 2007; Eysenck, 1960; Raine, 1986). Psychopathy is estimated to be observed in 1% of the population and includes features such as superficial charm, lack of remorse or shame, antisocial behavior, and a lack of emotional expression (Bonogofsky,

2007; Cleckley, 1941; Hare & Hart, 1993), Prior research supports an association between psychopathy and psychotic disorders, with some studies reporting comorbidity prevalence rates of between 17 and 19% (Nolan et al., 1999; Rasmussen & Levander, 1996). Other studies suggest that the comorbidity may be one pathway related to aggressive and violent behavior among persons with psychosis (Abushua'leh & Abu-Akel, 2006; Bo et al., 2011; Nolan et al., 1999; Silverstein et al., 2015; Volavka & Citrome, 2008). However, it is unclear whether a relationship between psychopathy and psychosis extends to the subclinical level of schizotypy, as this research remains underdeveloped and has primarily utilized forensic samples (Raine, 2011). Nevertheless, theoretical overlap between psychopathy and negative schizotypal traits, such as anhedonia and constricted affect, have been noted (Anderson, 2020).

Raine (1992) found higher levels of schizotypal traits in persons with moderate to high levels of psychopathy in a forensic sample. Rogers and colleagues (2007) examined correlations between Psychopathy Checklist-Revised (PCL-R; Hare, 2003) scores and schizotypal symptoms and found that schizotypy was positively related with Factor 1 scores—the interpersonal and affective dimension of psychopathy (e.g., manipulative, lack of empathy). In a similar study, Klipfel and colleagues (2017) examined dimensional schizotypy scores and PCL-R ratings in an incarcerated sample. They found that schizotypal traits were associated with total PCL-R scores and Factor 2 scores—the antisocial lifestyle dimension of psychopathy (e.g., irresponsibility, criminality; see also Klipfel, 2018).

Ragsdale and Bedwell (2013) examined the comorbidity of schizotypy and psychopathy in a college sample and hypothesized that impulsivity may explain a relationship between them. The researchers found that psychopathic and schizotypal traits were associated with total scores on both self-reported schizotypy and psychopathy (Ragsdale & Bedwell, 2013); however, this

relationship was thought to be driven by the self-centered impulsivity facet of psychopathy, commonly associated with Hare's (2003) PCL-R Factor 2. This finding may explain several of the features typically found in a subgroup of persons with schizotypy, particularly the positive dimension (e.g., suspiciousness, lack of close friends, odd beliefs), in addition to the negative and disorganized dimensions (Ragsdale et al., 2013). Based on the evidence to date, particular psychopathy dimensions may be related to particular schizotypy dimensions. Positive schizotypal traits seem to be related to the Factor 2 component of psychopathy (e.g., antisociality), whereas negative schizotypal traits tend to be positively correlated with the Factor 1 component of psychopathy (e.g., affective; Anderson, 2020).

In addition, Anderson (2020) proposed that impulsivity and paranoia, experiences common to psychopathy, schizotypy, and schizophrenia spectrum disorders, may reflect important explanatory and predictive factors for aggression and violence across these groups (see Fonseca-Pedrero et al., 2018; Hoptman, 2015; McDermott & Holoyda, 2014; Nolan et al., 1999; Raine, 2013; Stefanis, 2004; Walsh, 2013). Several studies have demonstrated that when psychopathy co-occurs with psychotic symptoms, there is a significant increase in the likelihood of aggression and violence (Nolan et al., 1999; Tengstrom et al., 2000). Tengstrom and colleagues (2004) proposed that psychopathy is the most important factor when explaining aggressive and violent behavior in schizophrenia spectrum disorders, and Rasmussen et al. (1995) indicated that psychopathy has the ability to discriminate between persons with psychosis who do and do not exhibit aggression and violence. Although aggression and violence are not defining features of psychopathy nor schizotypy; these outcomes may instead be predicted based on certain specific traits (Raine, 1991; 2013; Walsh, 2013). Appelbaum et al. (2000) observed

that psychopathy scores were correlated with future aggressive and violent behavior; symptoms

of psychosis standing alone were not.

Longitudinal Studies and Schizotypy Trajectories

Longitudinal studies exploring schizotypy trajectories across a psychosis continuum have

been rare, such that it remains unclear how schizotypy may relate to conversion to psychotic

disorders. In a review by Debbane and colleagues (2015), only six longitudinal reports of

schizotypy in the general population—three of which relied on the same sample—were

identified. A longitudinal study by Chapman and colleagues (1994) examined schizotypy in

college students over a ten-year period and found that participants with elevated levels of

positive schizotypy had increased rates of schizophrenia spectrum disorders at follow up. Using

the same data, Kwapil (1998) found that individuals with schizotypy, and particularly those with

high social anhedonia scores (24%), also had elevated rates of clinical psychosis at the ten-year

follow up relative to the control group (1%), which suggests that social anhedonia may be a

predictor of schizophrenia spectrum disorders. Analogously, Kwapil and colleagues (2013)

reanalyzed the Chapman et al. (1994) data by calculating dimensional scores for both positive

and negative schizotypy using the participants' original scores on the Wisconsin Schizotypy

Scales and found that positive and negative schizotypy were both associated with the

development of schizophrenia spectrum disorders at ten-year follow up.

In one of the few studies conducted independent of the Chapman et al. (1994) data,

Gooding and colleagues (2005) reported increased rates of schizophrenia spectrum disorders for

individuals high in social anhedonia over a five-year period. Bogren et al. (2010) examined the

association of personality traits with the occurrence of psychotic disorders in a 50-year follow-up

sample and found that schizotypal traits were significantly related to clinical psychosis diagnoses

50 years later. Barrantes-Vidal and colleagues (2013) conducted a longitudinal study on schizotypy in college students and found that positive schizotypy was associated with psychotic symptoms and both positive and negative dimensions were related to impaired functioning, negative symptomatology, and increased schizotypal traits. More recently, Racioppi et al. (2018) used Barrantes-Vidal and colleagues' (2013) non-clinical sample of young adults to examine the predictive utility of both positive and negative schizotypy on symptomatology and functioning over a three-year period. The researchers found that negative schizotypy was predictive of impaired functioning and schizotypal traits, whereas positive schizotypy was predictive of schizophrenia spectrum psychopathology (Racioppi et al., 2018).

Geng and colleagues (2013) observed changes in schizotypal traits in college students using latent class growth analysis in a two-year follow-up study. The researchers identified three different trajectory classes of schizotypy: a low group which had the lowest schizotypy scores that steadily decreased over time, a high group which had the highest schizotypy scores that gradually increased over two years, and a medium group which had moderate schizotypy scores that persisted over time. Wang and colleagues (2018) also conducted a study using latent class growth analysis to examine the different trajectories of schizotypy in college students over the course of 18 months and found four different groups. The first group was a non-schizotypy group of individuals who had low schizotypal scores across time (72%), the second group evidenced low schizotypal scores at baseline but had significant increases in scores by the 18-month follow up, the third group had high schizotypal scores consistently across all follow-up assessments (5%), and the fourth group demonstrated a steady increase in schizotypal scores across time.

Current Study

Relatively few studies have examined the stability of schizotypy over time, or the prospective predictive validity of a wide range of risk factors concurrently for schizotypy. More such research is needed for a better understanding of temporal changes in schizotypy, to inform developmental models of schizophrenia spectrum disorders, and to aid prognoses. The present study is an exploratory investigation of schizotypy and candidate psychosocial predictor variables at two time points—baseline (T1) and two-year follow up (T2)—to replicate and extend prior research on risk factors for schizotypy and the stability of schizotypy over time.

The current study expands upon prior research on schizotypy in several ways, including by use of a non-clinical sample to complement prior studies that used clinical samples (toward a more generalized understanding of psychotic-spectrum symptomology beyond extreme clinical samples); inclusion of numerous study variables (schizotypy and candidate predictor variables), which supplement prior studies that focused on a narrower range of variables; and utilization of a prospective design, which complements prior cross-sectional studies. Although the use of a shorter follow-up period than some prior prospective studies makes it less likely that schizophrenia spectrum disorders will be reflected in the current sample (cf., Barrantes-Vidal, 2013; Bolinskey et al., 2017; Chapman et al., 1994; Gooding et al., 2005; Kwapil, 1998; 2013; Racioppi et al., 2018), the shorter timeframe can help to identify relatively proximal changes of conceptual interest.

Study Aims

Aim 1. Investigate the stability of schizotypy and relevant psychosocial variables between baseline and two-year follow up.

Aim 2. Examine whether cross-sectional predictor variables for schizotypy at baseline continue to be significant predictor variables at two-year follow up.

Aim 3. Determine whether baseline schizotypy scores, and baseline psychosocial variables, predict increased schizotypy scores at follow up.

Study Hypotheses

Hypothesis 1. Based on prior baseline analyses, significant, strong positive correlations (i.e., bivariable associations) would be observed between baseline and follow up scores for the following variables: overall schizotypy and schizotypy dimensions, traumatic event exposure, substance misuse, impulsivity, aggression, negative affect, impaired social functioning, delinquency, psychopathy, and empathy, evidencing support for strong two-year stability. Additionally, the mean difference between scores from baseline to follow up would not be statistically significant ($p > .05$) for all variables listed above, which would further demonstrate two-year stability.

Hypothesis 2. Significant correlations between predictor variables for overall schizotypy and schizotypy dimensions (positive, negative, and disorganized) at baseline would also be significantly associated with, and significantly predict, overall schizotypy and schizotypy dimensions at follow up (i.e., in multivariable models). Thus, baseline predictor variables would remain significant predictors at follow up for all schizotypy models. Relatedly, few to no non-significant variables from baseline overall schizotypy and schizotypy dimension models would significantly predict schizotypy and schizotypy dimensions at follow up.

Hypothesis 3. Dimensional and overall schizotypy scores at baseline would be significantly associated with increased dimensional and overall schizotypy scores at follow up. Specifically, higher baseline scores would be associated with increases in schizotypy scores at

follow up. Additionally, significant baseline psychosocial predictor variables for schizotypy

dimensions and overall schizotypy would be significantly associated with and significantly

predict whether overall schizotypy and schizotypy dimensions increased at follow up.

Chapter 2: Method

Participants and Procedure

The Montclair State University Institutional Review Board approved modifications to the baseline study protocol before participant follow up began in September 2020. After completing the baseline survey, a total of 406 participants (61.5%) consented to be contacted again for follow up. The follow-up (T2) sample size consisted of 103 participants, a 25.4% response rate, which is considered to be an acceptable rate (see Van Mol, 2017). Participants consisted of a non-clinical sample of undergraduate and graduate students, as well as individuals from the community. The inclusion of graduate students and individuals from the community is due to the time elapsed since baseline (two years), as participants may have graduated or started other degree programs by T2. There was no formal screening of participants for inclusion in the study. After information was gathered from all responding participants, the data were examined to identify which participants met exclusion criteria for exclusion from primary analyses.

Baseline and two-year follow-up data were used for the current analyses. The two-year follow-up measurement occurred between September 2020 when the first participants were enrolled and December 2020 when the last enrolled participant completed the study. Earlier, after completing baseline measurement between September and December 2018, participants were asked whether they would be interested in contributing to follow-up studies, and if so, to provide an email address at which they could be contacted in the future. Online follow-up measurement of participants took place via an IRB-approved email for individuals who provided an email address and consented to be contacted for follow up. Participants were first contacted for follow up by email in September 2020, the beginning of the two-year period. These individuals were asked if they were interested in participating in a follow-up study exploring

factors associated with schizotypy and which variables change and have a relationship with

higher levels of schizotypy over time. For these participants, the survey was distributed via an

anonymous Qualtrics link to maintain security and confidentiality. The email also included each

participant's anonymous ID for the study. A second email was sent to participants who agreed to

be recontacted in October 2020, for various reasons (e.g., reminder, missed the original email)

toward maximizing the follow-up response rate. The T1 participants who did not consent to be

recontacted ($N = 254$) were not sent an email soliciting their participation in the follow-up study.

The study utilized an online survey delivered via the Qualtrics platform. The survey took

approximately 45 to 60 minutes to complete and consisted of all the study measures. At the end

of the survey, individuals chose whether to be entered into a lottery for one of three $100.00

Amazon gift cards. Participants were required to read and electronically sign an IRB-approved

online consent form before proceeding to completing the online study measures. Following the

completion of the informed consent procedure, participants provided their anonymous ID, basic

demographic information, and completed the same set of self-report questionnaires as they did at

baseline. Cloud-based Qualtrics data were exported to local data files for data cleaning and

analysis.

Measures

Demographic Form

A demographic form was created to collect information about participants' age;

biological sex; race; marital status; level of education; parental educational attainment; personal

mental health history; perinatal birth complications; urbanicity; socioeconomic status of the

neighborhood in which they were raised; history of parental separation, divorce, death, or

removal from home before age 18; family diagnoses of mental illness (including having a first-

degree relative with a serious mental illness); household history of alcohol, drug abuse, or incarceration; history of head injury; current living situation; and employment status.

Schizotypal Personality Questionnaire–Brief Revised (SPQ-BR)

The Schizotypal Personality Questionnaire–Brief Revised (SPQ-BR; Cohen et al., 2010) consists of 32 self-report items to measure schizotypy in non-clinical samples. The SPQ-BR is scored using a 5-point Likert-type response format from 0 (Strongly disagree) to 4 (Strongly agree) with items posed as statements or questions about oneself (e.g., "I often hear a voice speaking my thoughts aloud;" "Do you sometimes feel that other people are watching you?"). The SPQ-BR includes seven trait subscales, which comprise three higher-order (i.e., superordinate) factors (dimensions), which include positive (Ideas of References/Suspiciousness, Magical Thinking, Unusual Perceptions); negative (No Close Friends/Constricted Affect, Social Anxiety); and disorganized (Eccentric Behavior, Odd Speech) schizotypal traits. In addition to a total score, the SPQ-BR yields separate scores for each of the three dimensions, where higher scores indicate greater schizotypy symptomatology. The scores for the positive, negative, and disorganized subscales range from 0–56, 0–40, and 0–32, respectively. Total scores can span from 0–128. The instrument has shown good internal consistency ($\alpha = 0.91$), retest reliability ($r = .82$), and criterion validity ($r = .68$; see Callaway et al., 2014; Raine, 1991; Wuthrich & Bates, 2005). Results regarding the SPQ-BR's construct validity have been variable, with the positive superordinate factor (e.g., Cognitive-Perceptual Deficits) having the strongest support in prior studies (see Callaway et al., 2014; Davidson et al., 2016).

Childhood Trauma Questionnaire–Short Form (CTQ-SF)

Childhood trauma exposure was measured using the Childhood Trauma Questionnaire–Short Form (CTQ-SF; Bernstein et al., 2003), a 28-item retrospective self-report measure used to

rate the severity of five forms of abuse and maltreatment during childhood and adolescence. The types of maltreatment include emotional abuse (e.g., "People in my family said hurtful or insulting things to me"), emotional neglect (e.g., "I felt loved"), physical abuse (e.g., "People in my family hit me so hard that it left me with bruises or marks"), physical neglect (e.g., "My parents were too drunk or high to take care of the family"), and sexual abuse (e.g., "Someone tried to make me do sexual things or watch sexual things")—each of which are represented by five items. The remaining three items are considered to be a minimalization/denial scale (e.g., "I had the perfect childhood") to test for response style (e.g., identify individuals who may be underreporting their experiences). The item responses are scored on a 5-point Likert-type scale from 1 (Never True) to 5 (Very Often True) and indicate the frequency of specific maltreatment experiences. The individual items for each type of childhood traumatic event exposures are summed to yield subscale scores ranging from 5 to 25, with higher scores demonstrating greater traumatic event exposure. Subscale scores computed for each type of childhood traumatic event are then categorized as "None or Minimal," "Low to Moderate," "Moderate to Severe," and "Severe to Extreme" with specific cut-offs for each type of maltreatment experience. Prior research on the CTQ-SF has demonstrated good internal consistency (αs) for each of the subscales across diverse populations (e.g., emotional abuse = .84 to .89; emotional neglect = .85 to .91; physical abuse = .83 to .86; physical neglect = .61 to .78; and sexual abuse = .92 to .95; Bernstein et al., 2003; Thombs et al., 2007); good retest reliability; and convergent, divergent, and criterion validity (Bernstein et al., 2003; Paivio & Cramer, 2004).

Life Events Checklist–5 (*LEC-5)*

To measure other traumatic events a person may have experienced in their lifetime, the Life Events Checklist-5 (LEC-5; Weathers et al., 2013) was used. The LEC-5 is a 17-item self-

report measure that considers exposure to 16 specific events that could potentially lead to feelings of distress or PTSD (e.g., serious accident at work, home, or during recreational activity; fire or explosion; sudden accidental death), as well as one additional item that does not fall into one of the listed experiences yet is considered to be a stressful event. For each traumatic event, responses use a 6-point nominal scale and individuals may choose multiple responses options, if applicable. The differing levels of responses/exposure are "Happened to me," "Witnessed it," "Learned about it," "Part of my job," "Not sure," and "Doesn't apply." There is no scoring protocol for this measure; therefore, a total count of traumatic events endorsed by each participant was calculated. Earlier research on the LEC has provided evidence for sufficient temporal stability, as well as good concurrent validity (Gray et al., 2004).

Michigan Alcoholism Screening Test (*MAST)*

To measure alcohol problems, the Michigan Alcoholism Screening Test (MAST; Selzer, 1971) was used. The MAST is 24-item self-report measure for determining lifetime perceived control of alcohol use (e.g., "Can you stop drinking without a struggle after one or two drinks?"), drinking behaviors (e.g., "Do you drink before noon fairly often?"), consequences of drinking (e.g., "Have you ever been told you have liver trouble? Cirrhosis?"), and other alcohol-related problems (e.g., "Have you ever lost a job because of drinking?"). Response options are dichotomous (i.e., "yes" or "no") and each carries a weight of either 1, 2, or 5 points, with ratings of a 5 considered an alcoholic answer (e.g., "Have you ever attended a meeting of Alcoholics Anonymous?"). Response points are assigned on the basis of whether the item is worded positively or negatively. Item values are summed, and a total score is yielded ranging from 0 to 53, where scores ranging from 0 to 3 indicate non-dependence/social drinking, 4 implies borderline/probable alcohol abuse or dependence, and 5 or more suggests "alcoholic," or a clear

indication of alcohol abuse. The MAST's retest reliability has been found to be excellent (e.g., *r*s = .94 to .97; Teitelbaum & Carey, 2000; Minnich et al., 2018; Zung, 1982); good internal consistency (α = .84; Minnich et al., 2018) and adequate convergent and discriminative validity (Minnich et al., 2018) have also been reported.

Drug Abuse Screening Test (*DAST-10)*

To measure drug abuse, the Drug Abuse Screening Test (DAST; Skinner, 1982) was used. The DAST is a 10-item self-report tool for measuring problems (e.g., "Have you neglected your family because of your use of drugs?") and consequences (e.g., "Have you had medical problems as a result of your drug use?") of drug misuse over the past 12 months. The questions apply to various classes of drugs (e.g., cannabis, cocaine, stimulants, hallucinogens, narcotics, etc.). All items are presented as questions to which participants respond either yes (1 point) or no (0 points), with the number of yes responses summed (except for question 3, "Are you unable to stop abusing drugs when you want to?" where a "No" response receives 1 point). Higher scores indicate a higher degree of problems related to drug abuse and are categorized as follows: No problems reported (score of 0); Low level (score of 1–2); Moderate level (score of 3–5); Substantial level (score of 6–8); and Severe level (score of 9–10). The DAST has demonstrated excellent internal consistency (αs = .88 to .92; Giguere et al., 2017; Skinner, 1982), satisfactory retest, interitem, and item–total reliabilities (moderate to high), and satisfactory validity, specificity, and sensitivity (Yudko et al., 2007).

The Social Functioning Scale (*SFS)*

Originally designed to assess social functioning in schizophrenia spectrum disorders, the Social Functioning Scale (SFS; Birchwood et al. 1990) is a 79-item self-report measure that examines an individual's abilities and performance across seven domains of social behavior:

social engagement/withdrawal (e.g., time spent alone, initiation of conversation, interaction with strangers); interpersonal communication (e.g., number of friends, relationship status, quality of communication); independent performance (e.g., engagement in common activities of independent living in the past three months); recreation (e.g., participating in a variety of common hobbies, interests, and activities over the last three months); prosocial activities (e.g., partaking in a range of common social activities, including sports, during the past three months); independence competence (e.g., ability to perform an array of activities of daily living); and occupation/employment (e.g., capability of maintaining employment, disability, attending a therapeutic day program, attempts to find a job). The SFS consists of various response formats including dichotomous, fill-in-the-blank, and Likert-scale questions (e.g., "Are you in regular employment?"; "What sort of job?"; "How often do you make attempts to find a new job?"). Higher scores are indicative of greater social competence/functioning or more social engagement. All item values for each subscale are summed to yield total subscale scores. Raw subscale scores are then converted to scaled score equivalents. The SFS total social functioning score is computed by summing the seven individual subscale scores. Birchwood et al. (1990) found the SFS to be reliable and valid. Specifically, the SFS demonstrated high internal consistencies, and excellent face, criterion, discriminant, and construct validity (Birchwood et al., 1990).

Depression, Anxiety, and Stress Scale–21 (*DASS-21)*

A combined set of three self-report scales, the Depression, Anxiety and Stress Scale-21 Items (DASS-21; Lovibond & Lovibond, 1995), was used to measure the emotional states of depression, anxiety, and stress. The three 7-item subscales focus on an individual's feelings over the last week. Responses to each statement are made using a 4-point Likert scale ranging from 0

(Did not apply to me at all/Never) to 3 (Applied to me very much or most of the time/Always). The depression subscale assesses hopelessness, dissatisfaction with life, low self-esteem, anhedonia, and loss of interest and motivation (e.g., "I couldn't seem to experience any positive feeling at all"). The anxiety subscale measures somatic symptoms of anxiety, worry, situational anxiety, and experiences with panic (e.g., "I was worried about situations in which I might panic and make a fool of myself"). The stress scale assesses difficulty relaxing, nervous energy, sensitivity, agitation and irritability, overreacting, and feeling restless (e.g., "I found it difficult to relax"). Total scores for each of the three constructs are calculated by summing the scores for the seven relevant subscale items and multiplying them by two. The range of scores for each subscale have recommended cut-off scores to determine the levels of symptomatology which correspond to labels (e.g., normal, mild, moderate, severe, extremely severe) for each scale. Overall, prior studies on the DASS-21 have demonstrated good psychometric properties, including excellent internal consistency (e.g., "Depression $\alpha = .91$ to .97; Anxiety $\alpha = .81$ to .92; and Stress $\alpha = .88$ to .95"; Gloster et al., 2008, p. 2) and satisfactory convergent and discriminant validity (Antony et al., 1998; Brown et al., 1997; Clara et al., 2001; Gloster et al., 2008).

Short Urgency, Premeditation, Perseverance, Sensation Seeking, Positive Urgency, Impulsive Behavior Scale (SUPPS-P)

The Urgency, Premeditation, Perseverance, Sensation Seeking, Positive Urgency, Impulsive Behavior Scale–Short Version (SUPPS-P; Cyders et al., 2014) is a 20-item self-report questionnaire that measures how people act and think across five distinct impulsivity traits. The SUPPS-P was used to measure the multifaceted construct of impulsivity. The negative urgency trait assesses a person's inclination to act impetuously under intense negative emotions (e.g., "When I am upset I often act without thinking"); lack of premeditation evaluates the inclination

to act without thinking (e.g., "I usually think carefully before doing anything"); lack of perseverance explores attention and the inability to stay focused on one thing (e.g., "Once I get going on something I hate to stop"); sensation seeking examines the propensity to pursue new and exhilarating experiences (e.g., "I welcome new and exciting experiences and sensations, even if they are a little frightening and unconventional"); and positive urgency tendency assesses a person's inclination to act impetuously under intense positive emotions (e.g., "Others are shocked or worried about the things I do when I am feeling very excited"). In addition to these five traits, scores for second-order factors can also be calculated (i.e., emotion-based rash action, sensation seeking, and deficits in conscientiousness). All items are rated on a 4-point Likert scale from 1 (agree strongly) to 4 (disagree strongly). Total scores for each subscale and mean subscale scores were calculated. The SUPPS-P has demonstrated good psychometric properties, with internal consistency ranging from αs = .61 to .88 across the five subscales (Cyders et al., 2014; Dugre et al., 2019), good retest reliability (r = .87; Billieux et al., 2012; Dugre et al., 2019), and external validity (Cyders et al., 2014; Dugre et al., 2019).

Reactive-Proactive Aggression Questionnaire (RPQ)

Aggressive behavior was measured using the Reactive-Proactive Aggression Questionnaire (RPQ; Raine et al., 2006). The RPQ is a 23-item self-report assessment where each item is rated on a 3-point Likert scale from 0 (never), 1 (sometimes), to 2 (often) based on the incident frequency. Eleven items produce a subscale score for reactive aggression (e.g., "Reacted angrily when provoked by others," "Yelled at others when they have annoyed you"), which ranges from 0 to 33; whereas the remaining 12 items provide a subscale score for proactive aggression (e.g., "Threatened and bullied someone," "Had fights with others to show who was on top"), which ranges from 0 to 36. Both subscale scores are summed to yield a total

RPQ score from 0 to 69, with higher scores indicating greater levels of aggressive behavior. Raine et al. (2006) found that all three RPQ scales had internal consistencies of α = 0.83 or higher, as well as satisfactory construct, convergent, discriminant, and criterion validity.

Interpersonal Reactivity Index (IRI)

To measure different facets of empathy, The Interpersonal Reactivity Index (IRI; Davis, 1980) was used to measure four separate but related constructs of empathy: perspective taking, fantasy, empathic concern, and personal distress. The IRI is a 28-item self-report measure, with each subscale made up of seven items. Each item is rated on a 5-point Likert scale ranging from 0 (Does not describe me well) to 4 (Describes me very well). The perspective taking scale measures the tendency to freely adopt others' point of view (e.g., "Before criticizing somebody, I try to imagine how I would feel if I were in their place"); the fantasy scale measures the degree to which individuals identify with fictional characters, such as in books or movies (e.g., "I really get involved with the feelings of the characters in a novel"); the empathic concern scale measures feelings of compassion and concern for others in unfortunate circumstances (e.g., "When I see someone being taken advantage of, I feel kind of protective towards them"); and the personal distress scale measures experiences of anxiety and discomfort in response to a tense situation or interpersonal interaction (e.g., "Being in a tense emotional situation scares me"). Total scores for each subscale are generated and interpreted separately, rather than as a measure of global empathy. The IRI has shown good psychometric properties, with acceptable internal consistency (αs = .70 to .78) and retest reliability (rs = .61 to .81) for all four scales (Davis, 1980), in addition to good convergent validity (Davis, 1983).

Triarchic Psychopathy Measure* (*TriPM)

To measure psychopathy, the Triarchic Psychopathy Measure (TriPM; Patrick et al.,

2009) was used. The TriPM is a 58-item self-report questionnaire that uses self-descriptive

statements that correspond to three distinct constructs of psychopathy: boldness, meanness, and

disinhibition. The boldness subscale contains 19 items and measures the connection between

dominance, low levels of anxiety, and being daring and adventurous (e.g., "I'm afraid of far

fewer things than most people," "I'm a born leader"). The meanness subscale consists of 19

items and measures callousness, vindictiveness, proactive aggression, and thrill-seeking behavior

(e.g., "I would enjoy being in a high-speed chase," "It doesn't bother me to see someone else in

pain"). The disinhibition scale includes 20 items and measures impulsivity, recklessness,

combativeness, anger, and opposition (e.g., "I often act on immediate needs," "I have missed

work without bothering to call in"). Respondents rate each item on a 4-point Likert scale (3 =

true, 2 = somewhat true, 1 = somewhat false, 0 = false); scoring is reversed for certain items that

are indicative of lower psychopathy traits. Subscale items are summed to generate separate

subscale scores, and the subscale scores are added together to yield a total psychopathy score.

Higher total scores suggest greater levels of psychopathy. The TriPM has demonstrated very

good internal consistency across all three subscales (Boldness α = .79, Meanness α = .83, and

Disinhibition α = .79; Hall et al., 2014), as well as good construct and discriminant validity (van

Dongen et al., 2017).

Adult Extension of the National Youth Survey Self-Report Delinquency Measure

To examine the frequency of a variety of delinquent and antisocial activities, the 102-

item self-report Adult Extension (Raine et al., 2000) of the National Youth Survey Self-Report

Delinquency Measure (Elliott et al., 1983) was used. Questions are categorized based on the type

of illicit activity and involves 10 subscales: miscellaneous offenses (e.g., illegally loitered or trespassed, driven while your license was suspended, had a restraining order placed against you); driving offenses (e.g., driven while under the influence of alcohol or drugs, been responsible for a hit-and-run accident, been stopped for dangerous driving); theft–fraud offenses (e.g., been delinquent on alimony or child support payments, obtained unemployment or sickness benefits by telling lies, stolen a car, truck, or motorcycle, forged documents); manipulation offenses (e.g., made up or exaggerating physical or psychological illness to avoid military duty, take time off work, obtain drugs, manipulate people for your own gain); drug offenses (e.g., used illegal street drugs, forged prescriptions or stolen prescription drugs, made or grew illegal drugs for personal or friends' use, or for sale); sexual offenses (e.g., exposed yourself in public, engaged in prostitution, had sex with someone who was passed out or unconscious); assault offenses (e.g., threatened to injure or kill someone, hit or attacked your spouse, girl/boyfriend, or dating partner and caused bodily injury); weapons/serious assault offenses (e.g., illegally possessed a weapon, used force or a weapon to rob a person, kidnapped someone or moved someone from one location to another against his/her will); random legal offenses (e.g., committed perjury, obstructed justice); and custody offenses (e.g., failed to appear in court, violated probation). Individuals are asked to disclose the lifetime frequency of each type of delinquent activity: 0 times, 1 time, 2 times, 3 to 5 times, 6 to 10 times, 11 to 20 times, and 21 or more times, as well as the age that they first and last did any of the indicated activities. The number of offenses endorsed for each subscale are summed to yield a total number of offenses, which can range from 0 to 390, with higher scores indicating greater rates of delinquency. Huizinga and Elliott (1986) examined the retest reliability across frequencies of activities and subscales and determined the measure had a good mean reliability coefficient of 0.74.

Data Analysis Plan

Data was analyzed with IBM Statistics for Mac, version 27. For participants with partial

missing data, cases were excluded listwise per analysis. That is, if a participant had not fully

completed a measure, they were excluded from the sample for analyses that involved that

measure only, while their data for other measures were retained for other analyses for which they

provided complete data.

Data were also reviewed for violations of normality and skew using frequency

distributions, histograms, Q-Q plots, and boxplots. Assumptions checks were run for all analyses

(e.g., *t*-tests, ANOVAs, correlations, multiple regression; refer to Appendix). Univariable and

bivariable data analysis included descriptive statistics, significance difference testing, and

correlational analyses. Multivariable data analysis included multiple linear regression models

and exploratory binary logistic regression models for overall level of schizotypy and schizotypy

dimensions. Each multiple linear regression was run first with all predictor variables entered into

the prospective models and then by retaining only those variables that significantly related to the

dependent variables in bivariable analyses. Each binary logistic regression was exploratory in

nature and run first with all predictor variables entered in the prospective logistic regression

models to determine the relationship between each categorical variable (schizotypy dimensions

and schizotypy overall). Next, only those variables that were significantly related to the

dependent variables were retained and entered into a subsequent logistic regression model. The

significance level was set at $\alpha = .05$ for interpretative purposes. A Bonferroni correction was not

used as it reduces power and increases risk of Type II errors (Moran, 2003). While such

decreases the confidence that can be placed in significant observed relationships (which may be

spurious), such a possibility can be examined in future replication research. According to Moran (2003),

> The probability of finding some spurious results is quite high, but the chance of all the results being spurious is extremely improbable. These spurious results should not be of great concern, as they will not be confirmed in future experiments. The sequential Bonferroni, however, makes it likely that researchers will not publish important results that could open up new avenues of knowledge (p. 405)

Ultimately, the state of the literature was regarded as such that a more exploratory approach for interpreting significance was selected over a stricter approach. It is acknowledged that this choice can be debated.

Descriptive Statistics and Significant Difference Testing

Means, standard deviations, frequency counts, and percentages, as applicable, were reported for all study variables at baseline and follow up.

Stability Analyses

Pearson's correlation coefficient (r) was used to examine the stability between baseline and follow-up scores for all study variables. A non-parametric alternative, Spearman's correlation coefficient (ρ), was used when parametric assumptions were violated. If baseline and follow-up variable scores were significantly and strongly correlated—i.e., $p < .05$ and r or $\rho > 0.7$— this was interpreted as support for strong two-year stability. Cohen's (1988) benchmarks for weak ($r = .10$), moderate ($r = .30$), and strong ($r = .50$) correlations also informed the interpretation of degree of two-year stability (as well as correlations as a measure of effect size in general). In addition, paired-samples t-tests were used to examine significant differences

between baseline and follow-up scores, or else Wilcoxon sign tests (Z) for data that violated

parametric assumptions.

Baseline and Follow-Up Correlation Analyses

Bivariable correlations were used to examine whether there were significant associations

between baseline variables and overall schizotypy scores and schizotypy dimension scores at

follow up. Pearson's correlation coefficients (r) was used for continuous variables, or else the

nonparametric alternative (ρ) was used. For categorical variables, t-tests (for independent

samples) and F-tests (ANOVAs) were used to test for significant relationships between overall

schizotypy scores and schizotypy dimension scores. To determine which groups in F-tests

significantly differed, the Bonferroni post-hoc test was used. Wilcoxon sign tests (Z) were used

for data that violated parametric assumptions.

Exploratory analyses were also performed separately to determine whether dimensional

and overall schizotypy scores at baseline were significantly associated with increased schizotypy

scores at follow up. The positive, negative, and disorganized scales, and overall schizotypy, were

analyzed separately. First, change scores between baseline and follow up were calculated for

positive, negative, and disorganized scales, and overall schizotypy. These scores were then

recoded into a dichotomous variable for overall and dimensional scores based on the change

scores, where zero and negative values were coded as 0, and positive values were coded as 1. A

value of 0 indicates that the respective schizotypy score decreased or stayed the same at follow

up, whereas a value of 1 indicates that the respective schizotypy score increased at follow up.

Point-biserial correlations (r_{pb}) between all baseline dimensional and overall schizotypy scores

and the dichotomous variables were run to determine the strength and direction of the association

from baseline to follow up. More specifically, a positive correlation would demonstrate that a

higher positive, negative, disorganized, or overall baseline schizotypy score was associated with an increase in the respective schizotypy score at follow up, whereas a negative correlation would indicate a relationship in the opposite direction.

Regression Analyses

Multivariable relationships between baseline predictor variables and the follow-up criterion variables of overall schizotypy and schizotypy dimensions were examined using separate multiple linear regression analyses. Only significant predictors for positive, negative, disorganizd, or overall schizotypy at baseline were included in the related models for each of these four outcomes at follow up. Baseline schizotypy scores were controlled to examine whether follow-up schizotypy scores were significantly and incrementally predicted by the non-schizotypy study variables. Effect sizes were R-squared (the coefficient of determination; R^2), standardized beta weights, and semi-partial correlation coefficients. Exploratory analyses were also conducted using significant baseline psychosocial predictor variables and the follow-up categorical variables of schizotypy dimensions and overall schizotypy, to explore whether non-schizotypy predictors at baseline predicted significantly increased or decreased follow-up schizotypy scores. Finally, a set of exploratory regression analyses was conducted for positive, negative, disorganized, and overall schizotypy at follow up, with each of these models including *all* variables that significantly predicted any of positive, negative, disorganized, or overall schizotypy in the omnibus baseline models.

Chapter 3: Results

Baseline Sample Characteristics

The baseline sample consisted of 660 participants; 82% of these participants provided complete data for all variables. The average age of participants was 20.03 years ($SD = 2.52$). More than three-fourths of the sample were women ($N = 515$, 78.0%). Almost half identified as White/Caucasian ($N = 275$, 41.7%). A majority were freshman, sophomore, or junior undergraduate students ($N = 577$, 87.4%). Nearly all participants had never been married ($N = 627$, 95.7%). Approximately half were then working ($N = 303$, 46.0%), classified their socioeconomic status growing up as "average" ($N = 372$, 56.5%), and identified as being from an urban area ($N = 368$, 56.5%).

Overall, participants had no clear substance abuse issues. Specifically, participants had no evident problems with alcohol/alcoholism ($M = 3.13$, $SD = 3.81$) and no to low levels of drug use and abuse ($M = 1.51$, $SD = 1.43$). On average, participants disclosed that they had experienced four traumatic events in their lifetime ($M = 4.04$, $SD = 3.04$). The average scores for the positive, negative, and disorganized schizotypy dimensions were 22.04 ($SD = 10.70$), 15.62 ($SD = 7.20$), and 13.33 ($SD = 6.85$), respectively. Over a third of the sample ($N = 516$, 78.2%) reported that they had never been diagnosed with a mental illness and of those that had, depression and anxiety were the most frequently diagnosed disorders. Only a small percentage of participants reported that they had a first-degree relative with a serious mental illness ($N = 77$, 11.4%); bipolar disorder was the most frequent diagnosis among immediate family members.

Follow-Up Sample Characteristics

After completing the baseline survey (T1; September through December 2018), a total of 406 participants (61.5%) consented to be recontacted for follow up two years later (T2;

September through December 2020). The follow-up (T2) sample consisted of 103 participants,

and 90% of these participants provided complete data for all variables. As shown in Table 1,

among participants there were 13 males (12.6%), 85 females (82.5%) and five who identified as

non-binary (4.9%). The mean age of participants at T2 was 21.90 years ($SD = 2.70$ years). More

than half identified as White/Caucasian ($N = 59$, 57.3%). Of the remaining participants, nearly a

quarter identified as Hispanic/Latino ($N = 25$) and 17.4% identified as Black/African American

($N = 9$), followed by Asian ($N = 6$) and Other ($N = 3$). The majority of participants were junior or

senior undergraduate students or had a bachelor's degree ($N = 90$, 87.4%). More than half of all

participants had never been married ($N = 69$, 67%). A majority of participants were students ($N =$

68, 66%), lived with their parent(s)/supportive family ($N = 80$, 77.7%), and described the

neighborhood they grew up in as "average" ($N = 53$, 51.5%). Relatedly, almost half of the

participants endorsed being from an urban area ($N = 46$, 44.7%). A majority of participants had

no history of head injury (74.8%) or birth complications (80.6%).

Like participants at baseline, participants at T2 did not evidence substance abuse issues

overall. Specifically, participants, on average, did not evidence problems with

alcohol/alcoholism ($M = 2.35$, $SD = 3.75$) and yielded average scores in the range of no to low

levels of drug use and abuse ($M = 1.39$, $SD = 1.40$). Similar to T1, participants reported they had

experienced, on average, four traumatic events in their lifetime ($M = 4.40$, $SD = 2.86$). Average

scores for positive, negative, disorganized, and overall schizotypy dimensions were 24.10 ($SD =$

9.80), 17.64 ($SD = 6.76$), 13.55 ($SD = 6.50$), and 55.15 ($SD = 21.10$), respectively, and

comparable to baseline scores. More than half of participants ($N = 61$, 59.2%) reported that they

had never been diagnosed with a mental illness and of those that had, anxiety (34.88%) and

depression (29.07%) were the most frequently diagnosed disorders. More than half of the

participants indicated that they lived without someone with a mental illness (52.4%) and less than a quarter reported that they had a first-degree relative with a serious mental illness (21.4%), of which, bipolar disorder was the most frequently reported (81.0%).

Stability

To examine the stability between baseline and follow-up scores for all study variables, measures of association—Pearson's correlation coefficient (*r*) and Spearman's correlation coefficient (ρ)—were first used. All schizotypy dimension scores (positive, $r = .75$; negative, $r = .72$; and disorganized, $r = .63$), as well as overall schizotypy scores ($r = .75$), were significantly (all *p*s < .001) and moderately to strongly correlated between T1 and T2, supportive of generally strong two-year stability.

Moderate two-year stabilities for lifetime alcohol and drug use and abuse were evident. Both alcohol (ρ = .50, *p* < .001) and drug use and abuse (ρ = .37, *p* < .001) scores were significantly associated between T1 and T2.

Support for moderate two-year stability was evident for lifetime number of traumatic events experienced (ρ = .58, *p* < .001), and traumatic events occurring just in childhood and adolescence (ρ = .65, *p* < .001). All forms of abuse and maltreatment during childhood and adolescence were also significantly (all *p*s < .001) and moderately to strongly correlated between T1 and T2: emotional abuse (ρ = .69), physical abuse (ρ = .68), sexual abuse (ρ = .59), emotional neglect (*r* = .74), and physical neglect (ρ = .52).

Support for moderate two-year stability was evident for aggressive behavior. Specifically, reactive aggression (*r* = .48), proactive aggression (ρ = .45), and total scores for aggression (ρ = .44) were all significantly (all *p*s < .001) correlated between T1 and T2.

All psychopathy constructs appeared moderately to strongly stable between baseline and follow up. Specifically, boldness (r = .71), meanness (ρ = .67), disinhibition (r = .61), and total psychopathy scores (r = .55)—all significant associations (all ps < .001).

Moderate two-year stability was evident for all empathy constructs. Specifically, perspective taking (r = .45), empathic concern (r = .47), and personal distress (r = .55), all of which were significantly related (all ps < .001) between T1 and T2.

All impulsivity traits appeared moderately to strongly stable from baseline to follow up. Negative urgency (r = .60), lack of perseverance (r = .51), lack of premeditation (r = .64), sensation seeking (r = .62), and positive urgency (r = .59), as well as total impulsivity scores (r = .74), were all significantly correlated (all ps < .001) between T1 and T2.

Nearly all types of delinquent and criminal activities evidenced moderate to strong two-year stability: miscellaneous offenses (ρ = .44), driving offenses (ρ = .36), theft and fraud offenses (ρ = .49), manipulation offenses (ρ = .39), drug offenses (ρ = .77), sexual offenses (ρ = .38), assault offenses (ρ = .51), and total number of offenses (ρ = .63). All these correlations between T1 and T2 were significant (all ps < .001). However, weapons/serious assault offenses (ρ = –.04, p = .74) and random legal offenses (ρ = –.02, p = .83) were not significantly associated for T1 and T2, suggesting that these offense categories were not stable between baseline and follow up.

The emotional state traits of depression (ρ = .49), anxiety (ρ = .55), and stress (r = .54) were significantly (all ps < .001) and moderately correlated between T1 and T2. These results support their moderate two-year stability.

Nearly all domains of social behavior appeared moderately stable from baseline to follow up. That is, abilities and performances related to social engagement/withdrawal (ρ = .46),

independence-performance (ρ = .45), independence-competence (ρ = .57), recreation (r = .56),

and prosocial activities (ρ = .48)—which were all significantly associated (all ps < .001) between

T1 and T2. However, interpersonal communication (ρ = .14, p = .18) was not significantly

correlated between T1 and T2, and thus did not evidence two-year stability.

Paired-samples t-tests and Wilcoxon signed-rank tests were also used to further examine

the stability of scores for all study variables between baseline and follow up. There was no

significant difference in score for the positive schizotypy dimension at T1 (M = 24.08, SD =

10.46) vs. T2 (M = 24.05, SD = 9.80), t(98) = .04, p = .97, d = .003; the negative schizotypy

dimension at T1 (M = 16.84, SD =6.95) vs. T2 (M = 17.64, SD = 6.76), t(98) = –1.54, p = .13, d

= .12; nor the disorganized schizotypy dimension at T1 (M = 13.99, SD = 6.69) vs. T2 (M =

13.55, SD = 6.47), t(98) = .78, p = .96, d = .07. Similarly, there was no significant difference in

total schizotypy score between T1 (M = 55.24, SD =22.76) and T2 (M = 55.15, SD = 21.08),

t(100) = .06, p = .96, d = .004. The results of the complementary analyses further suggested that

overall schizotypy and schizotypy dimensional scores remained stable from baseline to follow

up.

For alcohol use and abuse, a Wilcoxon signed-rank test did not reveal a statistically

significant difference in median score between baseline (2.00) and follow up (1.00), Z = –1.89, p

= .06, r = –.19. However, for drug use and abuse, there was a statistically significant difference

in median score at baseline (1.00) compared to follow up (1.00), Z = –2.04, p = .04, r = –.20.

Thus, while further support for the stability of alcohol use and abuse was found pursuant to the

complementary analyses, such was not the case for drug use and abuse.

Regarding history of trauma, there was no statistically significant difference in the

median number of traumatic events experienced in one's lifetime between baseline (4.00) and

follow up (4.00), $Z = -0.54$, $p = .60$, $r = -.05$; the same was apparent for experiences of childhood physical abuse at T1 (5.00) vs. T2 (5.00), $Z = -1.16$, $p = .25$, $r = -.11$; and physical neglect at T1 (6.00) vs. T2 (6.00), $Z = -0.80$, $p = .42$, $r = -.08$. Similarly, average emotional neglect scores at T1 ($M = 10.64$, $SD = 4.82$) vs. T2 ($M = 11.35$, $SD = 5.23$) did not significantly differ, $t(100) = -1.93$, $p = .06$, $d = .14$. Conversely, there were statistically significant differences in median scores for experiences of childhood emotional abuse at baseline (10.00) compared to follow up (11.00), $Z = -2.43$, $p = .02$, $r = -.25$; childhood sexual abuse at T1 (5.00) vs. T2 (5.00), $Z = -2.41$, $p = .02$, $r = -.24$; and experiencing multiple traumas in childhood at T1 (2.00) vs. T2 (2.00), $Z = -2.13$, $p = .03$, $r = -.21$. Thus, the complementary analyses lent further support for the stability of trauma history in general and for some traumatic event subtypes and timeframes, but not for other subtypes and timeframes.

Aggressive behavior further appeared stable between baseline and follow up pursuant to the complementary analyses. There was no significant difference in average score for reactive aggression at T1 ($M = 7.28$, $SD = 4.07$) vs. T2 ($M = 7.10$, $SD = 3.54$), $t(98) = .46$, $p = .64$, $d = .05$; nor for median scores for proactive aggression T1 (1.00) vs. T2 (1.00), $Z = -.33$, $p = .74$, $r = -.03$; and total aggression T1 (7.00) vs. T2 (7.00), $Z = -.52$, $p = .60$, $r = -.05$.

Further support for the stability of several psychopathy constructs was found via the complementary analyses: there were no significant differences in average scores for boldness between T1 ($M = 12.78$, $SD = 4.77$) and T2 ($M = 12.14$, $SD = 4.91$), $t(93) = 1.67$, $p = .10$. $d = .13$; nor disinhibition at T1 ($M = 14.53$, $SD = 8.27$) vs. T2 ($M = 13.32$, $SD = 7.00$), $t(93) = 1.72$, $p = .09$, $d = .16$. However, there was a statistically significant difference in median score for meanness at baseline (6.00) compared to follow up (5.00), $Z = -2.30$, $p = .02$, $r = -.24$; as well as

a significant mean difference in total psychopathy score at T1 ($M = 34.93$, $SD = 15.46$) vs. T2 ($M = 31.44$, $SD = 12.06$), $t(93) = 2.53$, $p = .01$, $d = .25$.

All empathy constructs further appeared stable using the complementary analyses. There were no significant differences in average scores for perspective taking at T1 ($M = 14.12$, $SD = 3.97$) vs. T2 ($M = 14.20$, $SD = 4.08$), $t(93) = -.20$, $p = .85$, $d = .02$; empathic concern at T1 ($M = 11.98$, $SD = 3.34$) vs. T2 ($M = 12.57$, $SD = 3.41$), $t(93) = -1.66$, $p = .10$, $d = .18$; nor personal distress at T1 ($M = 10.10$, $SD = 4.10$) vs. T2 ($M = 9.93$, $SD = 4.01$), $t(93) = .43$, $p = .67$, $d = .04$.

All impulsivity traits further appeared stable pursuant to the complementary analyses. There were no significant differences in mean scores for negative urgency between T1 ($M = 9.45$, $SD = 3.20$) and T2 ($M = 9.33$, $SD = 2.92$), $t(97) = .44$, $p = .66$, $d = .04$; lack of perseverance at T1 ($M = 7.44$, $SD = 1.93$) vs. T2 ($M = 7.23$, $SD = 2.09$), $t(96) = 1.07$, $p = .29$, $d = .10$; lack of premeditation at T1 ($M = 7.41$, $SD = 2.31$) vs. T2 ($M = 7.12$, $SD = 2.12$), $t(96) = 1.51$, $p = .13$, $d = .13$; sensation seeking at T1 ($M = 9.10$, $SD = 3.07$) vs. T2 ($M = 8.86$, $SD = 2.79$), $t(97) = .95$, $p = .35$, $d = .08$; nor positive urgency at T1 ($M = 7.52$, $SD = 3.05$) vs. T2 ($M = 7.24$, $SD = 2.78$), $t(97) = 1.02$, $p = .31$, $d = .10$. However, there was a significant difference in total impulsivity score between baseline ($M = 40.95$, $SD = 9.04$) and follow up ($M = 39.63$, $SD = 8.66$), $t(97) = 2.05$, $p = .04$, $d = .15$.

Most delinquent and antisocial activities further appeared stable pursuant to the complementary analyses. There were no statistically significant difference between T1 and T2 for the median number of miscellaneous offenses (T1: 1.00, T2: 0.00; $Z = -.95$, $p = .34$, $r = -.10$); driving offenses (T1: 0.00, T2: 0.00; $Z = -1.12$, $p = .26$, $r = -.12$); theft–fraud offenses (T1: 0.00, T2: 0.00; $Z = -.89$, $p = .37$, $r = -.10$); sexual offenses (T1: 0.00, T2: 0.00; $Z = -.22$, $p = .83$, $r = -.02$); assault offenses (T1: 0.00, T2: 0.00; $Z = -.50$, $p = .62$, $r = -.05$); weapons/serious

assault offenses (T1: 0.00, T2: 0.00; $Z = -.17$, $p = .86$, $r = -.02$); custody offenses (T1: 0.00, T2:

0.00; $Z = -1.00$, $p = .32$, $r = -.10$); nor random legal offenses (T1: 0.00, T2: 0.00; $Z = -.69$, $p =$

.49, $r = -.07$). However, there was a significant difference in drug offenses between baseline and

follow up (T1: 0.00, T2: 0.00; $Z = -3.94$, $p < .001$, $r = -.41$), as well as for manipulation offenses

(T1: 3.00, T2: 0.00; $Z = -1.89$, $p = .06$, $r = -.20$) and total number of offenses (T1: 11.00, T2:

12.00; $Z = -2.40$, $p = .02$, $r = -.25$).

For emotional state traits, there were no significant differences in the median score for

depression (T1: 5.00, T2: 7.00; $Z = -1.37$, $p = .17$, $r = -.14$) and anxiety (T1: 5.00, T2: 6.00; $Z =$

$-.66$, $p = .51$, $r = -.07$), nor the average score for stress between T1 (M = 7.55, SD = 5.17) and

T2 (M = 8.34, SD = 4.72), $t(91) = -1.58$, $p = .12$, $d = .16$. Most abilities and performances across

domains of social behavior remained stable from baseline to follow up. More specifically, there

were no significant difference in the average or median scores for interpersonal communication

(T1: 8.00, T2: 8.00; $Z = -.05$, $p = .96$, $r = -.01$), independence-performance (T1: 30.00, T2:

31.00; $Z = -.95$, $p = .34$, $r = -.10$), nor recreation at T1 (M = 19.01, SD = 6.70) vs. T2 (M =

18.18, SD = 6.91), $t(91) = 1.23$, $p = .22$, $d = .12$. However, there were statistically significant

median differences in social engagement and withdrawal (T1: 10.00, T2: 9.00; $Z = -4.10$, $p <$

.001, $r = -.43$), prosocial activities (T1: 24.00, T2: 14.00; $Z = -6.77$, $p = .02$, $r = -.70$), and

independence-competence (T1: 36.00, T2: 37.00; $Z = -2.95$, $p = .003$, $r = -.31$) between baseline

and follow up.

Bivariable Analyses at Baseline

Positive Schizotypy

Group Contrasts. Significant and modestly higher positive schizotypy scores were

observed for individuals who had a history of one of more head injuries in their lifetime, $t(101) =$

–2.37, $p = .02$, $d = .45$. Additionally, significantly higher positive schizotypy scores were observed for persons who experienced the death of a parent before age 18, $t(101) = –2.68$, $p = .01$, $d = 1.25$, a large effect.

Correlations. Positive schizotypy scores were significantly, positively, and generally moderately associated with childhood emotional abuse ($\rho = .39$, $p < .001$), emotional neglect ($\rho = .25$, $p = .01$), and physical neglect ($\rho = .37$, $p < .001$). The same was true for having experienced multiple traumas in childhood ($\rho = .33$, $p < .001$).

Positive schizotypy scores were significantly, moderately, and positively correlated with multiple types of aggression: reactive aggression ($r = .45$, $p < .001$), proactive aggression ($\rho = .30$, $p = .002$), and total aggression ($\rho = .42$, $p < .001$). A small, negative, significant relationship was observed between positive schizotypy and the psychopathy construct of boldness ($r = –.20$, $p = .04$), whereas moderate- to large-sized significant positive associations were observed for meanness ($\rho = .19$, $p = .05$), disinhibition ($\rho = .49$, $p < .001$), and total psychopathy ($\rho = .29$, $p = .003$).

Medium- to large-sized significant (all ps $< .001$) and positive associations were observed between positive schizotypy and negative urgency ($\rho = .50$), positive urgency ($\rho = .37$), and total impulsivity ($\rho = .34$).

Positive schizotypy scores were significantly and positively correlated, to a moderate degree, with several types of offenses. Specifically, a history of miscellaneous offenses ($\rho = .22$, $p = .03$), theft–fraud offenses ($\rho = .25$, $p = .01$), and assault offenses ($\rho = .21$, $p = .04$), as well as total number of historical offenses ($\rho = .25$, $p = .01$).

Positive schizotypy scores were significantly (all ps $< .001$) and strongly positively correlated with the emotional states of depression ($\rho = .64$), anxiety ($\rho = .52$), and stress ($\rho =$

.62). Positive schizotypy was also significantly and moderately positively related to personal

distress ($r = .39$, $p < .001$).

Significant, small- to medium-sized negative relationships were observed between

positive schizotypy and abilities and performances within several domains of social behavior.

Specifically, social engagement and withdrawal ($\rho = -.32$, $p < .001$), independence-performance

($\rho = -.23$, $p = .02$), independence-competence ($\rho = -.27$, $p = .01$), and prosocial activities ($\rho = -$

.26, $p = .01$).

Negative Schizotypy

Group Contrasts. Significant and moderately higher negative schizotypy scores were

observed for individuals who had a diagnosis of a psychiatric illness, $t(101) = -2.55$, $p = .01$, $d =$

.53. Significantly greater negative schizotypy scores were found for persons who had a history of

one of more head injuries, $t(101) = -2.34$, $p = .02$, $d = .60$, a medium effect. Additionally,

significantly higher negative schizotypy scores were demonstrated for individuals who

experienced the death of a parent before age 18, $t(101) = -2.36$, $p = .02$, $d = 1.14$, a large effect.

Correlations. Negative schizotypy scores were significantly and positively correlated

with the total number of lifetime traumatic events an individual experienced ($\rho = .24$, $p =. 02$).

Negative schizotypy scores were also significantly, positively, and generally weakly to

moderately associated with childhood emotional abuse ($\rho = .38$, $p < .001$), emotional neglect ($\rho =$

.22, $p =. 03$), and physical neglect ($\rho = .31$, $p = .001$). The same was true for having experienced

multiple traumas during childhood ($\rho = .27$, $p = .01$).

Negative schizotypy scores were significantly, moderately, and positively correlated with

multiple types of aggression: reactive aggression ($r = .38$, $p < .001$) and total aggression ($\rho = .33$,

$p < .001$). A moderate, negative, significant relationship was observed between negative

schizotypy and the psychopathy construct of boldness ($r = -.31$, $p = .001$), whereas small to

medium-sized significant positive associations were found for disinhibition ($\rho = .43$, $p < .001$)

total psychopathy ($\rho = .21$, $p = .01$).

Medium to large-sized significant (all ps < .001) and positive correlations were observed

between negative schizotypy and negative urgency ($\rho = .53$), positive urgency ($\rho = .36$), and total

impulsivity ($\rho = .34$).

Negative schizotypy scores were significantly and positively related, to a small degree,

with several types of offenses. Specifically, a history of theft-fraud offenses ($\rho = .21$, $p = .03$),

assault offenses ($\rho = .23$, $p = .02$), as well as total number of offenses ($\rho = .21$, $p = .04$).

Negative schizotypy scores were significantly (all ps < .001) and strongly positively

associated with the emotional states of depression ($\rho = .58$), anxiety ($\rho = .63$), and stress ($\rho =$

.58). Relatedly, negative schizotypy scores were significantly and positively correlated, to a

moderate degree, with experiences of personal distress ($r = .42$, $p < .001$).

Significant, small to medium-sized negative relationships were observed between

negative schizotypy and abilities and performances within several domains of social behavior.

Specifically, social engagement and withdrawal ($\rho = -.33$, $p < .001$), interpersonal

communication ($\rho = -.26$, $p = .01$), independence-performance ($\rho = -.21$, $p = .04$), and

independence-competence ($\rho = -.21$, $p = .04$).

Disorganized Schizotypy

Group Contrasts. Significant and moderately higher disorganized schizotypy scores

were observed for individuals who had a diagnosis of a psychiatric illness, $t(101) = -2.66$, $p =$

.01, $d = .55$.

Correlations. Disorganized schizotypy scores were significantly and positively correlated with the total number of traumatic events a person experienced in their lifetime (ρ = .22, p = .03). Disorganized schizotypy scores were also significantly, positive, and moderately associated with childhood emotional abuse (ρ = .39, p < .001) and physical neglect (ρ = .34, p < .001). The same was true for having experienced multiple traumas during childhood (ρ = .30, p = .002).

Disorganized schizotypy scores were significantly, moderately, and positively related to multiple types of aggression: reactive aggression (r = .46, p < .001), proactive aggression (ρ = .23, p = .02), and total aggression (ρ = .42, p < .001). Weak to moderate, positive, significant correlations were observed between disorganized schizotypy and the psychopathy constructs of disinhibition (ρ = .39, p < .001) and total psychopathy (ρ = .22, p = .03).

Medium to large-sized significant and positive correlations were observed between disorganized schizotypy and multiple traits of impulsivity: negative urgency (ρ = .47, p < .001), positive urgency (ρ = .32, p = .01), and total impulsivity (ρ = .26, p = .01).

Disorganized schizotypy scores were significantly and positively associated, to a small degree, with several types of offenses. Specifically, a history of sexual offenses (ρ = .20, p = .04) and assault offenses (ρ = .26, p = .01).

Disorganized schizotypy scores were significantly (all ps < .001) and strongly positively related to the emotional states of depression (ρ = .56), anxiety (ρ = .54), and stress (ρ = .58). Similarly, disorganized schizotypy scores were significantly and positively associated, to a moderate degree, with experiences of personal distress (r = .35, p < .001).

Significant, small to medium-sized negative relationships were observed between disorganized schizotypy and abilities and performances related to several domains of social

behavior. Specifically, social engagement and withdrawal ($\rho = -.26$, $p = .01$), interpersonal communication ($\rho = -.21$, $p = .03$), and prosocial activities ($\rho = -.21$, $p = .03$).

Overall Schizotypy

Group Contrasts. Significant and moderately higher overall schizotypy scores were observed for individuals who had one or more head injuries, $t(101) = -2.35$, $p = .02$, $d = .62$. Significantly greater overall schizotypy scores were also found for persons who had a diagnosis of a psychiatric illness, $t(101) = -2.35$, $p = .02$, $d = .49$, a medium effect. Additionally, significantly higher overall schizotypy scores were found for individuals who experienced the death of a parent before age 18, $t(101) = -2.42$, $p = .02$, $d = 1.17$, a large effect.

Correlations. Overall schizotypy scores were significantly, positively, and weakly to moderately associated with childhood emotional abuse ($\rho = .41$, $p < .001$), emotional neglect ($\rho = .24$, $p = .02$), and physical neglect ($\rho = .37$, $p < .001$). The same was true for experiencing multiple traumas during childhood ($\rho = .33$, $p < .001$).

Overall schizotypy scores were significantly, positively, and generally moderately associated with multiple types of aggression: reactive aggression ($r = .46$, $p < .001$), proactive aggression ($\rho = .25$, $p = .01$), and total aggression ($\rho = .42$, $p < .001$). A small, negative, significant relationship was observed between overall schizotypy and the psychopathy construct of boldness ($r = -.24$, $p = .01$), whereas small to medium-sized significant positive correlations were found for disinhibition ($\rho = .48$, $p < .001$) and total psychopathy ($\rho = .26$, $p = .01$).

Medium to large-sized significant (all ps $< .001$) and positive correlations were observed between overall schizotypy and the impulsivity traits of negative urgency ($\rho = .54$) and positive urgency ($\rho = .38$), as well as total impulsivity ($\rho = .35$).

Overall schizotypy scores were significantly and positively related, to a small degree, with several types of offenses. Specifically, a history of theft-fraud offenses ($\rho = .21$, $p = .03$), assault offenses ($\rho = .24$, $p = .02$), and total number of offenses ($\rho = .21$, $p = .03$).

Overall schizotypy scores were significantly (all ps $< .001$) and strongly positively associated with the emotional states of depression ($\rho = .64$), anxiety ($\rho = .60$), and stress ($\rho = .64$). Relatedly, overall schizotypy scores were significantly and positively correlated, to a moderate degree, with feelings of personal distress ($r = .41$, $p < .001$).

Significant, small to medium-sized negative associations were observed between overall schizotypy and abilities and performances within several domains of social behavior. Specifically, social engagement and withdrawal ($\rho = -.35$, $p < .001$), interpersonal communication ($\rho = -.21$, $p = .04$), independence-performance ($\rho = -.24$, $p = .02$), independence-competence ($\rho = -.25$, $p = .01$), and prosocial activities ($\rho = -.23$, $p = .02$).

Bivariable Analyses at Follow up

Positive Schizotypy

Group Contrasts.

Significant and largely higher positive schizotypy scores were observed for individuals who had a diagnosis of a psychiatric illness, $t(97) = -2.91$, $p = .005$, $d = .60$. Relatedly, significantly higher positive schizotypy scores were found for persons who had a first-degree relative with a serious and persistent mental illness (e.g., schizophrenia, bipolar disorder, other psychoses), $t(97) = -2.83$, $p = .006$, $d = .70$, a large effect. Additionally, significantly higher positive schizotypy scores were observed for individuals who experienced the death of a parent before age 18, $t(97) = -4.12$, $p = .005$, $d = 1.16$, a strong effect.

Correlations. A small-sized significant and positive correlation was observed between positive schizotypy scores and alcohol use and abuse ($\rho = .21$, $p = .04$).

Positive schizotypy scores were significantly, positively, and generally moderately associated with childhood emotional abuse ($\rho = .28$, $p = .01$) and physical neglect ($\rho = .24$, $p = .02$), as well as having experienced multiple traumas in childhood ($\rho = .30$, $p = .003$).

Positive schizotypy scores were significantly, moderately, and positively correlated with multiple types of aggression: reactive aggression ($r = .27$, $p = .007$), proactive aggression ($\rho = .37$, $p < .001$), and total aggression ($\rho = .38$, $p < .001$).

A small, negative, significant relationship was observed between positive schizotypy and the psychopathy construct of boldness ($r = -.20$, $p = .04$), whereas moderate- to large-sized significant positive associations were observed for meanness ($\rho = .19$, $p = .05$), disinhibition ($\rho = .49$, $p < .001$), and total psychopathy ($\rho = .29$, $p = .003$). Medium-sized, positive, significant associations were found between positive schizotypy and the psychopathy constructs of meanness ($\rho = .26$, $p = .01$) and disinhibition ($r = .45$, $p < .001$), as well as total psychopathy ($r = .35$, $p < .001$).

Medium to large-sized significant (all ps $< .001$) and positive correlations were observed between positive schizotypy and negative urgency ($r = .50$), lack of premeditation ($r = .33$), positive urgency ($r = .42$), and total impulsivity ($r = .46$).

Positive schizotypy scores were significantly and positively correlated, to a generally moderate degree, with several types of offenses. Specifically, a history of miscellaneous offenses ($\rho = .28$, $p = .01$), theft-fraud offenses ($\rho = .25$, $p = .02$), and assault offenses ($\rho = .25$, $p = .02$), as well as total number of historical offenses ($\rho = .21$, $p = .05$).

Positive schizotypy scores were significantly (all $ps < .001$) and moderately to strongly positively correlated with the emotional states of depression ($\rho = .47$), anxiety ($\rho = .42$), and stress ($r = .40$).

Significant, small to medium-sized negative relationships were observed between positive schizotypy and abilities and performances within several domains of social behavior. Specifically, interpersonal communication ($\rho = -.32$, $p = .002$), independence-competence ($\rho = -.26$, $p = .02$), and prosocial activities ($\rho = -.23$, $p = .03$).

Negative Schizotypy

Group Contrasts. Significantly higher negative schizotypy scores were observed for individuals who had a diagnosis of a psychiatric illness, $t(97) = -3.01$, $p = .003$, $d = .61$, a large effect. Significantly and moderately greater negative schizotypy scores were found for persons who lived in a household with someone who abused alcohol on a regular basis before age 18, $t(97) = -2.06$, $p = .04$, $d = .46$. Relatedly, significantly higher negative schizotypy scores were observed for individuals who lived in a household with someone who abused drugs before age 18, $t(97) = -2.50$, $p = .02$, $d = .66$. Additionally, there was an effect for an individual's gender and negative schizotypy ($F(2, 96) = 4.14$, $p = .02$), such that significantly higher negative schizotypy scores were observed in persons who identified as non-binary than those who identified as male ($d_{\text{male vs. non-binary}} = 1.28$).

Correlations. A small-sized, significant positive association was observed between alcohol use and abuse and negative schizotypy scores ($\rho = .20$, $p = .05$).

Negative schizotypy scores were significantly and positively correlated with the total number of lifetime traumatic events an individual experienced ($\rho = .26$, $p = .01$). Negative schizotypy scores were also significantly, positively, and generally moderately associated with

childhood emotional abuse ($\rho = .23$, $p = .02$) and having experienced multiple traumas during childhood ($\rho = .25$, $p = .01$).

Negative schizotypy scores were significantly, weakly, and positively correlated with multiple types of aggression: reactive aggression ($r = .21$, $p = .04$) and total aggression ($\rho = .22$, $p = .03$). A weak, negative, significant relationship was observed between negative schizotypy and the psychopathy construct of boldness ($r = -.21$, $p = .05$), whereas a medium-sized significant positive association was found for disinhibition ($r = .37$, $p < .001$).

Small to large-sized significant and positive correlations were observed between negative schizotypy and negative urgency ($r = .46$, $p < .001$), lack of premeditation ($r = .20$, $p = .05$), positive urgency ($r = .30$, $p = .003$), and total impulsivity ($r = .34$, $p < .001$).

Negative schizotypy scores were significantly and positively related, to a small degree, with a history of assault offenses ($\rho = .21$, $p = .04$).

Negative schizotypy scores were significantly (all ps $< .001$), and moderately positively associated with the emotional states of depression ($\rho = .44$), anxiety ($\rho = .47$), and stress ($r = .40$). Relatedly, negative schizotypy scores were also significantly and positively correlated, to a moderate degree, with experiences of personal distress ($r = .34$, $p < .001$).

Disorganized Schizotypy

Group Contrasts. Significantly higher disorganized schizotypy scores were observed for individuals who had one or more head injuries, $t(97) = -2.75$, $p = .007$, $d = .61$, a large effect. Additionally, significantly greater disorganized schizotypy scores were found for persons who had a diagnosis of a psychiatric illness, $t(97) = -3.22$, $p = .002$, $d = .65$, a strong effect.

Correlations. A small-sized significant and positive correlation was observed between alcohol use and abuse ($\rho = .25$, $p = .01$) and disorganized schizotypy scores.

Disorganized schizotypy scores were significantly and positively correlated with the total number of traumatic events a person experienced in their lifetime (ρ = .22, p = .03), as well as having experienced multiple traumas during childhood (ρ = .24, p = .02). Both were modest effects.

Disorganized schizotypy scores were significantly, generally moderately, and positively related to multiple types of aggression: reactive aggression (r = .27, p = .008), proactive aggression (ρ = .21, p = .04), and total aggression (ρ = .33, p < .001). A moderate, positive, significant correlation was also observed between disorganized schizotypy and the psychopathy construct of disinhibition (r = .33, p = .001).

Medium to large-sized significant and positive correlations were observed between disorganized schizotypy and multiple impulsivity traits: negative urgency (r = .50, p < .001), lack of premeditation (r = .29, p = .004), and positive urgency (ρ = .37, p < .001), as well as total impulsivity (r = .39, p < .001).

Disorganized schizotypy scores were significantly and positively associated, to a small degree, with a history of assault offenses (ρ = .23, p = .03).

Disorganized schizotypy scores were significantly and moderately positively related to the emotional states of depression (ρ = .36, p = .002), anxiety (ρ = .36, p < .001), and stress (r = .34, p = .001). Similarly, disorganized schizotypy scores were significantly and positively associated, to a moderate degree, with experiences of personal distress (r = .34, p < .001).

Additionally, a significant, small-sized negative relationship was observed between disorganized schizotypy, and abilities and performances related to the independence-competence domain of social behavior (ρ = –.23, p = .03).

Overall Schizotypy

Group Contrasts. Significant and moderately higher overall schizotypy scores were observed for individuals who had one or more head injuries, $t(99) = -2.14$, $p = .04$, $d = .45$. Significantly greater overall schizotypy scores were also found for persons who had a diagnosis of a psychiatric illness, $t(99) = -3.55$, $p < .001$, $d = .72$, a large effect. Relatedly, significantly, and moderately higher overall schizotypy scores were observed for individuals who had a first-degree relative with schizophrenia, bipolar disorder, or other psychoses, $t(99) = -2.33$, $p = .02$, $d = .54$. Additionally, significantly, and moderately higher overall schizotypy scores were found for individuals who grew up in a household that abused alcohol before age 18, $t(99) = -2.00$, $p = .05$, $d = .45$.

Correlations. A small-sized significant and positive correlation was observed between alcohol use and abuse ($\rho = .22$, $p = .03$) and overall schizotypy scores.

Overall schizotypy scores were significantly and positively correlated with the total number of lifetime traumatic events an individual experienced ($\rho = .25$, $p = .01$). Overall schizotypy scores were also significantly, positively, and generally moderately associated with childhood emotional abuse ($\rho = .25$, $p = .02$) and physical neglect ($\rho = .21$, $p = .04$). The same was true for experiencing multiple traumas during childhood ($\rho = .29$, $p = .004$).

Overall schizotypy scores were significantly, positively, and generally moderately associated with multiple types of aggression: reactive aggression ($r = .23$, $p = .02$), proactive aggression ($\rho = .25$, $p = .01$), and total aggression ($\rho = .32$, $p = .001$). Medium-sized significant positive correlations were found for the psychopathy constructs of disinhibition ($r = .41$, $p < .001$) and total psychopathy ($r = .25$, $p = .02$).

Medium to large-sized significant and positive correlations were observed between overall schizotypy and the impulsivity traits of negative urgency ($r = .52$, $p < .001$), lack of premeditation ($r = .29$, $p = .01$), and positive urgency ($\rho = .40$, $p < .001$), as well as total impulsivity ($r = .43$, $p < .001$).

Overall schizotypy scores were significantly and positively related, to a small degree, with a history of miscellaneous offenses ($\rho = .21$, $p = .04$).

Overall schizotypy scores were significantly (all ps $< .001$) and moderately positively associated with the emotional states of depression ($\rho = .47$), anxiety ($\rho = .45$), and stress ($r = .42$). Similarly, overall schizotypy scores were significantly and positively correlated, to a moderate degree, with feelings of personal distress ($r = .30$, $p = .004$).

Significant, small-sized negative associations were observed between overall schizotypy and abilities and performances within several domains of social behavior. Specifically, interpersonal communication ($\rho = -.24$, $p = .02$), independence-competence ($\rho = -.23$, $p = .03$), and prosocial activities ($\rho = -.23$, $p = .03$).

Bivariable Analyses Considering Schizotypy at Baseline and Follow Up

Point-biserial correlations were run to determine the relationship between continuous schizotypy dimension scores at baseline and dichotomous schizotypy change scores at follow up (i.e., decreased or stayed the same vs. increased). All associations were significant, moderately sized, and negative: positive schizotypy ($r_{pb} = -.39$, $n = 103$, $p < .001$), negative schizotypy ($r_{pb} = -.27$, $n = 103$, $p = .01$), disorganized schizotypy ($r_{pb} = -.34$, n $= 103$, $p < .001$), and overall schizotypy ($r_{pb} = -.47$, $n = 103$, $p < .001$).

Multivariable Prediction Analyses at Baseline

As reported previously (Del Pozzo, 2019), the models at baseline for cross-sectional prediction of positive, negative, and disorganized schizotypy were all significant. Several variables were cross-sectionally associated with higher levels of each schizotypy dimension.

The model predicting positive schizotypy at baseline was significant ($F(7, 94) = 19.87$, $p < .001$) and explained 60% of the variance in scores. The following variables were significantly predictive: a history of one or more head injuries, greater reactive aggression, responding impetuously under extreme positive emotions, increased depressive symptoms of depression, experiencing the death of a parent before age 18, greater meanness towards others, and participating in fewer prosocial activities.

The model predicting negative schizotypy at baseline was significant ($F(3, 99) = 31.18$, $p < .001$) and explained 49% of the variance in scores. The following variables were significantly predictive: increased anxiety, responding impetuously under extreme negative emotions, and experiences of childhood and adolescent emotional neglect.

The model predicting disorganized schizotypy at baseline ($F(4, 98) = 19.46$, $p < .001$) was significant and explained 44% of the variance in scores. The following variables were significantly predictive: increased reactive aggression, responding impetuously under negative emotions, increased stress, and experiences of childhood and adolescent emotional abuse.

Finally, the model predicting overall schizotypy at baseline was significant ($F(6, 96) = 22.00$, $p < .001$) and explained 58% of the variance in scores. The following variables were significantly predictive: a history of one or more head injuries, increased reactive aggression, experiences of childhood and adolescent emotional abuse, responding rashly under negative

emotions, a tendency to experience anxiety and distress in reaction to another's negative circumstance, and increased symptoms of depression.

Multivariable Prediction Analyses at Follow Up

The cross-sectional predictive models were replicated in prospective models, with the outcome being schizotypy dimension or overall schizotypy score at follow up. The model predicting positive schizotypy at follow up was significant ($F(6, 78) = 15.29$, $p < .001$) and explained 54% of the variance in scores. The following variables were significantly predictive: having a first-degree relative with a serious mental illness ($B = 6.42$, $SE\ B = 1.81$, $\beta = 0.29$), increased alcohol use and abuse ($B = 0.63$, $SE\ B = 0.20$, $\beta = 0.25$), responding impetuously under negative emotions ($B = 1.22$, $SE\ B = 0.29$, $\beta = 0.35$), increased symptoms of depression ($B = 0.32$, $SE\ B = 0.14$, $\beta = 0.20$), poorer interpersonal communication ($B = -0.86$, $SE\ B = 0.42$, $\beta = -0.16$), and more assault offenses ($B = 0.38$, $SE\ B = 0.14$, $\beta = 0.22$).

The model predicting negative schizotypy at follow up was significant ($F(4, 80) = 12.70$, $p < .001$) and explained 39% of the variance in scores. The following variables were significantly predictive: increased anxiety ($B = 0.57$, $SE\ B = 0.13$, $\beta = 0.40$), greater alcohol use and abuse ($B = 0.54$, $SE\ B = 0.16$, $\beta = 0.30$), living with someone who abused drugs before age 18 ($B = 4.75$, $SE\ B = 1.63$, $\beta = 0.26$), and less boldness ($B = -0.29$, $SE\ B = 0.13$, $\beta = -0.20$).

The model predicting disorganized schizotypy at follow up was significant ($F(4, 82) = 12.44$, $p < .001$) and explained 38% of the variance in scores. The following variables were significantly predictive: responding impetuously under negative emotions ($B = 0.87$, $SE\ B = 0.21$, $\beta = 0.38$), a history of one or more head injuries ($B = 3.91$, $SE\ B = 1.30$, $\beta = 0.27$), increased alcohol use and abuse ($B = 0.35$, $SE\ B = 0.15$, $\beta = 0.20$), and an inclination to

experience anxiety and distress in reaction to another's negative circumstance ($B = 0.33$, $SE\ B =$ 0.16, $\beta = 0.19$).

Finally, the model predicting overall schizotypy at follow up was significant ($F(6, 80) =$ 12.95, $p < .001$) and explained 50% of the variance in scores. The following variables were significantly predictive: a history of one or more head injuries ($B = 12.96$, $SE\ B = 3.90$, $\beta = 0.27$), experiences of childhood and adolescent emotional abuse ($B = 0.18$, $SE\ B = 0.35$, $\beta = 0.03$), responding rashly under negative emotions ($B = 2.84$, $SE\ B = 0.66$, $\beta = 0.37$), increased symptoms of depression ($B = 0.92$, $SE\ B = 0.31$, $\beta = 0.26$), greater alcohol use and abuse ($B =$ 1.13, $SE\ B = 0.46$, $\beta = 0.21$), fewer miscellaneous offenses ($B = -0.35$, $SE\ B = 0.13$, $\beta = -0.22$), and poorer interpersonal communication skills ($B = -2.55$, $SE\ B = 0.97$, $\beta = -0.23$).

Exploratory Regression Analyses at Follow Up

Exploratory regression analyses were conducted for positive, negative, disorganized, and overall schizotypy**,** with each of the models including all variables that significantly predicted any of the four outcomes at baseline (Del Pozzo, 2019). The model predicting positive schizotypy at follow up was significant ($F(11, 74) = 4.43$, $p < .001$) and explained 40% of the variance in scores. The following variables were significantly predictive: increased alcohol use and abuse, experiences of childhood and adolescent emotional abuse, and increased symptoms of depression. The model predicting negative schizotypy at follow up was also significant ($F(11, 74) = 2.74$, $p = .01$) and explained 29% of the variance in scores. The following variables were significantly predictive: increased alcohol use and abuse and increased symptoms of depression. The model predicting disorganized schizotypy at follow up ($F(11, 74) = 2.40$, $p = .01$) was likewise significant and explained 26.3% of the variance in scores. The following variables were significantly predictive: a history of one or more head injuries and increased alcohol use and

abuse. Finally, the model predicting overall schizotypy at follow up was significant ($F(11, 76) =$ 3.74, $p < .001$) and explained 35% of the variance in scores. The following variables were significantly predictive: a history of one or more head injuries, increased alcohol use and abuse, and increased symptoms of depression.

Multivariable Analyses Considering Schizotypy at Baseline and Follow Up

Binary logistic regressions were used to assess the relationship between psychosocial predictor variables and dimensional and overall schizotypy change scores. All possible predictor variables were entered into each prospective logistic regression model and only those variables that were significantly related to the dependent variables (positive, negative, disorganized, overall) were retained. As such, a logistic regression was performed to examine the effects of urbanicity, living in a household with someone who abused drugs before age 18, and prosocial activities on the likelihood that participants have higher positive schizotypy scores at follow up. The model was significant ($\chi^2(3) = 23.65$, $p < .001$), explained 27.6% of the variance in positive schizotypy scores, and correctly classified 72.5% of cases. Individuals who grew up in a household with someone who abused drug before age 18 were 6.63 times more likely to have increased positive schizotypy scores at follow up than persons who did not grow up in such a household. Also, individuals who did not grow up in an urban area had a reduced likelihood of higher positive schizotypy scores at follow up. However, persons who participated in fewer prosocial activities were 1.10 times less likely to have increased positive schizotypy scores at follow up. Further, 64.6% of participants who had increased positive schizotypy were also correctly predicted by the model to have increased positive schizotypy scores at follow up. Thus, growing up in an urban area and living in a household with someone who used or abused drugs before age 18 was associated with an increased likelihood of higher positive schizotypy scores at

follow up, whereas fewer prosocial activities were associated with lower likelihood of higher positive schizotypy scores at follow up.

Next, a logistic regression was performed to establish the effects of having a first-degree relative with a serious mental illness on the likelihood that participants have higher negative schizotypy scores at follow up. The logistic regression model was statistically significant, $\chi^2(1) = 4.53$, $p = .03$. The model explained 6% (Nagelkerke R^2) of the variance in negative schizotypy scores and correctly classified 59.2% of cases. Individuals who had a first-degree relative with a serious mental illness, such as schizophrenia, schizoaffective disorder, or bipolar disorder were 4.00 times more likely to have increased negative schizotypy at follow up relative to persons who did not have a first-degree relative with a serious mental illness. Further, 95% of participants who had increased negative schizotypy were also predicted by the model to have increased scores on negative schizotypy at follow up. Therefore, having a first-degree relative with a diagnosed serious mental illness was associated with an increased likelihood of greater negative schizotypy scores at follow up.

Then, a logistic regression was run to determine the effects of reactive aggression, lack of perseverance, prosocial activities, and manipulation offenses on the likelihood that participants have higher disorganized schizotypy scores at follow up. The logistic regression model was statistically significant, $\chi^2(4) = 26.55$, $p < .001$. The model explained 31% (Nagelkerke R^2) of the variance in disorganized schizotypy scores and correctly classified 71.6% of cases. Reactive aggression and a history of manipulation offenses were associated with a reduction in disorganized schizotypy scores at follow up, whereas greater lack of perseverance and prosocial activities were associated with an increased likelihood of higher disorganized schizotypy scores at follow up. Further, 69% of participants who had increased disorganized schizotypy scores

were also predicted by the model to have increased scores on disorganized schizotypy at follow up. Thus, decreased reactive aggression, fewer manipulation offenses, and increased lack of perseverance (e.g., attention and the inability to stay focused on one thing), and prosocial activities were associated with an increased likelihood of higher disorganized schizotypy scores at follow up.

Finally, logistic regression was used to analyze whether total aggression, symptoms of stress, and experiencing the death of a parent before age 18 predicted higher overall schizotypy scores at follow up, as these variables were significantly correlated with overall schizotypy scores. The overall model was statistically significant when compared to the null model, $\chi^2(3) =$ 23.44, $p < .001$. It explained 27.4% of the variance in overall schizotypy scores (Nagelkerke R^2) and correctly predicted 64% of cases. Total aggression ($p = .05$) and symptoms of stress ($p = .04$) were significant but experiencing the death of a parent before age 18 was not ($p = 1.00$). Lower total aggression and fewer symptoms of stress were associated with decreased likelihood of higher overall schizotypy scores at follow up. Further, 75% of participants who had increased overall schizotypy were also predicted by the model to have increased scores on overall schizotypy at follow up. Thus, decreased aggression and fewer symptoms of stress were associated with a decreased likelihood of increased overall schizotypy scores at follow up.

Chapter 4: Discussion

This study investigated the stability of schizotypy and relevant psychosocial risk factors between baseline and two-year follow up. It was hypothesized that large sized positive correlations would be observed between baseline and follow up for all study variables, demonstrating two-year stability. Additionally, it was hypothesized that the mean difference between scores for all variables from baseline to follow up would not be statistically significant, further evidencing two-year stability. This hypothesis was partially supported, as moderate to strong evidence of stability for overall schizotypy, schizotypy dimensions, and several psychosocial risk factors was observed over the two-year period. However, two-year stability appeared modest to poor for several other variables, as discussed further below.

The current study also examined whether predictor variables for schizotypy at baseline continued to be significant predictor variables at two-year follow up. It was hypothesized that significant baseline predictor variables for both dimensional and overall schizotypy would be significantly associated with and significantly predict schizotypy scores at follow up, and that few to no non-schizotypy baseline study variables that did not significantly predict baseline overall schizotypy and schizotypy dimensions would significantly predict schizotypy scores at follow up. This hypothesis was also partially supported, as detailed further below.

Finally, analyses were performed to determine whether baseline schizotypy scores predicted increased schizotypy scores at follow up. A portion of the final hypothesis, that higher baseline schizotypy scores would be associated with increases in schizotypy scores at follow up, was not supported. However, significant baseline predictor variables for schizotypy dimensions and overall schizotypy were significantly associated with schizotypy change scores at follow up. All these results are discussed in more detail below.

Hypothesis 1

Evidence of stability for all schizotypy factors over the two-year period was observed. Significant, strong, positive correlations (i.e., $p < .05$ and r or $\rho > 0.7$) were found for positive, negative, and disorganized schizotypy dimensions, in addition to overall schizotypy. There were also no significant mean or median differences between schizotypy variables at T1 and T2, which was interpreted as support for two-year stability.

Similarly strong support for stability was also observed for several variables in the form of large-sized positive correlations and no significant mean or median differences in scores at T1 vs. T2: lifetime alcohol use and abuse; number of lifetime traumatic events, childhood and adolescent physical abuse, physical neglect, and emotional neglect; psychopathic boldness and disinhibition; empathy (perspective taking, empathic concern, and personal distress); impulsivity (negative urgency, lack of perseverance, lack of premeditation, sensation seeking, and positive urgency); a few types of delinquent or criminal offenses (i.e., theft–fraud and assault); depression, anxiety, and stress; and the recreation aspect of social behavior.

Moderate support for stability was observed for several variables in the form of medium-sized positive correlations and no significant mean or median differences in scores at T1 vs. T2: reactive, proactive, and total aggression; several types of delinquent or criminal offenses (i.e., miscellaneous, driving, sexual); and the independence-performance aspect of social behavior.

Mixed support for stability was observed for several variables in the form of moderate to strong correlations but a significant mean or median difference in scores at T1 vs. T2, or a minor correlation but no significant mean or median difference: some offense types (e.g., weapons/serious assault, custody, random) and the interpersonal communication aspect of social behavior.

However, this hypothesis was only partially supported, as notably mixed to no evidence of two-year stability was observed for several psychosocial risk factors: drug use and abuse; experiences of childhood emotional abuse, sexual abuse, and experiencing multiple traumas in childhood; psychopathic meanness and total psychopathy; total impulsivity, manipulation, drug, and total offenses; and social engagement and withdrawal, independence-competence, and prosocial activities.

Regarding drug use and abuse, scores were moderately and positively associated between baseline and follow up. However, there was a significant average difference between drug use and abuse scores, with scores at follow up being lower.

Childhood and adolescent emotional and sexual abuse scores, and scores for multiple traumatic experiences, were strongly and positively related between baseline and follow up. Though all these scores were also significantly higher at T2.

Scores for the psychopathy construct of meanness were strongly and positively associated between baseline and follow up. But the average score was higher at follow up. As for total psychopathy, scores were also strongly and positively associated over the two-year period. But the average score was significantly lower at follow up.

Total impulsivity scores were strongly and positively correlated across the two-year period. Yet, scores at follow up were significantly lower, as the significant average difference between total impulsivity scores decreased from baseline.

As for offense types, manipulation offenses were moderately and positively associated between baseline and follow up, whereas drug offenses and total number of offenses were strongly and positively correlated. However, scores for all these offense types were significantly higher at follow up.

Finally, regarding social functioning, social engagement, withdrawal, and prosocial activities were moderately and positively correlated, whereas independence-competence was strongly and positively correlated, between T1 and T2. However, scores for social engagement, withdrawal, and prosocial activities were significantly lower at follow up, whereas independence-competence scores were significantly higher at follow up.

In sum, participants, as a whole, at follow up relative to baseline, evidenced decreased drug use and abuse; increased experiences of childhood and adolescent emotional abuse, sexual abuse, and multiple traumas; increased meanness but decreased total psychopathy; less impulsivity; a greater number of manipulation, drug, and total offenses; and increased independence-competence, less social engagement, increased withdrawal, and engagement in fewer prosocial activities. Evidence of a lack of stability across time for these potential risk factors is mixed in the literature.

It is somewhat difficult to adequately explain the finding of lower drug use and abuse at follow up, although some studies have also observed this (e.g., Cantwell et al., 1999). It is possible that the effect of time, and subsequently, better adjustment to university life over the two-year period, is responsible for the observed decrease. Other possibilities include: participants may have received some form of treatment over the two-year interval, regression to the mean, or participants were underreporting their illicit drug use at follow up, the latter of which is common among individuals with schizophrenia spectrum disorders (e.g., Bahorik et al., 2014). Additionally, nearly 30% of the participants graduated college at follow up and it may be that drug use tends to decline after college.

It is also difficult to explain the increased reports of childhood and adolescent emotional abuse, sexual abuse, and experience of multiple traumas, given the retrospective nature of

reporting, as there is significant evidence that reports of childhood trauma are reliable and stable over time, even among individuals who convert to psychosis (e.g., Bonoldi et al., 2013; Fisher et al., 2011; Velikonja et al., 2015; Xiang et al., 2021). Additionally, the measure used (CTQ) refers to any event that an individual may have experienced prior to the age of 18, so it is unlikely that participants experienced additional childhood and adolescent traumatic events since baseline, given the age ceiling and the average age of participants being 20 and 22 at baseline and follow up, respectively.

The finding of lower psychopathic traits at follow up may be related to the lack of clinically significant substance use and abuse in the sample, and decreased reports of impulsivity reported over time, given that psychopathy is often marked by, among other things, impulsivity, and sensation-seeking tendencies. Additionally, there may have been less opportunities for alcohol and drug use and subsequently, impulsivity and various offense types, due to COVID-19 restrictions, particularly on college campuses.

Finally, regarding social functioning, prior studies have found that increased social isolation and lack of engagement with others and the community are often features associated with increased risk of/precursors to conversion to psychosis (e.g., Addington et al., 2008; Cornblatt et al., 2012). Participants were generally of the age where risk of first conversation to psychosis is highest (e.g., Angst et al., 2005; Jongsma et al., 2018; Kirkbride et al., 2006; 2012). Alternative possibilities are that increased independence and decreased socialization are normative changes during young adulthood (e.g., Eagan et al., 2014) and that there may have been less opportunities for socialization and engagement due to COVID-19 restrictions and protocols, especially on college campuses.

Hypothesis 2

At baseline, depressive symptoms, reactive aggression, positive urgency, feelings of personal distress, and having one or more head injuries significantly predicted the positive schizotypy dimension. For the negative schizotypy dimension, anxiety symptoms, negative urgency, and childhood and adolescent experiences of emotional neglect were significant predictors. The disorganized schizotypy dimension was significantly predicted by stress, reactive aggression, experiences of childhood and adolescent emotional abuse, and negative urgency. Finally, having a history of one or more head injuries, reactive aggression, childhood and adolescent experiences of emotional abuse, negative urgency, feelings of personal distress, and depressive symptoms significantly predicted overall schizotypy. Across the baseline models for all three schizotypy dimensions (positive, negative, and disorganized), there were no consistent predictive factors. However, reactive aggression, negative urgency, and experiences of childhood and adolescent emotional abuse were the most commonly observed significant predictors across the three models.

Baseline variables of negative urgency, depressive symptoms, having a first-degree relative with a serious mental illness, higher alcohol use and abuse, assault offenses, and lower interpersonal communication significantly predicted positive schizotypy at follow up. The negative schizotypy dimension at follow up, in turn, was significantly predicted by baseline anxiety, higher alcohol use and abuse, higher drug use and abuse, and lower feelings of boldness. Significant baseline predictors for the disorganized schizotypy dimension at follow up were negative urgency, having a history of one or more head injuries, higher alcohol use and abuse, and feelings of personal distress. Finally, negative urgency, depressive symptoms, having a history of one or more head injuries, lower interpersonal communication, miscellaneous

offenses, higher alcohol use and abuse, and experiences of childhood and adolescent emotional abuse significantly predicted overall schizotypy at follow up. Of note, higher baseline alcohol use and abuse consistently predicted all three types schizotypy dimensions (positive, negative, and disorganized) at follow up.

Several psychosocial risk factors predicted schizotypy both at baseline and follow up. Importantly, the four follow-up models for positive, negative, disorganized, and overall schizotypy did not include all the same predictor variables, but rather only those predictors that were significant for each respective outcome at baseline. Thus, for positive schizotypy, depressive symptoms; and for negative schizotypy, anxiety symptoms. Schizotypy has previously been found to be associated with negative affect and emotional dysfunction—specifically, depression and anxiety (Díez-Gómez et al., 2020; Fonseca-Pedrero et al., 2011; 2021; Jahn et al., 2016; Lewandowski et al., 2006; Lin et al., 2013; McCleery et al., 2012; Schimanski et al., 2017; Wang et al., 2018). Depression and anxiety are also often comorbid with schizophrenia spectrum disorders. Thus, from a continuum perspective, persons with schizotypy or schizotypal traits may suffer from clinical and subclinical depressive and/or anxiety symptomatology (Buckley et al., 2009; Fonseca-Pedrero et al., 2021; Lewandowski et al., 2006; Sun et al., 2022; Yung et al., 2003). For example, previous studies have found rates of depression to range from 23–41%, and anxiety from 15–41%, in persons with schizophrenia spectrum disorders (Fusar-Poli et al., 2014; Sun et al., 2022; Wilson et al., 2020), with rates of depression and anxiety as high as 89% for individuals with schizotypy (Breetvelt et al., 2010). Such seeming comorbidity is not particularly surprising considering the significant overlap in symptoms between depression, anxiety, and schizophrenia spectrum disorders (e.g., social withdrawal, anhedonia, sleep problems, fatigue, difficulty concentrating).

In non-clinical and student samples, depression has been found to be significantly associated with positive schizotypy (Chapman et al., 1994; Kwapil et al., 2008; Lenzenweger & Loranger, 1989; Lewandowski et al., 2006; Lin et al., 2013). For example, in a more recent study, positive schizotypy was associated with depression in young adults (Racioppi et al., 2018). Evidence that negative affect—particularly anxiety—is commonly related to negative schizotypy has also been regularly observed (Debbané et al., 2009; Lin et al., 2013; Rey et al., 2009; Wang et al., 2020), as well as increasing risk for conversion to schizophrenia spectrum disorders (Lewandowski et al., 2006; Tibbo et al., 2003). Of note, symptoms of anxiety share several phenotypic similarities with negative schizotypy (Lewandowski et al., 2006).

The findings from the current study, that positive and negative schizotypy were significantly related to higher symptoms of depression and anxiety, lend themselves to the stress-sensitivity model of schizotypy, which highlights that stressful experiences and troubles in daily life may be triggers for psychotic-like experiences in persons at increased risk for psychotic disorders (Van Winkel et al., 2008). Especially for individuals who are higher in positive or negative schizotypy (Barrantes-Vidal et al., 2013b). Samsom and Wong (2015) emphasize that "depression has been reported during all stages of the course of schizophrenia" (p. 1). More specifically, it has been suggested that neuroinflammation, particularly microglial activation, mediates the relationship between psychosocial stressors and mental health outcomes in adulthood (Bloomfield et al. 2015; Calcia et al., 2016; Ganguly & Brenhouse, 2015; Troubat et al., 2016)—such as in depression (Calcia et al., 2016; Hennessy et al., 2010; Jones & Thomsen, 2013; Scott et al., 2012; Torres-Platas et al. 2014; Troubat et al., 2016; Valkanova et al., 2013), anxiety (Calcia et al., 2016; Frick et al. 2013; Hennessy et al., 2010), and schizophrenia spectrum disorders (Calcia et al., 2016; Jones & Thomsen, 2013; van Berckel et al. 2008). In the current

study, the risk factors that were predictive, specifically depressive and anxiety symptoms, could

be categorized as neuroinflammation factors.

The current findings are also important because prior studies have indicated that for

individuals with schizotypy, depression or anxiety may contribute to an increased risk of

transition to a psychotic disorder (Yung et al., 2003). Thus, the affective dysregulation associated

with depression and anxiety may signal increased risk for conversion to psychosis, perhaps due

to their contribution to or reflection of significant distress for persons with schizotypy, which

might hasten decompensation. Alternatively, as schizotypal traits develop and persist, it may be

that negative coping strategies (e.g., substance use) are employed to cope with stress as it arises,

the ineffectiveness of which may lead to greater depressive and anxious symptomatology.

Accordingly, future research should continue to attend to depressive and anxious symptoms, and

further clarify the sequencing of these factors in line with schizotypy and schizophrenia spectrum

disorders, as well as explore these risk factors as possible neuroinflammatory markers. Such

clarification can further inform practice, including risk assessment for conversation to psychosis

among those at risk (e.g., persons evidencing schizotypy).

In the current study, the impulsivity trait of negative urgency, or one's proclivity to act

impulsively under intense negative emotions to rid themselves of these emotions (Cyders &

Smith, 2008; Howard & Khalifa, 2016), was a significant baseline predictor of disorganized

schizotypy at follow up. Mobini and colleagues (2006, 2007) found that persons with impulsivity

presented with considerably more potentially problematic cognitive processes and some of these

cognitive patterns (e.g., short-term orientation, confusion of needs and wants) can affect one's

capacity to plan and consider different consequences. Such deficits are not only seen in negative

urgency; this type of impulsive characteristic can also intensify such thinking patterns.

Furthermore, prior studies have found that emotional problems, including problematic affective expressiveness, are most strongly related to disorganized schizotypy (Kwapil et al., 2020; Lin et al., 2013). Kwapil and colleagues (2020) found that disruptions in high-arousal negative affect may be a distinct indicator of disorganized schizotypy. Relatedly, Few et al. (2015) found that negative urgency significantly and positively correlated with schizotypy, while Denovan et al. (2020) found that negative urgency predicted disorganized schizotypy. Garcia and colleagues (2012) observed that, in schizophrenia, individuals tend to have trouble stopping negative thinking and emotional reasoning, which is related to negative urgency. Similarly, several other studies have found that negative urgency is elevated in schizophrenia spectrum disorders, as persons have significant difficulty with both impulsivity and emotion regulation (Hoptman, 2015; Hoptman et al., 2014; Muhlert & Lawrence, 2015; Oh et al., 2021; Perlin et al., 2018; Weiss et al., 2012). These findings can help improve our understanding of the role of impulsivity in both schizotypy and schizophrenia spectrum disorders, as well as the clinical implications, which may focus on cognitive interventions targeting cognitive distortions, evaluation of negative emotionality, and emotion regulation techniques for negative affect.

For overall schizotypy, baseline depressive symptoms, negative urgency, a history of one or more head injuries, and experiences of emotional abuse during childhood and adolescence consistently predicted both baseline and follow-up overall schizotypy. The potential contributions that depressive symptoms, including neuroinflammation, and impulsive negative urgency may make to schizotypy were described above. Regarding persons with a history of one or more head injuries having higher overall schizotypy scores at follow up, this is a novel finding for schizotypy, as the limited prior research that has attended to this factor has only found it to be relate to schizophrenia spectrum disorders. Moreover, prior findings are mixed, as sex, genetics

(e.g., most participants that have been examined have a family history of schizophrenia), and timing and degree of the injury are unclear, such that determining a causal relationship is difficult.

Several studies have found head injury to be a risk factor for the development of schizophrenia spectrum disorders (AbdelMalik et al., 2003; Chen et al., 2011; Fann et al., 2004; Harrison et al., 2006; Malaspina et al., 2001; Molloy et al., 2011; Nielsen et al., 2002; Orlovska et al., 2014). AbdelMalik and colleagues (2003) found that early childhood head injuries were associated with later development of schizophrenia. Relatedly, several studies found that risk for schizophrenia spectrum disorders was increased after head injury in persons with a genetic predisposition for the former (AbdelMalik et al., 2003; Malaspina et al., 2001). More recently, Orlovska et al. (2014) conducted a population-based study to examine the prevalence of schizophrenia spectrum disorders and found there to be a 65% increase in the risk of schizophrenia spectrum disorders following a head injury. Nevertheless, given the relative dearth of studies examining the association between head injury and schizophrenia spectrum disorders, and the lack of any studies on its relationship to schizotypy specifically, the finding from the current study warrants further investigation and replication. Head injury may increase vulnerability, or constitute a specific pathway (e.g., neuroinflammatory), for conversion to psychosis. Additionally, for persons at increased genetic risk/predisposition for psychosis, head injuries may interact with genes to alter the expression and course of schizophrenia spectrum disorders, starting with schizotypy at the beginning of the continuum (AbdelMalik et al., 2003; Malaspina et al., 2001; Molloy et al., 2011).

An additional predictor of overall schizotypy scores at follow up was experiences of emotional abuse during childhood and adolescence. Numerous prior studies have explored

childhood trauma and adversity. All forms of childhood trauma and abuse, including emotional abuse, have been found to relate to schizotypy (Berenbaum et al. 2003, 2008; Campbell & Morrison, 2007; Cristóbal-Narváez et al., 2016; Goodall et al., 2015; Powers et al., 2011; Spauwen et al., 2006; Steel et al., 2009; Thomas et al., 2022; Toutountzidis et al., 2018; Velikonja et al., 2015). Moreover, childhood emotional abuse has emerged as the strongest predictor of schizotypy in studies of early childhood trauma (Berenbaum et al. 2003; Goodall et al., 2015; Powers et al., 2011; Toutountzidis et al., 2018; Velikonja et al., 2015; 2019). The finding from the current study is consistent with this prior research, as it was found that emotional abuse during childhood and adolescence, in particular, was associated with higher overall schizotypy at follow up. Childhood and adolescent emotional abuse may be a more persistent and constant form of abuse compared to other types of abuse (e.g., physical, sexual). And as such, it may be more likely to exhibit a dose-response relationship for psychotic disorders, where the risk of psychosis increases with greater frequency of emotional abuse incidents (Goodall et al., 2015; Janssen et al., 2004; Toutountzidis et al., 2018; Velikonja et al., 2015).

Furthermore, overall schizotypy may also be associated with increased hypervigilance, intrusions, avoidance, and low mood (Mason, 2015). Childhood and adolescent trauma is likely heterogenous and may lead to the onset of psychosis or psychotic-like experiences by activating veiled genetic predisposition or vulnerability an individual may have toward schizophrenia spectrum disorders, and through an environmental pathway (e.g., extreme stress related to childhood and adolescent abuse; Goodall et al., 2015; Powers et al., 2011; Toutountzidis et al., 2018; Varese et al., 2012; Velikonja et al., 2015). The current findings suggest that, of the different types of traumatic childhood experiences, emotional abuse may be especially related to

increased schizotypal traits, as it was predictive of positive, negative, and overall schizotypy scores at follow up. Nonetheless, it is worth noting that the relationships were only small to medium in magnitude. Ultimately, the current and prior findings are suggestive of a developmental model of psychosis proneness, wherein childhood and adolescent trauma and adversity, and specifically emotional abuse, may increase an individual's susceptibility and sensitivity to stress, and the reactivity to stress may interact with a predisposition to psychosis, thereby increasing the risk of developing subclinical schizotypal symptoms or even clinical schizophrenia.

In addition, in prior research, childhood maltreatment has been commonly observed to relate to both cognitive distortions and impulsivity, such as seen in the form of negative affect and negative urgency (Gagnon et al., 2013), as described above. Gagnon and colleagues (2013) explored the effect of self-reported childhood trauma and adversity on impulsivity in undergraduate students and found that it was significantly associated with negative urgency, as well as negative affect (e.g., depressive symptoms). Similarly, several studies have found a relationship between childhood trauma and depression (Font & Maguire-Jack, 2016; Garcia et al., 2016; Jones et al., 2018; Pruessner et al., 2019; Thomas et al., 2022; Tonini et al., 2021). Negative urgency has also been found to predict depression (Johnson et al., 2013; Smith et al., 2013; Oh et al., 2021; Wang et al., 2020). For example, Liu and Kleiman (2012) found that individuals with depression had increased rates of negative mood-congruent events (e.g., acting out), which is thought to relate to negative urgency.

Head injury may also mediate the relationship between negative urgency and schizotypy, as reduced behavioral control and impulsivity are common after a head injury and associated with the development of psychosis (Batty et al., 2013; Ponsford et al., 2012). Relatedly, head

injury is also significantly associated with depression (Orlovska et al., 2014). Thus, there seems

to be some overlap and the potential for interactive effects among childhood and adolescent

abuse, negative urgency, head injury, and depressive symptomatology.

       An additional set of exploratory analyses for positive, negative, disorganized, and overall

schizotypy that included *all* predictor variables for any of positive, negative, disorganized, or

overall schizotypy at baseline, provided further insight into the predictors across all three

schizotypy dimensions and overall schizotypy at follow up. Baseline variables of alcohol use and

abuse, experiences of childhood and adolescent emotional abuse, and symptoms of depression

significantly predicted positive schizotypy at follow up. The negative schizotypy dimension at

follow up, in turn, was significantly predicted by alcohol use and abuse and symptoms of

depression. For the disorganized schizotypy dimension at follow up, significant baseline

predictors included a history of one or more head injuries and alcohol use and abuse. Finally, a

history of one or more head injuries, alcohol use and abuse, and symptoms of depression

significantly predicted overall schizotypy at follow up.

       Examining these exploratory prediction models highlights the significance of alcohol

abuse and use, as it significantly predicted all four outcomes at follow-up, followed by symptoms

of depression, which significantly predicted three follow-up outcomes (positive, negative, and

overall schizotypy). Thus, these factors appear, preliminarily, to be the most promising clinical

predictors based on their consistency across dimensional and overall schizotypy, followed

closely by having a history of one or more head injuries. As discussed above, these factors are

well-supported in the literature and align with the stress-sensitivity model of schizotypy.

Additionally, alcohol use and abuse has also been found to be related to increased levels of

schizotypy, specifically the positive and disorganized dimensions (e.g., Esterberg et al., 2009;

Nunn et al. 2001). As such, it is recommended that future research focus on these tentatively promising factors using more rigorous designs (e.g., multi-wave longitudinal), large sample sizes yielding high statistical power, more sophisticated statistical approaches, and corrections for risk for multiple comparisons—toward better understanding complex relationships potentially evident in the current data and given concerns about replicability across psychological science.

Importantly, relatively few studies have examined the prospective predictive validity of a wide range of risk factors concurrently for schizotypy. The findings from the current study in connection to hypothesis 2 suggest that several specific psychosocial factors may hold particular utility for future longitudinal research, and in practice, early psychosis screening efforts. More longitudinal multivariable research is needed to further inform developmental models of schizophrenia spectrum disorders, with an eye toward incremental predictive utility, and aspirations to inform efforts to prevent the onset of clinical psychosis.

Hypothesis 3

In the current study, support for part of the final hypothesis, that higher baseline dimensional and overall schizotypy scores would be associated with and predict increased schizotypy scores at follow up, was not found. Positive, negative, disorganized, and overall schizotypy scores generally did not increase across the two-year period. Instead, all dimensional and overall schizotypy scores trended in the opposite direction between baseline and follow up, with baseline and follow up scores being moderately to strongly negatively correlated. Thus, the findings from the present study suggest that both dimensional and overall schizotypal traits tend to decrease over a two-year period in a non-clinical population.

Although this relationship was not expected, it is consistent with several studies that examined the stability of schizotypal traits over various periods of time in non-clinical

populations, including college students (Cohen et al., 2020; Geng et al., 2013; Karamaouna et al., 2021; Wang et al., 2018). The decrease in positive, negative, disorganized, and overall schizotypal traits observed at follow up in the current study comport with findings demonstrating fluctuations in schizotypal features over time (Cohen et al., 2020; Geng et al., 2013; Grilo et al., 2004; Karamaouna et al., 2021; Lenzenweger et al., 2004; Sanislow et al., 2009; Shea et al., 2002; Wang et al., 2018). The decrease in schizotypal traits in the current study may be associated with the timing of participant recruitment. Recruitment of college students began in the fall semester, a time when many students are beginning their college careers. Additionally, participants had the option of receiving course credit for two different undergraduate courses typically taken by freshman and sophomores. Thus, study enrollment and subsequent assessment of baseline schizotypal traits may have overlapped with the beginning of college for many participants, a time commonly associated with stress and adjustment problems due to significant changes in an individual's environment and role, as individuals transition from adolescence to adulthood. Follow-up assessment occurred two years later, which likely allowed individuals time to adapt, leading to a subsequent decrease in stress, adjustment problems, and schizotypal traits. It is also possible that participants received mental health treatment over the course of the two-year period, although participants were not questioned about this possibility. Additionally, it would be remiss not to mention the possibility of regression to the mean. Although higher schizotypy scores were observed at baseline, follow-up scores were lower, consistent with the phenomenon of initial measurements of psychological symptoms tending to be higher than reassessments. Therefore, given the unanticipated results of this study concerning part of hypothesis 3, more research is needed to clarify and better understand temporal changes in schizotypy.

However, results from the current study were generally consistent with the portion of hypothesis 3 that significant baseline predictor variables for the positive, negative, and disorganized schizotypy dimensions, and overall schizotypy, would also predict change in schizotypy at follow up. Per the positive schizotypy change model, growing up in an urban environment, living in a household with someone who abused drugs before age 18, and engaging in fewer prosocial activities at baseline predicted increased positive schizotypy scores at follow up. Additional support for these seeming risk factors is evident in the literature, as urban residence, urban birth, or urban upbringing have been found to increase risk for schizotypy and psychosis (Ettinger et al., 2014; Linscott & van Os, 2013; Spauwen et al. 2004; van Os et al., 2008). Additionally, impairments in social functioning are a persistent feature of both schizotypy and schizophrenia spectrum disorders, specifically within the positive dimension—with such impairments often including difficulties with leisure time activities and community participation (Addington et al., 2008; Barrantes-Vidal et al., 2015; Kwapil et al., 2008a; 2013; McCleery et al., 2016; Minor et al., 2020; Pinkham et al., 2007; Wang et al., 2013b). Indeed, positive schizotypy is associated with fewer social activities and reduced social contact (Barrantes-Vidal, 2013a; Brown et al., 2008; Kwapil et al., 2008a; 2012).

Per the negative schizotypy change model, having a first-degree relative with a serious mental illness at baseline (such as schizophrenia, bipolar disorder, or schizoaffective disorder) predicted increased negative schizotypy scores at follow up. Previous literature supports this association, as persons with first-degree relatives with a serious mental illness have been shown to exhibit more schizotypal traits (Tarbox & Pogue-Geile, 2011), particularly in relation to negative schizotypy (Calkins et al., 2004; Fanous et al., 2001; Goulding et al., 2009; Kendler et al., 1995).

Increased disorganized schizotypy scores at follow up, in turn, were predicted by higher reactive aggression, lower perseverance, fewer prosocial activities, and higher manipulation offenses at baseline. Support for this combination of seeming risk factors is evident in the literature. The relationship between schizotypal traits and reactive aggression has been found in prior studies and was strongest for the disorganized dimensions of schizotypy, the latter of which also related to higher aggressive urges (Chung et al., 2016; Le et al., 2018). Lack of perseverance, an impulsivity trait, has previously been found to relate to disorganized schizotypy as well, as has risk-taking behavior (Denovan et al., 2020). As discussed above, that various social deficits relate to schizotypy has been frequently observed (Barrantes-Vidal et al., 2015; Kwapil et al., 2008; 2013; McCleery et al., 2015; Minor et al., 2020; Wang et al., 2013b). Further, prior studies have found a relationship between increased disorganized schizotypy traits and a higher offense history (Mason et al., 2012).

Finally, higher total aggression, stress, and experiencing the death of a parent before age 18 at baseline predicted increased overall schizotypy scores at follow up. Corroborative support for these seeming risk factors is evident in the literature. Although research examining schizotypy and aggression remains limited, initial studies have found that schizotypy is associated with higher aggressivity—i.e., that it is positively related to total aggression scores (Mojtabai, 2006; Raine et al., 2011; Rössler et al., 2007; Silverstein et al., 2015). Furthermore, numerous studies have found that higher schizotypal symptomatology is associated with psychosocial stress and everyday life hassles (Barrantes-Vidal et al., 2013a; Cohen et al., 2008; Geng et al., 2013; Horan et al., 2007; Pagano et al., 2004; Wang et al., 2018).

Strengths and Limitations

Many prior studies that have examined schizotypy and early psychotic experiences in the general population have used cross-sectional designs. In contrast, the number of prior studies that have examined change in schizotypy scores/symptomatology, including as measured via the SPQ-BR, using follow-up or longitudinal designs, is limited. Thus, a notable strength of the current study was its use of a prospective design. This design made it possible to explore the stability of study variables and potential changes in schizotypal traits over a two-year period. The prospective design was also important because participants in the current study were in the midst of a period of particularly high risk for psychosis (i.e., onset of psychotic disorders peaks between 20 and 40 years old; Angst et al., 2005).

The large baseline sample size was also a strength of the present study, increasing statistical power and confidence in baseline results. It also facilitated enough follow up participants to pursue the prospective aims of the current study. The response rate at follow up in the current study was 25.4% ($N = 103$), which is considered to be acceptable, if not good, for studies employing web-based surveys for measurement (Van Mol, 2017). Prior research has found that surveys completed by student populations tend to have response rates below 20%, and that a response rate for online surveys below 10% is increasingly common (Lee, 2010; Van Mol, 2017). The use of an *online* survey in the current study is also a strength, as Internet-based surveys have been observed to yield higher response rates than paper-and-pencil and in-person surveys (Koundinya et al., 2016; Liu & Wronski, 2017; Saleh & Bista, 2017). The email invitations sent to participants were personalized, and reminders (two in total, the most frequently used number of reminders in student web-based surveys; Fan & Yan, 2010; Said et al., 2013) with deadlines, were sent over the course of the follow up period, strategies which

have been shown to significantly improve survey response rates (Muňoz-Leiva et al., 2010;

Petrovčič et al., 2016; Porter & Whitcomb, 2005; Saleh & Bista, 2017; Van Mol, 2017).

The current study also employed a large and fairly comprehensive assessment battery,

which allowed for concurrent examination of numerous potential risk factors for schizotypal

traits. Although the assessment battery exclusively utilized self-report measures, which carried

limitations as discussed below, such an approach also carries some strengths. The self-report

measures were brief, free, or inexpensive, and user-friendly—all beneficial given the large

sample of participants in the present study, particularly at baseline. The current study also

utilizes many of the same measures for specific variables of interest (e.g., SPQ-BR, CTQ, RPQ)

and a similar sample composition (e.g., college students) as used in previous studies, which

strengthens the ability to compare the current findings with those of prior studies.

The current study also has several limitations deserving of note. The first was the use of a

non-clinical sample of college students. Although common in this area of research, the sample

was nonetheless one of convenience, encompassing mostly undergraduate students who

participated in exchange for course credit or another incentive (e.g., Amazon gift cards).

Focusing on this population exclusively limited the generalizability of the results to community

and clinical populations, as the sample was fairly constricted in age (18–32 years old), gender

(83% women), race (57% White), socioeconomic status (52% average), and psychiatric history

(60% none).

The large percentage of women was likely reflective of participants being recruited

primarily from undergraduate psychology courses, in which most students tend to be women

(Barlow & Cromer, 2006; Dickinson et al., 2012). Having a sample primary consisting of

women, with limited representation of men and other gender expressions, raises questions about

the generalizability of the results. Such a gender composition may well not be illustrative of

schizotypy populations, with younger men more at risk for schizotypal traits during the examined

window of time (e.g., late teens to early twenties). Participants in the current sample were also

likely to be higher functioning than young adults in both the general population and clinical

populations, as college students tend to have comparatively higher intelligence, greater

motivation, higher socioeconomic standing, and more social resources. Moreover, several

cultural factors (e.g., urban vs. rural or suburban residence, religious affiliation, cultural

practices, non-Western cultures, languages) were not considered in the present study. Such

factors may influence how participants report symptoms and experiences common in schizotypy

(e.g., odd, or distorted perceptions, unusual beliefs, limited emotional responses). Ultimately, the

ranges for schizotypal traits and other study variables may have been limited or restricted in

meaningful ways (e.g., this was a non-incarcerated sample; thus, the incidence of offenses was

likely narrow).

A second limitation was the use of Internet-administered self-report measures for data

collection, versus, for instance, in-person interview-based measures involving ratings by an

assessor. Self-report measures may result in biased responses, as they rely on participants'

subjective and retrospective accounts of their relevant experiences. The hallmark features of

schizotypy may not be completely understood, recognized, or accurately endorsed by

participants who may be having such experiences, which may result in unreliable responses (e.g.,

acquiescence, denial, impression management, minimization or underestimation of symptoms,

fear of stigmatization, lack of insight). Concerns can also be raised about self-reports about

trauma, aggression, substance use, and delinquency, due to the sensitive nature of such topics

(answers to which could be damaging to the individual if exposed, via a data breach, for

instance). Given these issues, it is possible that some number of participants may have deliberately or accidentally reported imprecise information about their experiences (e.g., underreporting, or inaccurate reporting). Moreover, a lengthy measurement battery was administered (twice to follow-up participants), which may have proven fatiguing for participants. Moreover, no attentional checks were embedded in the battery to detect participants who may have randomly responded or evidenced inattentiveness to specific item content.

Relatedly, because no structured diagnostic assessments were used to determine the presence of a mental disorder or confirm any clinical information, it is possible that more (or less) psychopathology was actually present in this sample than was captured by the self-report measurement tools employed. For instance, it is possible that participants with greater psychopathology may have been more likely to opt to take part in research about mental health, such that such persons may have been overrepresented in the current sample. Oppositely, participants with mental illnesses may have been more averse to participating due to, for instance, worries about level of functioning or stigma. The study was similarly limited in its approach to measuring participants' family history of mental illness. Collateral information (e.g., family member, medical record review, friend) was not obtained and participants may not have known about this topic, or they may have rendered inaccurate diagnostic information.

A third limitation of the current study is that items were added to the demographic form to attempt to account for the impact of COVID-19 on the development of schizotypal traits (e.g., to the best of your knowledge, have you been exposed to the coronavirus? Have you been diagnosed with the coronavirus?)—and particularly, positive symptoms (e.g., hallucinations, paranoia). However, an error in the Qualtrics survey related to "skip logic" was discovered after data collection was complete, whereby only individuals who answered "yes" to the question

about whether their mother experienced birth complications were then asked the COVID-19-related questions. If an individual answered "no" to their mother experiencing birth complications, the survey skipped to the next measure without asking about COVID-19 exposure or diagnosis. Although these concerns would not necessarily hinder the ability to explore the expression of schizotypal traits across time and on a continuum, it may have an impact on the manifestation of risk factors and their identification.

A fourth limitation concerned the response rate at follow up. There are several logistical issues that could have hindered the response rate. One issue was that accurate or updated email addresses were not available for all participants who agreed to be recontacted. Additionally, students may not regularly check the email address provided, may have dropped out of school, or the follow up survey invitation could have gone to their SPAM folder. Relatedly, students are often asked to complete numerous surveys every semester, such as course and teacher evaluations, as well as to participate in research studies for course credit, which may lead to survey fatigue (Muňoz-Leiva et al., 2010; Saleh & Bista, 2017; Van Mol, 2017). Thus, the time of year of survey-based research solicitation may impact rates of student participation, as it has been found that between 20–30% of students indicated that they are less likely to complete surveys at the beginning or end of the semester or academic year (Van Mol, 2017). The timing of the follow-up survey in the current study coincided with both the beginning and end of the semester. Another concern is the length of the current survey, as the longer a survey takes to complete, the less likely individuals are to participate (Saleh & Bista, 2017; Van Mol, 2017). Researchers have found that shorter surveys lead to higher response rates and that the ideal length of time to complete an online survey is under 15 minutes (Fan & Yan, 2010; Liu & Wronski, 2017; Saleh & Bista, 2017). The current survey was nearly three times that length,

which may have represented a deterrent for participants. Finally, prior research suggests that having offered an incentive to all participants who completed the survey, rather than only extending them the opportunity to enter a lottery for a chance to win an incentive, may have increased the response rates (Mercer et al., 2015; Saleh & Bista, 2017).

Beyond these highlights, there are several other limitations of the present study also worth briefly mentioning. The study, though prospective, only collected data from participants at two time points—baseline and two-year follow up. It would have been beneficial to have had at least a one-year follow up time point included in the study, or follow up assessments every 6-months, to better enable analysis of the multi-wave trajectory of schizotypal traits and covariates over time. As such, the ability to conduct a broader and more complex array of analyses and statistical modeling options was limited in the current study; many relatively simple analyses were conducted instead. However, with three of more time points, a more sophisticated and integrative statistical approach, such as cross-lagged panel analysis, could be employed to examine the causal influences between variables and estimate the directional effects that variables have on each other across time (Kearney, 2017).

The two-year follow up may also have been too short of a follow up period, as some prospective and longitudinal studies in this area have tracked participants for several years and even for up to 50 years. The shorter timeframe utilized in the current study may not have been long enough to identify relatively proximal changes of theoretical interest well. As part of enrollment for the current study, we did not focus on the recruitment of any genetically or biologically at-risk individuals (e.g., persons who have first-degree relatives with a schizophrenia spectrum disorder) for psychotic disorders, including those with known schizotypal features. This may be considered a limitation because individuals with and without genetic/biological risk

may have different etiologies and pathways to schizotypy (e.g., persons without genetic predisposition may have more psychosocial factors that influence the path to schizotypy) and along the continuum of psychosis. Relatedly, the current study did not assess the conversion rates of individuals high in schizotypy to a schizophrenia spectrum disorder. Finally, the study occurred during the period of the COVID-19 pandemic, an exceptional worldwide event that may have variously impacted participation and responses.

Implications and Future Directions

Current approaches to understanding schizotypy, and subsequent risk for more severe psychopathology, conceptualize schizotypy as a multidimensional construct consisting of a collection of impairments, experiences, and symptomatology leading to an underlying liability for the development of schizophrenia spectrum disorders. Schizotypy lends itself to a developmental approach and provides a context from which to understand the different trajectories of psychotic disorders. Although schizotypy is a personality trait found in non-clinical populations, it is expressed along a dynamic continuum for psychosis, varying from normal individual differences/non-clinical, subclinical, ultra-high risk, prodromal, and frank psychosis, and related schizophrenia spectrum disorders. This continuity approach to schizotypy assumes that the states on the continuum share similar etiologies, as well as developmental and phenomenological processes as schizophrenia spectrum disorders. Relatedly, the differences observed between the various states, and potential progression along the continuum, are suggestive of the extent of symptomatology experienced. Though it is also worth noting that not all individuals high in schizotypy or with schizotypal traits will go on to develop a psychotic disorder, as a person can be at risk but never progress along the continuum to clinical psychosis.

Consistent with existing literature, the current study presumed that schizotypy, and by extension schizophrenia spectrum disorders, is expressed along a continuum due to various genetic, environmental, and psychosocial factors that function interactively and cumulatively, even if the precise nature, etiology, and associations among these factors remains uncertain. Despite the use of a non-clinical sample and relatively short follow-up period, it was assumed that the more psychosocial risk factors an individual experiences, the more likely it is that they will manifest higher levels of schizotypal traits (i.e., a linear relationship). Moreover, the more distressing a person finds these features to be, the more difficult it may be to cope, subsequently leading to the development of additional dysfunction and risk for more severe psychotic symptoms (i.e., movement along the continuum toward more severe psychopathology).

The current study's focus on both predictors for and stability of schizotypal symptoms helps to inform early identification and intervention efforts. The results of the current study have implications for assessment, and specifically measures aiming to capture the multidimensionality of schizotypy, lending additional data about the SPQ-BR measure. Moreover, the current study lent data to inform prediction via combinations of risk factors that portend schizotypy over time, including different dimensions of schizotypy. Of note, a fair proportion of the variance in schizotypy outcomes was able to be accounted for by the predictive models. Furthermore, results also suggested that it may be these risk factors, rather than level of schizotypal traits, that are more useful for prognoses about whether symptoms manifested by non-clinical young adults will likely intensify over time, to help inform whether individuals are in need of mitigating services.

Thus, improvements in prediction can help to advance intervention efforts. Recent research has shown that interventions targeting the earlier stages of the psychosis continuum (e.g., prodromal phase, first episode) can considerably delay or prevent conversion to a psychotic

disorder (Addington et al., 2011; Fonseca-Pedrero et al., 2021; Morrison et al., 2012; Schmidt et al., 2017; Stafford et al., 2013; van der Gaag et al., 2013; Woodbury et al., 2016). Interventions that are psychosocial centered and focus on stress management; social, educational, and vocational support; health and wellness; and interpersonal skills training are needed (Bechdolf et al., 2012). The results of this study suggested several psychosocial factors with predictive utility that could be targeted in such interventions.

Despite its limitations, the current study adds to the growing literature exploring the development of schizotypy over time and across a continuum, as well as factors associated with higher schizotypal traits in healthy samples. However, additional research is needed to address the limitations of the current study.

First, future studies should include a larger, representative, and more diverse sample (e.g., age, gender, socioeconomic status, cognitive functioning, general functioning, non-Western cultures) of participants from both community and clinical settings to strengthen the generalizability of the findings. As the present sample predominantly consisted of White college-aged women attending a university and with average family socioeconomic status, focusing on greater diversity in sampling will not only improve generalizability, but it is also poised to yield specific insights. For instance, specifically recruiting non-clinical first-degree relatives of persons with a serious mental illness (e.g., schizophrenia spectrum disorder, bipolar disorder) would enable future researchers to examine the influence of genetics on the development of schizotypy (i.e. "biologically at-risk individuals;" Geng et al., 2013, p. 8) compared to those without a genetic predisposition for serious mental illness (i.e. "behaviorally at-risk individuals;" Geng et al., 2013, p. 8) and whether either has a greater liability for schizophrenia spectrum disorders; whether certain characteristics are more salient between the two groups; and how, if at

all, those features are associated with particular superordinate factors of schizotypy. As another example, more attention is needed on the effects of different cultural factors on ratings of schizotypy. Cohen et al. (2009, 2015) noted the prevalence of cultural differences in self-reported schizotypy, although the multitude of roles that culture may have on schizotypy expression remain uncertain.

Second, future research should include more follow-up time points (i.e., multi-wave designs). This would allow for better understanding of the longitudinal functioning of risk factors for schizotypal traits, and stability and change in the expression of such traits to further inform developmental models of schizotypy and pathways that potentially lead to clinical psychosis. Furthermore, the everyday life outcomes of participants high in schizotypal traits are not well known. Additional longitudinal studies with more and extended follow up periods could help to address this uncertainty by exploring the progression and prognosis for persons with schizotypal traits, especially conversion rates to schizophrenia spectrum disorders, and functional consequences, such as psychiatric hospitalization, deceased work productivity, and decreased adaptive functioning.

Third, to address concerns regarding the use of self-report measures, future studies could consider using clinical rating scales and incorporating, when available, collateral information (e.g., reports from family and friends; psychiatric records), as an adjunct to self-report measures. Other levels of analysis could also be pursued, including genetics, neuroimaging, and neuropsychological testing. This, in turn, can help to increase confidence in the accurate and comprehensive measurement of relevant variables among participants.

Fourth, future studies should continue to attend to the superordinate factors of schizotypy (e.g., positive, negative, disorganized), in addition to global schizotypy, to continue to refine

knowledge about seemingly distinct etiological pathways, which may lead to higher levels of schizotypy. Additional research is also needed to clarify the contention between the categorical and dimensional conceptualizations of schizotypy. Considerable prior research has applied categorical boundaries to measures of schizotypy by using cutoff scores, median splits, and percentiles to separate participants into groups (e.g., low, medium, and high schizotypy) for comparisons, such as with the SPQ-BR, which yields dimensional–continuous scores. However, categorizing a continuous variable into strata introduced similar concerns to categorical measurement. Such an approach may give rise to misleading results due to loss of information, loss of statistical power, and reduced magnitudes of effects, in addition to increased difficulty comparing results across studies (Altman & Royston, 2006; MacCallum et al., 2002; Royston et al., 2006).

Fifth, greater attention to potential protective factors for schizotypy is needed. An overwhelming majority of previous studies have focused solely on identifying risk factors for schizotypy, liability to psychosis, and later pathology, rather than protective factors which might prevent or slow the progression of schizotypal traits across the continuum. Focusing on protective factors can aid in informing developmental models and creating interventions where protective factors are highlighted and reinforced.

Sixth, assessing executive functioning in persons with schizotypy may also be advantageous given the relationships between schizotypal and schizophrenia spectrum psychopathology, and the evidence that individuals with schizophrenia present with significant cognitive impairment (Fioravanti et al., 2005; Heinrichs & Zakzanis, 1998; Orellana & Slachevsky, 2013). Identifying early deficits in executive functioning in persons with schizotypy may be an early sign/risk factor of liability for psychosis and a target for early intervention.

Relatedly, as suggested by Tabak and Weisman de Mamani (2013), employing behavioral or experimental tasks for non-clinical individuals with schizotypy may allow researchers to understand how the common features seen in schizotypy are made sense of and explained by healthy individuals. By including these tasks, the findings may help provide insight into how healthy individuals utilize cognitive interpretations that are adaptive for making sense of unusual, odd, and ambiguous experiences. These insights, in turn, can help inform cognitive modification strategies attempted with persons with schizotypy.

Seventh, research on antisocial behavior, including aggression, as a risk factor for schizotypy, or vice versa, remains limited. Recruitment of justice-involved samples would help to elucidate how schizotypal traits relate to aggression, psychopathy, delinquency, impulsivity, and empathy. Of note, future research on schizotypy and aggression should focus on reactive and proactive incidents of aggressive behavior separate from global aggressivity, as the motivations and pathways to each subtype of aggression may help to better grasp how and why schizotypal traits and associated symptomatology may increase an individual's probability of engaging in aggressive behavior. Furthermore, attention should be paid to the sequencing of effects (e.g., schizotypy as a risk factor for violence or the other way around). In addition, exploring antisocial conduct in general among persons high in schizotypy will help to provide a context for the study of aggression and schizotypy (e.g., are persons with schizotypy at increased risk for violence relative to other types of law violations?).

An Additional Study Artifact Consideration

The follow-up period of this study occurred during the height of the COVID-19 pandemic, and as such, the impact of the pandemic on participants' reports of their psychosocial functioning should be considered when interpreting the results. Based on early estimates (Rosen

et al., 2020), a substantial majority of people have experienced some degree of psychological distress during the pandemic. For college students, the unceasing spread of the COVID-19 virus, strict isolation protocols, and indefinite closings of colleges and universities across the country appeared to significantly impact mental health functioning (Camacho-Zuñiga et al., 2021; Cao et al., 2020; Kmietowicz et al., 2020; Wang et al., 2020; Xiao, 2020). Previous studies conducted during public health emergencies have suggested that college students may be especially vulnerable to mental health problems during such times (e.g., stress, depression, anxiety, substance abuse; Cao et al., 2020; Mei et al., 2011). And in general, the National College Health Assessment Survey (n.d.) found that one in four students have a diagnosable mental illness.

Accordingly, the pandemic should be considered a study artifact, which likely impacted participants' reported psychosocial functioning when measured at follow up, including with respect to mental health symptoms, trauma exposure, and social functioning. While such impacts might also have extended to the outcome variable, a trend suggestive of lower schizotypy scores at follow up lessens concern about this possibility.

Conclusion

The present study replicated and extended prior research concerning demographic, socio-environmental, clinical, and personality factors and their relationship to positive, negative, and disorganized schizotypy dimensions, as well as overall schizotypy, in a non-clinical sample. Most risk factors remained relatively stable from baseline to follow up, with some exceptions (i.e., drug use and abuse, some types of trauma, meanness and psychopathy, impulsivity, certain types of offenses, and some areas of social functioning). Comparing dimensional and overall schizotypal traits between baseline and follow up was suggestive of a trend toward decreasing, rather than increasing, schizotypy over time. Consistent with previous studies, many factors that

related to schizotypy at baseline also significantly predicted schizotypy at follow up. Across time, symptoms of depression were significantly predictive of positive schizotypy; anxiety symptoms were significantly predictive of negative schizotypy; negative urgency was a significant predictor of disorganized schizotypy; and negative urgency, depressive symptoms, a history of one or more head injuries, and experiences of emotional abuse during childhood were consistent predictors of overall schizotypy. In addition, several baseline psychosocial factors significantly predicted increased schizotypy at follow up (i.e., depression and anxiety symptoms, negative urgency, history of one or more head injuries, and experiences of emotional abuse during childhood).

Relatively few studies have examined the stability of schizotypy over time, or the prospective predictive validity of a wide range of risk factors concurrently. Thus, more such research is needed for a better understanding of temporal changes in schizotypy, to inform developmental models of schizophrenia spectrum disorders; and to learn about predictive factors with incremental utility. The results from the current study are informative for construct validation studies of schizotypy, risk-factor-targeting invention studies, and future prospective and longitudinal research on risk factors leading to conversion to schizophrenia spectrum disorders and other clinical psychoses. Improving our understanding of not only the construct of schizotypy and its multidimensionality, but the associated risk factors, including their stability or transiency, leading to greater impairment along the continuum of psychosis is vital. For such advances can enhance screening and assessment measures and early intervention efforts for individuals at risk for developing a psychotic disorder.

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Appendix: Assumption Checks

t-**tests**

Normally Distributed

First, data for each dependent variable (positive, negative, disorganized, and overall schizotypy) at follow up were graphed using histograms (see Figures 1–4). Another graph, a Q-Q plot, was used to confirm that the distributions were normal, where all values for each dependent variable fell either on the diagonal line or slightly above or below the line of the plot and indicated the data deviated from normality only slightly (see Figures 5–8). To quantify normality with numbers, frequency distributions were generated for each of the dependent variables and the values of skewness and kurtosis were examined. The dependent variable distributions for S (skewness) and K (kurtosis) were recorded and results reported as follows: positive schizotypy distribution ($S = -.31$, $K = -1.36$); negative schizotypy distribution ($S = .78$, $K = -.90$); disorganized schizotypy distribution ($S = .13$, $K = -1.23$), and overall schizotypy distribution ($S = .22$, $K = -1.10$). Thus, the positive schizotypy scores were slightly skewed to the left (negatively), whereas negative, disorganized, and overall schizotypy scores were minimally skewed to the right (positively). The negative K scores for all schizotypy score distributions were platykurtic with light-tails. Additionally, a Shapiro-Wilk test (W) was run for all schizotypy dimensions, where positive schizotypy ($W(99) = .99$, $p = .40$); negative schizotypy ($W(98) = .98$, $p = .25$); disorganized schizotypy ($W(98) = .98$, $p = .27$); and overall schizotypy ($W(101) = .99$, $p = .58$) were all non-significant and the distributions were normal. Two-tailed tests were run for all analyses, as suggested by Field (2011), who states that the error rate and power for two-tailed tests are minimally affected by skewed distributions. Wilcoxon sign tests were used for psychosocial variables data that violated parametric assumptions.

Independence of Observations

Observations were independent and the data were measured at the interval level.

Homogeneity of Variance

Levene's test for homogeneity of variances was conducted for all follow-up variables. If $p > .05$, the group variances were interpreted as equal. If $p < .05$, the groups were interpreted as evidencing unequal variances and thus, violative of the assumption of homogeneity of variances.

For head injury, the variances were not significantly different for the positive ($F(97) = 2.19$, $p = .14$), disorganized ($F(97) = .33$, $p = .57$), and overall schizotypy dimensions ($F(99) = 2.98$, $p = .09$), respectively. However, unequal variances were evident for the negative schizotypy dimension ($F(32) = 4.80$, $p = .03$). For birth complications, the variances did not significantly differ for the positive ($F(97) = 2.40$, $p = .13$), negative ($F(97) = 1.81$, $p = .18$), disorganized ($F(97) = 1.37$, $p = .25$), and overall schizotypy dimensions ($F(99) = 2.90$, $p = .09$), respectively. For self-reported psychiatric illness, the variances did not significantly differ for the positive ($F(97) = .01$, $p = .91$), negative ($F(97) = .48$, $p = .49$), disorganized ($F(97) = .60$, $p = .44$), and overall schizotypy dimensions ($F(99) = .10$, $p = .75$), respectively. For hospitalization for mental health issues over the past two years, the variances did not significantly differ for the negative ($F(38) = .58$, $p = .45$), disorganized ($F(38) = .11$, $p = .74$), and overall schizotypy dimensions ($F(39) = 1.54$, $p = .22$). However, unequal variance was evident for the positive schizotypy dimension ($F(38) = 4.64$, $p = .04$). For household diagnosis of mental illness, the variances were equal for the positive ($F(97) = .52$, $p = .47$), negative ($F(97) = 2.26$, $p = .14$), disorganized ($F(97) = 3.50$, $p = .06$), and overall schizotypy dimensions ($F(99) = 1.63$, $p = .20$), respectively. For first-degree relatives with a serious mental illness, the variances significantly differed for the negative ($F(28) = 5.53$, $p = .02$) and disorganized schizotypy dimensions ($F(28)$

= 5.51, p = .02), respectively; whereas they appeared equal for the positive ($F(97)$ = .23, p = .63) and overall schizotypy dimensions ($F(99)$ = 1.30, p = .26), respectively.

For urbanicity, the variances were evidently equal for the positive ($F(97)$ = .93, p = .34), negative ($F(97)$ = .76, p = .39), disorganized ($F(97)$ = 3.72, p = .06), and overall schizotypy dimensions ($F(99)$ = 1.98, p = .16), respectively. For parental separation or divorce, the variances did not significantly differ for the positive ($F(97)$ = .37, p = .55), negative ($F(97)$ = .10, p = .76), disorganized ($F(97)$ = .12, p = .73), and overall schizotypy dimensions ($F(99)$ = .14, p = .71), respectively. For household alcohol abuse, the variances did not significantly differ for the positive ($F(97)$ = 2.10, p = .15), negative ($F(97)$ = .17, p = .68), disorganized ($F(97)$ = 1.30, p = .26), and overall schizotypy dimensions ($F(99)$ = .03, p = .87), respectively. For household drug abuse, the variances were evidently equal for the positive ($F(97)$ = .13, p = .72), negative ($F(97)$ = .38, p = .54), disorganized ($F(97)$ = .01, p = .91), and overall schizotypy dimensions ($F(99)$ = .03, p = .86), respectively. For family incarceration, the variances did not significantly differ for the positive ($F(97)$ = 1.26, p = .27), negative ($F(97)$ = .64, p = .43), disorganized ($F(97)$ = .27, p = .60), and overall schizotypy dimensions ($F(99)$ = .00, p = .99), respectively. For parental death, the variances were evidently equal for negative ($F(97)$ = .32, p = .58), disorganized ($F(97)$ = .10, p = .76), and overall schizotypy dimensions ($F(99)$ = .03, p = .86), respectively; whereas the variance appeared unequal for the positive schizotypy dimension ($F(7)$ = 4.68, p = .03). For removal from home, the variances did not significantly differ for positive ($F(97)$ = .01, p = .93), negative ($F(97)$ = .04, p = .85), disorganized ($F(97)$ = .06, p = .80), and overall schizotypy dimensions ($F(99)$ = .07, p = .80), respectively.

Overall, homogeneity of variance was evident for most variables, apart from head injury and negative schizotypy, hospitalization for mental health issues and positive schizotypy, first-

degree relatives with a serious mental illness and negative and disorganized schizotypy, and

parental death and positive schizotypy. Although Levene's test can still be significant when

group variances are not very different in large samples (Field, 2011), Welch's *t*-test (Welch-

Satterthwaite method) was used in light of the violations, as it does not assume equal variance

and is an adjustment to the degrees of freedom.

Correlations

Pearson Correlation

Level of Measurement. All follow-up variables were continuous (interval).

Linear Relationship. This assumption was not met for all follow-up variables pursuant

to scatterplots. Thus, Spearman's correlation coefficient (ρ), a non-parametric test (see below),

was used when parametric assumptions were violated for specific variables.

No Significant Outliers. Extreme or significant outliers were removed for each follow-

up variable, if applicable. This varied depending on the variable and was decided based on

boxplots of the data.

Normally Distributed. Assumed, as the sample data (see above) at follow up are

normally distributed, and the sample is large.

Spearman's Correlation

Level of Measurement. All follow-up variables were interval.

Observations. The two variables were paired observations.

Monotonicity. Scatterplots were used to test for a monotonic relationship between the

two variables, which revealed all relationships to be monotonically increasing.

F **tests** (**ANOVA**)

Normally Distributed

See above.

Independence of Observations

Observations were independent and the dependent follow-up variables were measured on interval scales.

Homogeneity of Variance

Levene's test for homogeneity of variances was conducted for all follow-up variables. If $p > .05$, the group variances were deemed equal, and if $p < .05$, the groups were deemed to have unequal variances and thus, in violation of the assumption of homogeneity of variances.

For gender, the variances did not significantly differ for positive ($F(2, 96) = .62, p = .54$), negative ($F(2, 96) = .42, p = .66$), disorganized ($F(2, 96) = .23, p = .80$), and overall schizotypy dimensions ($F(2, 98) = .65, p = .52$), respectively. For student status, the variances were evidently equal for positive ($F(4, 94) = .34, p = .85$), negative ($F(4, 94) = .42, p = .80$), disorganized ($F(4, 94) = .61, p = .66$), and overall schizotypy dimensions ($F(4, 96) = .21, p = .93$), respectively. For marital status, the variances did not significantly differ for positive ($F(2, 95) = 2.46, p = .09$), negative ($F(2, 95) = .91, p = .41$), disorganized ($F(2, 95) = .34, p = .71$), and overall schizotypy dimensions ($F(2, 97) = .25, p = .78$), respectively. For race/ethnicity, the variances did not significantly differ for positive ($F(4, 93) = 1.29, p = .28$), negative ($F(4, 93) = 1.80, p = .14$), disorganized ($F(4, 93) = 1.85, p = .13$), and overall schizotypy dimensions ($F(4, 95) = 2.34, p = .06$), respectively.

For current living situation, the variances did not significantly differ for the positive ($F(4, 94) = 1.21, p = .31$), negative ($F(4, 94) = 2.33, p = .06$), disorganized ($F(4, 94) = .21, p = .93$), and overall schizotypy dimensions ($F(4, 96) = .76, p = .56$), respectively. For the level of wealth of the neighborhood in which one grew up, the variances were evidently equal for the positive

($F(4, 94) = 1.60$, $p = .18$), disorganized ($F(4, 94) = .97$, $p = .43$), and overall schizotypy

dimensions ($F(4, 96) = 1.60$, $p = .18$), respectively. However, unequal variance was evident for

the negative schizotypy dimension ($F(4, 94) = 3.80$, $p = .01$). For current employment, the

variances did not significantly differ for positive ($F(2, 96) = .59$, $p = .56$), negative ($F(2, 96) =$

2.68, $p = .07$), disorganized ($F(2, 96) = 1.19$, $p = .31$), and overall schizotypy dimensions (F(2

97) = 1.09, $p = .34$), respectively.

Overall, homogeneity of variance was evident for all follow-up variables except for

income level of the neighborhood in which one grew up and negative schizotypy. As noted

above, Levene's test can be significant when group variances are not very different in large

samples, such as the sample here (Field, 2011). Nonetheless, to correct for this violation, the

Welch-Satterthwaite method.

F tests (Multiple Regression)

Variable Types

All follow-up predictor variables were quantitative or categorical (with two categories),

and the outcome variables were also quantitative, continuous, and unbounded.

Non-zero Variance

The follow-up predictors all had some variation in value for each model (e.g., they did

not have variances of zero).

Multicollinearity

The correlation matrices for all the follow-up predictor variables for each model

(positive, negative, disorganized, overall) were examined to see if any correlated very highly

(above .80 or .90). In the positive schizotypy model, there was multicollinearity between the

RPQ Proactive and RPQ Total score variables ($r = .82$), RPQ Reactive and RPQ Total score

variables ($r = .93$), SUPPSP Positive Urgency and SUPPSP Total score variables ($r = .87$), and

TriPM Disinhibition and TriPM total score variables ($r = .81$). Similarly, in the negative

schizotypy model, there was also multicollinearity between SUPPSP Positive Urgency and

SUPPSP Total score variables ($r = .87$). In the disorganized schizotypy model, there was

similarly multicollinearity between the RPQ Proactive and RPQ Total score variables ($r = .82$),

RPQ Reactive and RPQ Total score variables ($r = .93$), and SUPPSP Positive Urgency and

SUPPSP Total score variables ($r = .87$). Finally, in the overall schizotypy model, there was also

multicollinearity between TriPM Disinhibition and TriPM total score variables ($r = .81$). There

was no multicollinearity in the negative, disorganized, or social anxiety models. Additionally,

using the variance inflation factor (VIF), no additional variables were identified in any model.

Homoscedasticity

At each level of the follow-up predictor variables, the variance of the residual terms was

constant and evidenced by scatterplots for each model of schizotypy. Points were equally

distributed above and below zero on the X-axis, and to the left and right of zero on the Y-axis.

Independent Errors

The Durbin-Watson test was used to test for serial correlations between errors;

specifically, whether adjacent residuals were correlated (e.g., observations were independent).

For the baseline schizotypy models, positive ($d = 1.90$), negative ($d = 1.87$), disorganized ($d =$

1.91), and overall ($d = 1.93$) all had values between 1.5 and 2.5, indicating that the residuals

were not autocorrelated. The follow-up schizotypy models for positive ($d = 1.60$), negative ($d =$

1.64), disorganized ($d = 1.57$, and overall ($d = 1.79$) also all had values between 1.5 and 2.5,

indicating that the residuals were not autocorrelated.

Normally Distributed Errors

The residuals for both baseline and follow-up positive, negative, disorganized, and overall schizotypy models were random, normally distributed variables, as evidenced by histograms and P-P plots.

Independence

All values of the follow-up outcome variables were independent.

Linearity

The residuals were normally distributed and homoscedastic; thus, the predictor variables and outcome variables were linear

Table 1

Participant Demographics at Baseline

Variables	*M*	*SD*
Age	20.03	2.52
	Frequency (*n*)	**Percent (%)**
Biological Sex		
Male	138	20.90
Female	515	78.00
Transgender	7	1.10
Race		
White/Caucasian	275	41.70
Black/African American	91	13.80
Hispanic	194	29.40
Asian	41	6.20
Native American	2	0.30
Pacific Islander	3	0.50
Other	53	8.00
Marital Status		
Never Married	627	95.70
Living with Partner	19	2.90
Married	5	0.80
Divorced	2	0.30
Widowed	2	0.30
Year in School		
Freshman	255	38.60
Sophomore	180	27.30
Junior	142	21.50
Senior	73	11.10
Master's	8	1.20
Doctoral	2	0.30
Diagnosed Mental Illness		
No	516	78.20

Yes	144	21.80
Birth Complications		
No	573	88.00
Yes	78	12.00
Urbanicity		
No	283	43.50
Yes	368	56.50
Neighborhood Growing Up		
Wealthy	29	4.40
Well-off	145	22.00
Average	372	56.50
Somewhat Poor	95	14.40
Poor	17	2.60
Parent Separation/Divorce before 18		
No	397	60.90
Yes	255	39.10
Household Diagnosed Mental Illness		
No	389	59.40
Yes	266	40.60
First Degree Relative with Serious Mental Illness		
No	581	88.60
Yes	77	11.40
Lived with Someone who Abused Alcohol before 18		
No	527	81.10
Yes	123	18.90
Lived with Someone who Abused Drugs before 18		
No	557	85.60
Yes	94	14.40

Lived with Someone who was/is
Incarcerated before 18

No	536	82.30
Yes	115	17.70

Head Injury

No	560	85.00
Yes	99	15.00

Parental Death Before 18

No	624	95.90
Yes	27	4.10

Removed from Home Before 18

No	631	96.90
Yes	20	3.10

Living Situation

Parent/Supportive Family	472	71.80
Friend/Roommate	143	21.80
Alone	14	2.10
Cohabitant/Significant Other	12	1.80
Spouse	7	1.10
Boarding House	7	1.10
Homeless	2	0.30

Employment Status

Student	316	48.00
Working Now	303	46.00
Looking for Work/ Unemployed	39	5.90
Temporarily Laid Off/ Sick Leave/ Maternity Leave	1	0.20

Self-Reported Diagnosis

Depression	97	37.50
Anxiety	95	36.80
OCD	17	6.50
Trauma/Stress	13	5.00
Neurodevelopmental	13	5.00

Schizophrenia Spectrum	5	1.90
Eating	4	1.50
Personality	3	1.10
Sleep	1	0.09
Household Diagnosis		
Depression	179	48.20
Anxiety	107	28.80
Bipolar	43	11.60
Neurodevelopmental	9	2.40
Schizophrenia Spectrum	8	2.20
Trauma/Stress	7	1.80
OCD	6	1.60
Neurocognitive	6	1.60
Substance Use	3	0.01
Disruptive Behavior	2	0.01
Eating	1	0.01
First Degree Relative Diagnosis		
Bipolar	62	81.00
Schizophrenia	14	18.20
Schizoaffective	1	0.01

Note. $N = 660$.

Table 2

Participant Demographics at Follow Up

Variables	M	SD
Age	21.85	2.70
	Frequency (*n*)	**Percent (%)**
Biological Sex		
Male	13	12.60
Female	85	82.50
Transgender/Non-Binary	5	4.90
Race		
White/Caucasian	59	57.30
Black/African American	9	8.70
Hispanic/Latino	25	24.30
Asian American	6	5.80
Other	3	2.90
Marital Status		
Never Married	69	67.00
Married	3	2.90
Committed Relationship	30	29.10
Year in School		
Sophomore	8	7.80
Junior	41	39.80
Senior	24	23.30
Bachelor's	25	24.30
Master's	5	4.90
Diagnosed Mental Illness		
No	61	59.20
Yes	42	40.8
Birth Complications		
No	83	80.60
Yes	20	19.40

Urbanicity

No	57	55.30
Yes	46	44.70

Neighborhood Growing Up

Wealthy	4	3.90
Well-off	20	19.40
Average	53	51.50
Somewhat Poor	19	18.40
Poor	7	6.80

Parent Separation/Divorce before 18

No	60	58.30
Yes	43	41.70

Household Diagnosed Mental Illness

No	49	47.60
Yes	54	52.40

First Degree Relative with Serious Mental Illness

No	81	78.60
Yes	22	21.40

Lived with Someone who Abused Alcohol before 18

No	76	73.80
Yes	27	26.20

Lived with Someone who Abused Drugs before 18

No	88	85.40
Yes	15	14.60

Lived with Someone who was/is Incarcerated before 18

No	92	89.30
Yes	11	10.70

Head Injury

No	77	74.80

Yes	26	25.20
Parental Death Before 18		
No	97	94.20
Yes	6	5.80
Removed from Home Before 18		
No	101	98.10
Yes	2	1.90
Living Situation		
Parent/Supportive Family	80	77.70
Friend/Roommate	11	10.70
Alone	3	2.90
Cohabitant/Significant Other	4	3.90
Spouse	5	4.90
Employment Status		
Student	68	66.00
Working Now	25	24.3
Looking for Work/ Unemployed	9	8.70
Temporarily Laid Off/ Sick Leave/ Maternity Leave	1	1.00
Self-Reported Diagnosis		
Depression	25	29.07
Anxiety	30	34.88
OCD	7	8.14
Trauma/Stress	5	5.81
Neurodevelopmental	8	9.30
Schizophrenia Spectrum	1	1.16
Bipolar Disorder	4	4.65
Eating	2	2.33
Personality	1	1.16
Sleep	2	2.33
Substance Use	1	1.16
Hospitalization Last Two Years (Self)		
No	35	83.33

Yes	7	16.67
Household Diagnosis		
Depression	32	41.03
Anxiety	22	28.21
Bipolar	11	14.10
Neurodevelopmental	4	5.13
Schizophrenia Spectrum	3	3.85
Trauma/Stress	1	1.28
OCD	2	2.56
Substance Use	1	1.28
Personality	2	2.56
First Degree Relative Diagnosis		
Bipolar	17	80.95
Schizophrenia	4	19.05
Hospitalization Last Two Years (Self)		
No	35	83.33
Yes	7	16.70

Note. $N = 10$

Figure 1

Histogram of the Distribution of Positive Schizotypy Scores
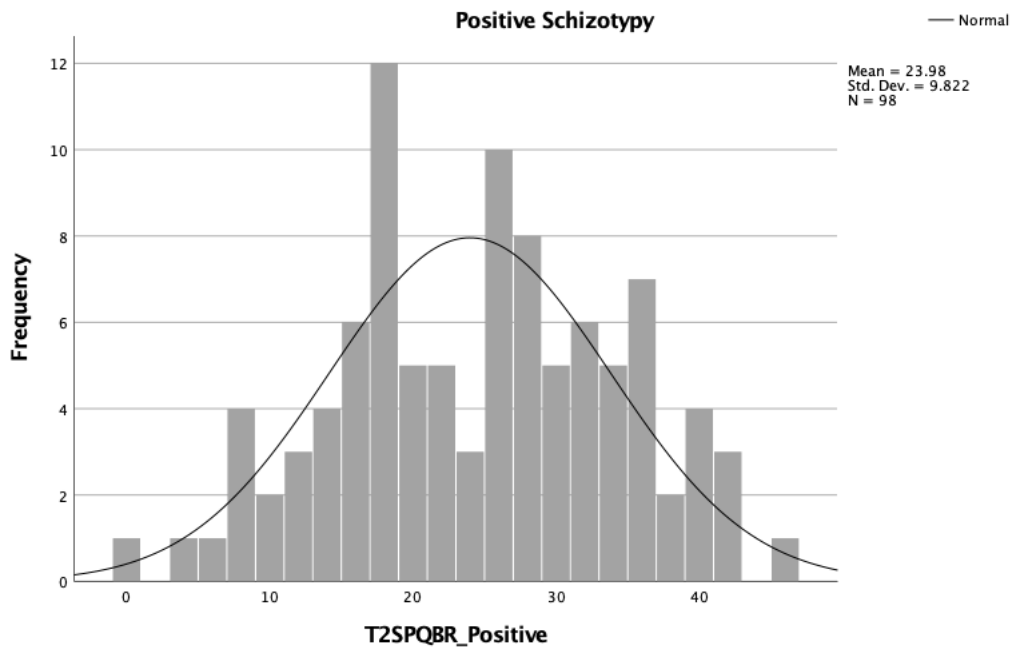
Figure 2

Histogram of the Distribution of Negative Schizotypy Scores
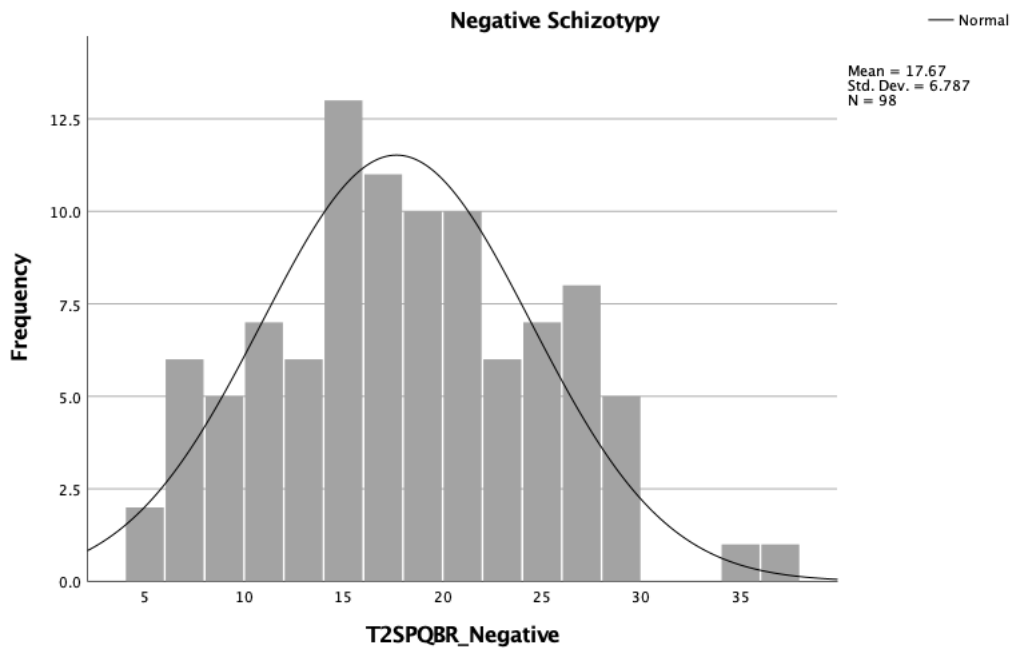
Figure 3

Histogram of the Distribution of Disorganized Schizotypy Scores
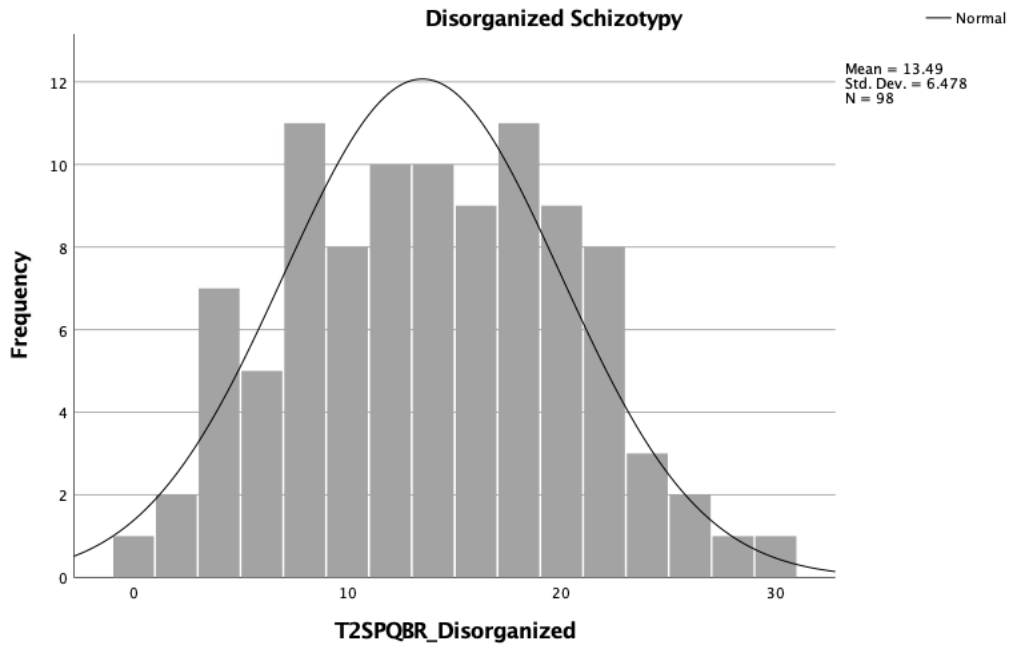
Figure 4

Histogram of the Distribution of Overall Schizotypy Scores
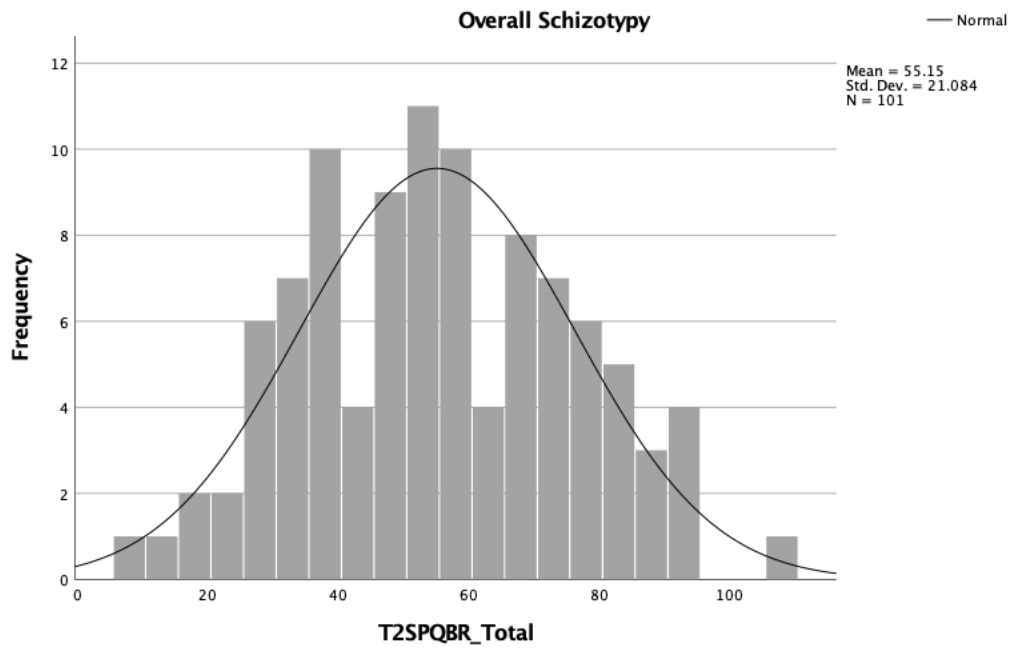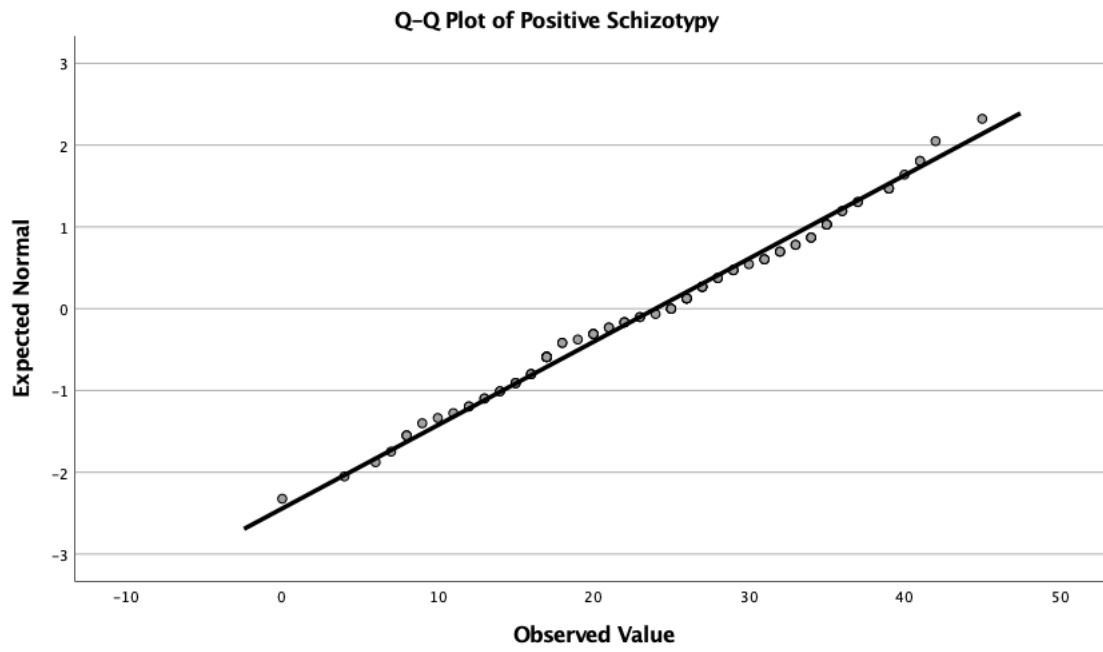
Figure 5

Q-Q Plot of Positive Schizotypy Scores
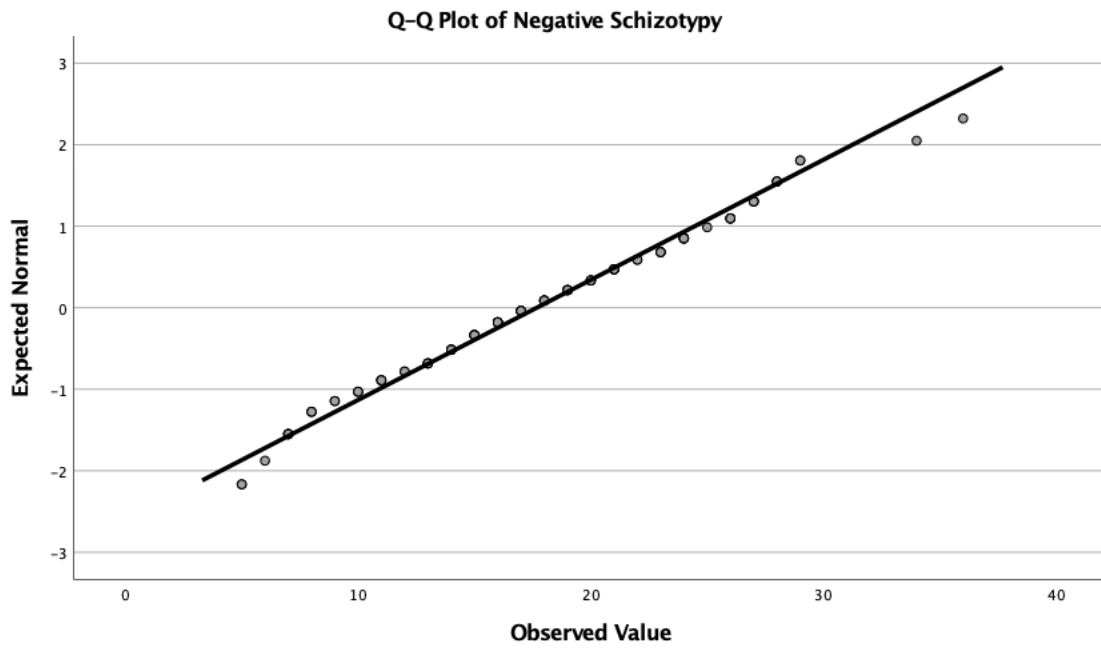
Figure 6

Q-Q Plot of Negative Schizotypy Scores

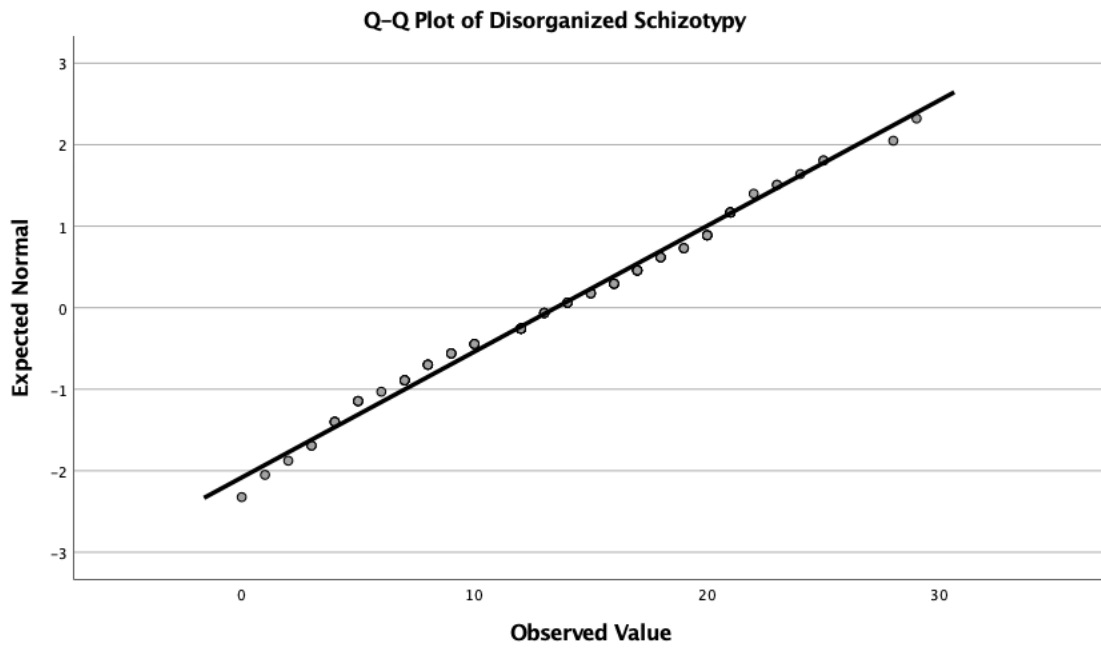**Figure 7**

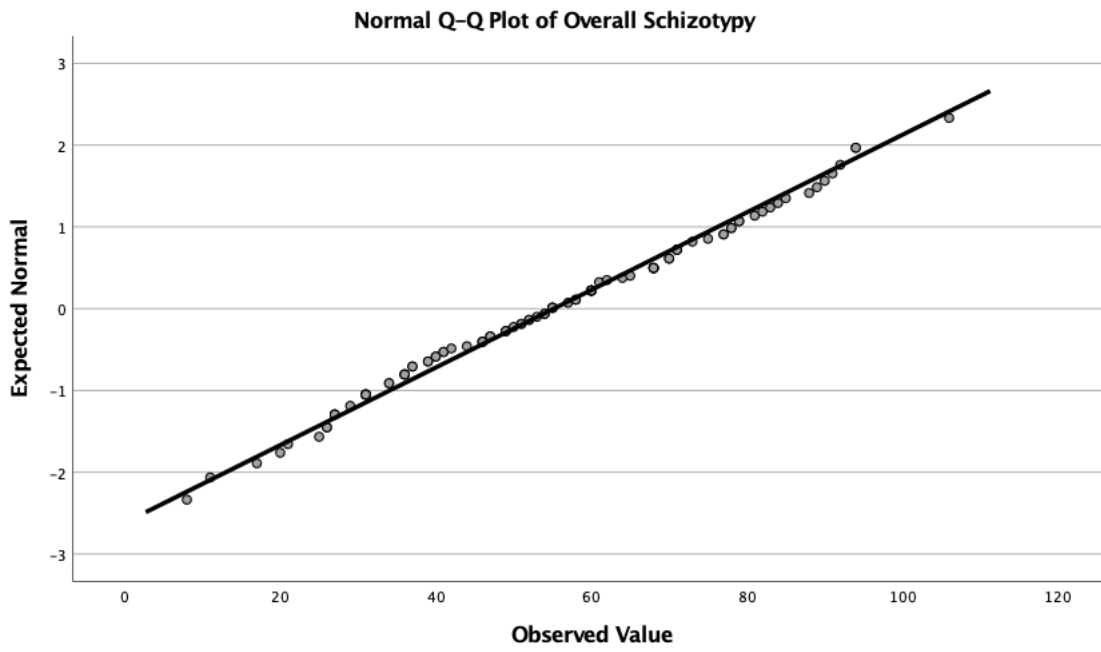*Q-Q Plot of Disorganized Schizotypy Scores*

Figure 8

Q-Q Plot of Overall Schizotypy Scores

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