TRAUMATIC LIFE EVENT EXPOSURE AND ATTENUATED PSYCHOSIS: SYMPTOM SPECIFICITY AND EXPLANATORY MECHANISMS

A Dissertation
Submitted to
the Temple University Graduate Board

In Partial Fulfillment
of the Requirements for the Degree
DOCTOR OF PHILOSOPHY

by
Lauren E. Gibson, EdM, MA
August 2017

Examining Committee Members:

Lauren M. Ellman, PhD, Advisory Chair, Psychology
Lauren B. Alloy, PhD, Psychology
Thomas M. Olino, PhD, Psychology
Deborah A. Drabick, PhD, Psychology
Tania Giovannetti, PhD, Psychology
Meredith Weber, PhD, College of Education

ABSTRACT

Although genetic factors appear to contribute substantially to the onset of psychotic disorders, environmental factors also influence the development and course of psychosis. One environmental risk factor that has been robustly associated with multiple psychosis outcomes is exposure to traumatic life events (TLEs). Specifically, TLEs have been associated with increased risk of psychotic disorders, with the prodrome of psychosis, and with dimensional measures of psychotic symptoms, such as attenuated positive psychotic symptoms. Nevertheless, TLEs have been linked to various mental disorders; therefore, the specificity of TLEs to psychosis remains unclear. Similarly, the mechanisms underlying the TLE-psychosis relation have not been fully delineated. The current project addressed these gaps by exploring three areas within the field of TLEs and psychosis. The first is by reviewing the literature on two understudied areas of the trauma and psychosis literature: 1) the specificity between trauma and psychosis in relation to other disorders that often result post-trauma, and 2) proposed mechanisms that uniquely link trauma to psychosis. Second, this project tested whether attentional biases, present in samples with trauma histories and experiencing attenuated forms of psychosis, were similar within both populations. Third, this project examined multiple putative mechanisms influencing the association between TLEs and attenuated psychosis that have been proposed, but not fully tested, in psychosis research, including dissociation, negative self-schemas, negative other-schemas, external locus of control, and stress sensitivity. Analysis of variance suggested that individuals with TLE histories demonstrate attentional biases for physical abuse words and overall TLE-related words, but that experiencing attenuated positive psychotic symptoms does not increase

attentional biases in conjunction with a TLE history. Additionally, a bootstrapping method for examining multiple mediation indicated that increases in dissociation, negative self- and other-schemas, external locus of control, and perceived stress mediate the relationship between TLEs and attenuated psychosis. Collectively, this project underscores the importance of targeting multiple cognitive-based mechanisms that may emerge post-trauma in order to reduce psychotic-like experiences or disorders.

This dissertation is dedicated to:

My parents, Francine and Charles, who emulate what I respect most in life: integrity, hard-work, and unconditional love. I am forever in awe of your wisdom and I owe my success to you;

My best friend and sister, Gina, whose incredible insight, creativity, and compassion have helped me through the worst of times;

And my life-long partner, Seth, who is my eternal source of hope, teaches me that there are no limits to happiness, and whose love has shaped my resilience and flexibility.

This triumph is as much mine as it is yours.

ACKNOWLEDGMENTS

I wish to most importantly express my sincere appreciation to my graduate advisor, Dr. Lauren Ellman, whose guidance and support have been fundamental in honing my career trajectory as a psychologist. I have learned immensely from Dr. Ellman's expertise in major psychopathology and professional mentorship, which have granted me incredible opportunities to conduct high-quality research projects. I respect her intelligence and fairness and hope to make her proud.

I am so very grateful to my dissertation committee for each providing such meaningful guidance. Thank you to Dr. Lauren Alloy for serving as a thoughtful and supportive contributor to my predissertation, preliminary examination, and dissertation proposal experiences. I have also learned an immense amount from Dr. Thomas Olino, and I thank him for his generous time in helping me with statistical aspects of my project. To my graduate faculty readers, Dr. Meredith Weber, Dr. Deborah Drabick, and Dr. Tania Giovannetti, your time and feedback has been invaluable.

Several other individuals have been instrumental in my graduate school and dissertation success; my lab-mates, my cohort-mates, undergraduate volunteers, and many faculty members, particularly Dr. Catherine Panzarella. My lab-mates have been an endless source of strength; I will treasure our thought-provoking discussions and friendships. The compassion and lively energy afforded by my cohort has been essential to many of my graduate school feats. A special thanks to my lab- and cohort-mate, Lauren Reeves, for knowing me well enough to offer the sagest of advice on all matters of life. Dr. Panzarella's influence on my development as a clinical psychologist will be felt for years to come.

Lastly, I will be forever value the sacrifice, inspiration, and hope offered by my family and friends. Their encouragement, time, and understanding are the backbone of my success.

TABLE OF CONTENTS

Page

LIST OF TABLES

LIST OF FIGURES

Figure Page

CHAPTER 1

EXPANDED LITERATURE REVIEW

Traumatic Life Events as a Risk Factor for Psychosis: The Underlying Relationship

Studies yield consistent findings that traumatic life events (TLEs) are one of the most robust environmental risk factors for the development of psychosis (Bendall, Alvarez-Jimenez, Nelson, & McGorry, 2013a; Varese et al., 2012a). Overall odds of developing a psychotic disorder or positive psychotic symptoms in adolescents and adults with TLE histories ranges between 2.78 and 11.50, depending on the study methodology or TLE type (Janssen et al., 2004; Varese et al., 2012a). Individuals with psychotic disorders are also significantly more likely to report TLE histories than controls or their siblings, indicating that differences in TLE exposure may yield discordance in psychotic diagnoses (van Dam et al., 2014a). Further, methodologically rigorous clinical and general population studies find medium to large effect sizes and dose-response relationships for TLEs and psychosis, such that risk for psychotic disorders or symptoms increases substantially for each additional adversity (Janssen et al., 2004; Matheson, Shepherd, Pinchbeck, Laurens, & Carr 2012; Thompson et al., 2009; Trauelsen et al., 2015).

There is also evidence that TLEs temporally precede the onset of psychosis, as longitudinal studies find TLEs predict psychotic symptoms (Arseneault et al., 2011; Mackie, Castellanos-Ryan, & Conrod, 2011) and that discontinuation of abuse predicts a significant reduction in psychotic experiences (Kelleher et al., 2013). Similarly, individuals experiencing psychosis with TLE histories compared to those with no TLE histories present with higher rates of psychotic symptoms, comorbid disorders, cognitive

deficits, and treatment resistance, as well as earlier and more frequent hospitalizations (Hassan & De Luca, 2015; Schenkel, Spaulding, DiLillo, & Silverstein, 2005). The strength of the TLEs and psychosis association is underscored by findings that this relationship persists despite the addition of the following potential covariates: familial psychiatric history, psychiatric comorbidities, cannabis use, genetic risk, ethnicity, and education level, suggesting that TLEs are at least in part independent from these variables (Bendall et al., 2013a; Fisher et al., 2014a; Janssen et al., 2004; Kelleher et al., 2008).

A series of studies, including prospective longitudinal studies, have consistently substantiated the relationship between TLEs and the entire continuum of psychosis (Elklit & Shevlin, 2010; Shevlin, Dorahy, & Adamson, 2007), clinical high risk (CHR) for psychosis (Addington et al., 2013; Bechdolf et al., 2010; Thompson et al., 2009), and subclinical psychosis (Arseneault et al., 2011; Kelleher et al., 2013; Mackie et al., 2011). Despite findings linking TLEs to psychosis, TLEs also have been associated with other mental disorders (Green et al., 2010; McLaughlin et al., 2010), although these large comorbidity studies did not include assessment of psychotic or personality disorders. These studies also yield minimal diagnostic specificity for the onset or persistence of one disorder versus another given a TLE history. The disorders most strongly linked to TLEs (i.e., mood, anxiety, and substance use and borderline personality disorders) also are comorbid with psychotic disorders (Buckley, Miller, Lehrer, & Castle, 2009). Collectively, these findings underscore the diagnostic complexity connected to trauma sequelae, the importance of adjusting for co-occurring symptomatology when exploring the impact TLEs have on mental health, and the need for delineating why, given a TLE

history, an individual may develop one disorder versus another. Therefore, it remains unclear how TLEs specifically increase risk for psychotic disorders and symptoms.

This review is intended to 1) differentiate the associations between TLEs and three psychosis outcomes from the associations between TLEs and other disorders (i.e., mood, trauma and stressor, substance use, and personality), and 2) identify the potential mechanisms specifically involved in the TLE-psychosis spectrum relation. In this article, we review the role of TLEs as a risk factor for psychosis, the specificity of the TLE-psychosis association in relation to other disorders also related to TLEs, and potential mechanisms that may uniquely link trauma to psychosis.

Methodology

Controversy exists about how to define psychological trauma both clinically and empirically (Weathers & Keane, 2007). Traditionally, studies have not distinguished "trauma" from "adversity" or "other negative life events." For example, the Adverse Childhood Experiences (ACE) study, one of the largest nationally representative studies to investigate the prevalence and short- and long-term social and health outcomes of traumatic and/or adverse experiences, considered several discrete types of events under the definition of ACEs (Centers for Disease Control and Prevention, 2014). These include emotional, physical, or sexual abuse; emotional or physical neglect; and household dysfunction, including: mother treated violently, household substance abuse, household mental illness, parental separation or divorce, or incarcerated household member (Centers for Disease Control and Prevention, 2014). Further, the US National Comorbidity Survey Replication II, a large adult general population that assessed childhood adversities and the risk factors and consequences of mental health disorders, did not discriminate

between overarching trauma-based or adversity-based events, merging such categories as loss events (e.g., parental divorce), parental maladjustment (e.g., criminality), maltreatment (e.g., rape), and "other childhood adversities" (e.g., serious physical illness; McLaughlin et al., 2010).

The categorization of different stressful life events has differed depending on the field of research. For instance, the depression and anxiety disorder literature has differentiated trauma, which tends to include more intrusive and/or interpersonal abuse experiences (e.g., physical abuse), from other negative life events, which tend to capture a broader category, such as parental maladjustment (Hovens et al., 2012). Distinctions have also been drawn between events that are non-intentional (e.g., motor vehicle accident) and those that are intended to inflict harm (e.g., assault), the latter of which have been associated with increased prevalence of posttraumatic stress disorder (PTSD) and first episode psychosis (Raune, Kuipers, & Bebbington, 2009; Santiago et al., 2013). However, the psychosis literature often defines TLEs and more general adversities under the same category (Lataster, Myin-Germeys, Lieb, Wittchen, & Van Os, 2012; Varese et al., 2012a). Although the life event-psychosis connection appears relevant for both traumatic events and adversities, no study has determined whether TLEs or more general adversities, when grouped together, are differentially related to psychosis, despite the possibility that each category of events operate via different mechanisms in their influence on psychosis.

Definition of Terms

Given the lack of separation between life event categories in the psychosis literature, the current review broadly defines TLEs to include traumas, adversities, and

negative life events. This review includes studies that measure TLEs in three overarching ways. The first is based on Diagnostic and Statistical Manual of Mental Disorders, Fifth Edition (DSM 5) criteria, which require that an individual is exposed to (via direct exposure, witnessing in person, indirectly learning about someone close to the individual, or repeated or extreme indirect exposure to details of a TLE) "death, threatened death, actual or threatened serious injury, or actual or threatened sexual violence" (American Psychiatric Association, 2013). The second includes TLEs encountered that are predominantly defined as: experiences of physical, sexual, or emotional/psychological abuse, neglect, or bullying (Gray, Litz, Hsu, & Lombardo, 2004; van Dam et al., 2012; Varese et al., 2012a). The third, less common category (often referred to as "adversities") includes: parental loss or separation; natural catastrophes; serious accidents; imprisonment; and being kidnapped or held hostage (Gray et al., 2004; Kessler, Davis, & Kendler, 1997). In response to the lack of consensus about what constitutes TLEs, we chose to adopt a comprehensive definition.

In the present review, findings pertaining to three psychosis outcomes will be discussed: 1) a diagnosis of a psychotic disorder (e.g., schizophrenia), 2) classification as clinical high risk (CHR) for psychosis (i.e., a prepsychotic stage describing individuals who are at an increased risk for developing psychosis; Fusar-Poli, Yung, McGorry, & van Os, 2014), and 3) the extended psychosis phenotype, which denotes subclinical or attenuated psychosis (i.e., less frequent, severe, convincing and/or distressing positive psychotic symptoms) examined in non-clinical, general population samples. Deviations from these outcomes (e.g., schizotypy) will be appropriately defined.

Search Strategy

Potential studies were identified through a search of peer-reviewed articles in English via PsychINFO and PubMed databases using the following search terms: '[childhood] trauma,' '[childhood] adversity,' AND 'psychotic symptoms,' 'clinical high risk,' 'psychosis,' or 'schizophrenia.' The first author identified relevant articles via title and abstract search, which then were reviewed for inclusion by the third author. Articles that assessed TLEs experienced only in adulthood (with the exception of war trauma) or that were in dissertation or conference format were excluded. Studies that used a self-report or clinician-administered assessment of trauma or adversity, psychotic disorders/symptoms, or CHR were included.

The Psychosis Spectrum and Traumatic Life Events

Clinical High Risk for Psychosis

Within CHR populations, TLEs have been found to be significantly more prevalent than in non-psychiatric controls, and mean TLE rates appear consistent across CHR and clinically diagnosed psychotic samples, falling around 85% for endorsement of at least one TLE (Addington et al., 2013; Kraan, Velthorst, Smit, de Haan, & van der Gaag, 2015; Larsson et al., 2013). Further, conversion to psychosis rates were significantly higher for individuals with trauma histories compared to those at CHR for psychosis without such histories (Bechdolf et al., 2010), although one study found that only childhood sexual abuse increased risk of conversion (Thompson et al., 2014).

The Psychosis Phenotype

Growing evidence supports the existence of an extended psychosis phenotype, whereby more common, subclinical psychotic symptoms appear to be associated with

many of the same risk factors for psychotic disorders, such as cannabis use, obstetric complications, and TLEs (Linscott & van Os, 2010). Individuals who experience these attenuated positive psychotic symptoms have been the focus of recent global efforts to prevent and treat such severe mental conditions as psychosis (van Os & Linscott, 2012). Attenuated positive psychotic symptoms occur in 5-8% of non-clinical, healthy populations and have been linked to elevated risk for developing a psychotic disorder (Kaymaz et al., 2012; van Os, Linscott, Myin-Germeys, Delespaul, & Krabbendam, 2009; van Os & Linscott, 2012). Consistent support has emerged for TLEs being linked to this psychosis spectrum, such that TLEs are related to both diagnostic (i.e., schizophrenia, schizophreniform, schizoaffective, and delusional disorders) and dimensional outcomes of psychosis, such as schizotypy and attenuated positive symptoms (Gibson et al., 2014; Shevlin, Houston, Dorahy, & Adamson, 2008; Varese et al., 2012a; Velikonja, Fisher, Mason, & Johnson, 2014). These findings indicate that TLEs are implicated in the pathway to both broad and strict psychosis classifications.

Does Traumatic Life Event Type Matter?

The majority of evidence suggests that the relationship between TLEs and psychosis persists regardless of trauma type. Specifically, a meta-analysis demonstrated that no specific TLE predicted diagnostic or dimensional levels of psychosis in the general population more frequently than others (Varese et al., 2012a). Nevertheless, other studies have found individual differences in TLE types, which is important to consider given the potential for underpowered findings to be obscured by meta-analytic procedures. Further, the Varese et al. (2012a) meta-analysis did not include CHR samples, which also have produced significant differences among TLE types with regard

to psychosis outcomes. Additionally, a recent review of findings in general population and psychotic disordered samples suggested links between specific TLEs and certain symptom dimensions, such as child sexual abuse with hallucinations and neglect with paranoia (Bentall et al., 2014). One consistent finding is that interpersonal TLEs characterized by intent to harm (e.g., physical or sexual abuse) are associated with a worse psychotic disorder trajectory (Arseneault et al., 2011; van Nierop et al., 2014a).

The bulk of studies that examine specific TLEs focus on childhood sexual abuse (CSA), childhood physical abuse (CPA), childhood emotional abuse (CEA), childhood neglect, childhood bullying, life-threatening events, and/or war exposure (Bonoldi et al., 2013; Matheson et al., 2012; Varese et al., 2012a). Table 1 presents the odds ratios for the four most commonly reported TLE types (i.e., CSA, CPA, CEA, and neglect) in relation to psychotic symptoms and disorders, and is intended to highlight the finding that the specific type of TLE experienced is not as salient as the endorsement of the TLE itself in predicting risk of various psychosis outcomes.

Reported below is a summary of the findings for these four most commonly reported TLEs, as well as three TLE categories that may be distinct from early childhood abuse experiences and receive much less attention in the trauma and psychosis literature (i.e., life threatening events, bullying, and war exposure). Importantly, a recent study found that the odds of first-episode psychosis diagnosis for specific TLEs diminished after accounting for other TLEs, suggesting that each TLE experienced may have a shared impact on risk for psychosis (Trauelsen et al., 2015). These authors suggest that categorizing traumas into types obscured the overall trauma loading and may, in turn, account for the inconsistent findings for different TLEs increasing psychosis risk.

Table 1. *Association Between Type of Traumatic Life Events and Psychosis Outcomes*

Author	Study Design	Psychosis Outcome (adjustments noted)	Type of TLE Assessed	Odds Ratio (95% Confidence Interval)
Bechdolf et al., 2010	Prospective, Clinical High Risk	Transition to Psychosis (adjusted for inclusion into multiple Ultra High Risk groups)	Physical Trauma, Total Cohort	0.87 (0.35-2.18)
			Emotional Trauma/Neglect, Total Cohort	0.80 (0.27-2.39)
			Sexual Trauma, Total Cohort	2.96 (1.16-7.57)*
Fisher et al., 2010	Epidemiological, case-control	First-episode Psychotic Disorder (adjusted for gender, age, ethnicity, study center, and highest parental social class)	Physical Abuse-Mother	2.91 (1.25-6.79)*
			Physical Abuse-Father	1.22 (0.66-2.25)
			Sexual Abuse	1.60 (0.87-2.95)
			Neglect-Mother	2.23 (1.03-4.83)*
			Neglect-Father	0.77 (0.39-1.51)
Trauelsen et al., 2015	Cross sectional, case-control	First Episode Psychotic Disorder Diagnosis (adjusted for gender, age, first degree psychiatric disorder, parental socio-economic status)	Sexual Abuse	8.51 (2.30-31.50)*
			Physical Abuse	3.53 (1.59-7.83)*
			Emotional Abuse	7.33 (3.54-15.21)*
			Emotional Neglect	16.93 (5.41-52.98)*
			Physical Neglect	6.23 (2.99-13.00)*
			Separation	7.45 (2.78-19.94)*
			Death of a Parent < age 18	1.20 (0.32-4.53)
Thompson et al., 2014+	Prospective, Clinical High Risk	Transition to Psychosis (unadjusted, as adjustments for global functioning, gender, age at baseline, and education were consistent)	Emotional Abuse	1.01 (0.96-1.06)
			Physical Abuse	1.04 (0.99-1.09)
			Sexual Abuse	1.05 (1.01-1.09)*
			Emotional Neglect	1.01 (0.96-1.06)
			Physical Neglect	0.98 (0.90-1.07)
Afifi et al., 2011**	Cross sectional, general population	Schizotypal Personality Disorder Diagnosis (adjusted for age, gender, education, income, race/ethnicity, marital status, any cluster B & C personality disorders, any lifetime mood, anxiety, or substance use disorder)	Physical Abuse	1.62 (1.28-2.03)*
			Emotional Abuse	1.76 (1.35-2.31)*
			Sexual Abuse	2.05 (1.59-2.65)*
			Physical Neglect	1.61 (1.26-2.05)*
			Emotional Neglect	1.35 (1.05-1.74)*

Note. * = significant association; ** = 99% CI reported, *** = significance values not reported; + = hazard ratios reported instead of odds ratios.

Table 1. (*Continued)*

Author	Study Design	Psychosis Outcome (adjustments noted)	Type of TLE Assessed	Odds Ratio (95% Confidence Interval)
Whitfield et al., 2005***	Cross-sectional, cohort	Lifetime history of hallucinations (adjusted for age at survey, sex, race and educational attainment)	Emotional Abuse	2.30 (1.80-3.00)
			Physical Abuse	1.70 (1.40-2.10)
			Sexual Abuse	1.70 (1.40-2.10)
Galletly et al., 2011	Prospective, cohort	Positive Psychotic Symptoms (Psychosis Probe Positive)	Sexual Abuse	2.81 (1.06-7.46)
			Physical Abuse	5.48 (2.03-14.78)*
			Verbal Abuse	7.90 (3.02-20.66)*
			Physical Neglect	6.88 (1.87-25.38)*
			Emotional Neglect	4.19 (1.35-13.07)*
Kelleher et al., 2008	Cross sectional, general population	Positive Psychotic Symptoms (adjusted for gender and socio-economic status)	Sexual Abuse	4.16 (0.34-50.51)
			Physical Abuse	5.96 (1.27-27.97)*

Note. * = significant association; ** = 99% CI reported, *** = significance values not reported; + = hazard ratios reported instead of odds ratios.

The Four Commonly Reported Traumatic Life Events

Whereas evidence supports the link between general TLEs and psychosis, research is inconsistent as to whether specific TLE types are more strongly related to certain psychosis outcomes. For instance, while some studies find support for increased prevalence of CPA in individuals with psychotic disorders (Bonoldi et al., 2013; Larsson et al., 2013; Spence et al., 2006) or CHR for psychosis (Thompson et al., 2009) relative to CEA and CSA, CEA has been found to be more prevalent in individuals with psychotic disorders compared to CPA and CSA (Duhig et al., 2015). CPA was also the only TLE type to persist in predicting psychotic disorders compared to CSA, CEA, or neglect after accounting for several covariates, such as gender, age, ethnicity, social class, and depression (Shevlin et al., 2007; Fisher et al., 2010), as well as when accounting for other TLEs (Rubino, Nanni, Pozzi, & Siracusano, 2009). Despite the higher prevalence of CPA

and CEA found for individuals experiencing psychosis, the link between CSA and schizotypal personality disorder and CSA and conversion to psychosis has been found to exceed that of other TLE types, such as CEA, CPA, and neglect (Afifi et al., 2011; Bechdolf et al., 2010; Thompson et al., 2014).

The association between neglect and psychosis at both the diagnostic and general population level is much more attenuated than CSA, CPA, and CEA (Daalman et al., 2012), and neglect may in fact have stronger connections to general psychopathology in psychotic samples (Heins et al., 2011; van Dam, Korver-Nieberg, Velthorst, Meijer, & de Haan, 2014b). These latter studies propose that one differentiating factor of neglect is that the child does not experience the stimulating, positive aspects that an otherwise normally developing brain encounters, which is more likely to lead to cognitive difficulties, rather than to dysregulated stress systems that are more frequently implicated in abuse. Nevertheless, a recent review suggests that neglect and being brought up in an institution may be linked to paranoid symptoms above and beyond other TLE types (Bentall et al., 2014). To our knowledge, there are no unique findings in the CHR literature regarding neglectful experiences during childhood.

Bullying

Studies find consistent associations between bullying and a variety of psychosis outcomes, although one meta-analysis indicated that associations were stronger for population-based samples endorsing attenuated levels of positive psychotic symptoms (van Dam et al., 2012). Evidence also suggests that bullying experiences may lead to specific functional difficulties, such as poor social functioning, compared to other types of trauma in CHR populations (Addington et al., 2013). The bullying-psychotic symptom

relationship has also been found to endure regardless of other factors (e.g., family adversity, comorbid psychopathology, gender, age, or other negative life events; Schreier et al., 2009).

Non-Intentional Life Threatening Events

Support for the TLE-psychosis relationship is weaker, and somewhat inconsistent, when trauma is defined as experiencing a non-intentional life threatening environmental event, such as a serious injury or illness or experiencing a natural disaster. Nevertheless, several studies suggest links between life threatening events and psychosis outcomes. In a first-episode psychotic sample, the prevalence of life threatening events (e.g., a car accident resulting in personal and vehicular injury) was highest compared to other TLEs, such as CSA or CPA (Neria, Bromet, Sievers, Lavelle, & Fochtmann, 2002). Additionally, a large population-based study demonstrated that serious illness, injury, or assault was linked to risk of psychotic disorders after adjusting for current depression and the interrelationship between other life events (Bebbington et al., 2004).

Despite these findings, several studies do not yield significant associations between life threatening events and psychotic symptoms or diagnoses. A first-episode sample study found decreased prevalence rates for non-interpersonal childhood TLEs (e.g., car accidents) compared to interpersonal childhood TLEs (Stain et al., 2014). Among a CHR sample, the "other trauma" category (primarily comprised of life-threatening events, such as accidents or natural disasters), did not yield significant results for conversion to psychosis (Bechdolf et al., 2010). An additional prospective study found that individuals exposed to a natural disaster were not at greater risk for experiencing psychotic symptoms 20 years post-trauma (Galletly, Van Hooff, &

McFarlane, 2011). Thus, research on life threatening events in psychosis is limited and conflicting.

War Exposure

Research on the relationship between war exposure trauma and psychosis is far more limited than other TLEs. Elevations in psychotic diagnoses and symptoms have been found in various war-exposed populations that experienced their trauma in adulthood (e.g., Cambodian victims of the Pol Pot regime, prisoners of war; for a review, see Read, van Os, Morrison, & Ross, 2005). Further, PTSD may only partially account for the relation between war trauma and psychosis (Soosay et al., 2012). Nevertheless, conflict exposure may be considered discretely different than other commonly reported TLEs due to the diversity of TLEs conflict ridden environments produce. For instance, individuals in a post-conflict region of southeastern Asia frequently reported exposure to major disasters, witnessing murders, engaging in direct combat, or experiencing torture or assaults, each of which are discretely different (Soosay et al., 2012). Thus, it can be difficult to parse the driving force behind potential risk for psychosis.

Traumatic Life Events and Specific Psychotic Symptom Expression

Positive Symptoms

Several researchers have explored whether specific psychotic symptoms are more likely to emerge post-TLE exposure. In psychotic (Alemany et al., 2013; Duhig et al., 2015) and CHR (Kraan et al., 2015) samples, consistent relationships have been established between the positive symptom dimension of psychosis and TLEs. The preponderance of general population studies linking TLEs to psychosis classify psychotic symptoms based on the positive symptom dimension (Bentall, Wickham, Shevlin, &

Varese, 2012; van Nierop et al., 2014a; Varese et al., 2012a). However, evidence is inconsistent as to whether TLEs impact the emergence of specific positive symptoms, as some large-scale studies find symptom specificity (Bentall et al., 2012) and others do not (Janssen et al., 2004; van Nierop et al., 2014a). For example, one study found that childhood rape was associated with hallucinations, controlling for paranoia, whereas institutional care was associated with paranoia, controlling for hallucinations (Bentall et al., 2012).

Additional support for specificity between TLE type and symptom outcome include findings that CPA is more strongly linked to disorganization and suspiciousness among CHR individuals than CEA and CSA (Thompson et al., 2009), and that CEA is more strongly associated with the development of hallucinations relative to CPA and CSA (Daalman et al., 2012; McCarthy-Jones et al., 2014). CEA may also have a specific link to subthreshold forms of psychosis, such as schizotypy (Lobbestael, Arntz, & Bernstein, 2010; for a review, see Velikonja et al., 2014). Conversely, data from two large population-based samples did not support differential links between childhood trauma and hallucinations or delusions, instead proposing that TLEs are more frequently associated with their co-occurrence (van Nierop et al., 2014a).

Negative and Disorganized Symptoms

Few studies have examined TLEs in relation to negative symptoms of psychosis. Although correlations have been found between any TLE and/or specific abuse experiences and negative symptoms in those with psychotic disorders (Alemany et al., 2013; van Dam et al., 2014a), general population studies have not replicated these findings (Dominguez, Saka, Lieb, Wittchen, & van Os, 2010). However, recent studies

reveal independent links between neglect and negative symptoms and abuse and positive symptoms in general population and psychotic disordered samples (Duhig et al., 2015; van Dam et al., 2014a).

Evidence for the link between TLEs and disorganized symptoms is even more sparse and equivocal. Dominguez and colleagues (2010) separated the effects of the negative/disorganized symptom cluster and found that disorganized symptoms were not associated with TLEs. Studies on the relationship between disorganized symptoms and specific TLEs are also limited and conflicting. For example, whereas one study did not find a significant association between thought disorder and CSA (Read, Agar, Argyle, & Aderhold, 2003), a study of female psychiatric inpatients found a significant association between psychotic thinking (e.g., paranoid and grandiose thinking) and CPA (Bryer, Nelson, Miller, & Krol, 1987). Given that most studies assess for the relationship between TLEs and positive symptoms, whether an association exists between TLEs and negative and disorganized symptoms remains unclear.

Multifinality

Researchers have emphasized that despite the worsening psychotic disorder trajectory found in the presence of psychological symptoms comorbid with psychosis, a "smoking gun" (i.e., plausible mechanism) linking these comorbidity patterns remains elusive (Buckley et al., 2009). Multifinality (i.e., that multiple outcomes are related to a single predictor) may offer a way to address the challenge of predicting which individual may develop one disorder versus another after being exposed to the same risk factor, in this case TLEs (Fusar-Poli et al., 2014).

Traumatic Life Events and Diagnostic Ambiguity

An important diagnostic question regarding the relation between TLEs and psychosis is whether comorbid psychopathology accounts for this association, although most studies find the relation to persist after adjusting for psychological comorbidities (Varese et al., 2012a). Despite exposure to TLEs consistently linking to multiple psychological disorders, including psychotic, mood, substance use, personality, and anxiety- and stressor-related disorders, evidence is ambiguous as to whether there is a stronger association between TLEs and a particular diagnosis (Sideli, Mule, La Barbera, & Murray, 2012). Several researchers underscore the importance of considering comorbid affective, substance use, posttraumatic stress, and personality disorders when assessing TLEs in samples with psychosis or psychotic symptoms, as these disorders are the most common in psychosis comorbidity profiles and each independently link to TLEs (Buckley et al., 2009; van Nierop et al., 2014b). See Table 2 for a list of studies comparing the effect of TLEs on disorders comorbid with psychotic disorders. The following sections primarily compare *diagnosti*c outcomes for individuals with a trauma history, and thus, the predominant focus is on psychotic disorders as an outcome. Few studies explore the role of TLEs in subclinical psychosis samples in comparing diagnostic sequelae. No CHR studies appear to have directly compared the TLE-other disorder versus TLE-CHR associations.

Traumatic Life Events and Posttraumatic Stress Disorder Versus Psychotic Disorders

PTSD appears to be the only psychiatric outcome associated with TLEs at a more pronounced *and* consistent rate than psychotic disorders (Matheson et al., 2012), which is expected given that a diagnosis of PTSD is contingent upon TLE exposure. For example,

Table 2. *Association Between Traumatic Life Events and Psychiatric Disorders Comorbid With Psychosis*

Author	Study Design	Age; Type of TLE Assessed	Psychiatric Outcome	Adjusted Odds Ratio (95% Confidence Interval)
Cutajar et al., 2010b	Prospective, general population	≤16 year old; sexual abuse	Psychotic Disorders	2.13 (1.44-3.17)*
			Affective Disorders	2.07 (1.59-2.70)*
			Posttraumatic Stress Disorder	5.56 (3.44-8.99)*
			Other Anxiety Disorders	2.67 (1.97-3.61)*
			Alcohol Abuse	5.88 (3.26-10.63)*
			Drug Abuse	5.94 (3.68-9.58)*
			Borderline Personality Disorder	6.07 (2.87-12.85)*
Spauwen et al., 2006	Prospective, general population	14-24 years old; any trauma (physical threat, rape, sexual abuse, natural catastrophe, serious accident, imprisoned or kidnapped, terrible event to other)	Broadly Defined Positive Psychotic Symptoms	1.07 (0.82-1.40)*
			Narrowly Defined Positive Psychotic Symptoms	1.89 (1.16-3.08)*
			Bipolar Disorder	0.40 (0.10-1.57)
			Major Depression	1.16 (0.79-1.71)
Schurhoff et al., 2009	Cross sectional, case control	≥18; any trauma (physical, emotional, and sexual abuse, physical and emotional neglect)	Schizophrenia First Degree Relatives	3.60 (1.09-11.80)*
			Bipolar First Degree Relatives	1.64 (0.57-4.72)
van Nierop et al., 2014b	Cross sectional, general population	18-65 (NEMESIS-2 sample only); any abuse (emotional neglect, physical abuse, psychological abuse, sexual abuse, and peer victimization)	≥1 Depression Symptom	1.21 (1.18-1.23)*
			≥1 Anxiety Symptom	1.18 (1.16-1.21)*
			≥1 Manic Symptom	1.19 (1.17-1.22)*
			≥1 Psychotic Symptom	1.23 (1.20-1.26)*

Note. * = significant association; + = only unadjusted odds ratio reported.

Table 2. *(Continued)*

Author	Study Design	Age; Type of TLE Assessed	Psychiatric Outcome	Adjusted Odds Ratio (95% Confidence Interval)
Matheson et al., 2012	meta-analysis (cohort, case-control, and cross-sectional studies)	<18 years old; physical abuse, sexual abuse, neglect	Schizophrenia vs. Non-Psychiatric Controls	3.60 (2.08-6.23)*
			Schizophrenia vs. Affective Psychosis	1.23 (0.77-1.97)
			Schizophrenia vs. Anxiety Disorders	2.54 (1.29-5.01)*
			Schizophrenia vs. Depressive Disorder	1.37 (0.53-3.49)
			Schizophrenia vs. Dissociative Disorders & PTSD (sexual abuse only)	0.03 (0.01-0.15)
			Schizophrenia vs. Other Psychoses	0.69 (0.28-1.68)
			Schizophrenia vs. Personality Disorders (sexual abuse only)	0.65 (0.09-4.71)
Rubino et al., 2009	Cross sectional, case-control	>18 years old; any abuse (emotional, psychological, physical, and sexual abuse)	Schizophrenia vs. Non-Psychiatric Controls	6.57 (3.48-12.39)*
			Schizophrenia vs. Depressive Disorder	3.24 (1.93-5.45)*
Harley et al., 2010	Cross sectional, general population	12-15 years old; any trauma (sexual abuse, physical abuse, exposure to domestic violence)	Cannabis Use	4.86 (1.63-14.51)*+
			Positive Psychotic Symptoms	6.16 (1.65-23.1)*
Konings et al., 2012	Prospective, general population	18-64 (NEMESIS sample only); any abuse (emotional, physical, psychological, and sexual abuse)	Positive Psychotic Symptoms	1.96 (1.73-2.20)*
			Positive Psychotic Symptoms Controlling for Cannabis Use	1.93 (1.71-2.18)*
			Cannabis Use	1.57 (1.33-1.86)*

Note. * = significant association; + = only unadjusted odds ratio reported.

a 41.1% mean prevalence rate of ever having PTSD as a result of intentional TLE exposure was reported in a recent study that compared PTSD rates across five different studies (Santiago et al., 2013). Additionally another study found that the rate of PTSD (4.0%) was larger than that of psychotic disorders (2.9%) in a sexually abused sample (Cutajar et al., 2010b). Despite the complex interrelation between posttraumatic symptoms, psychotic symptoms, and TLEs, there is minimal agreement as to whether psychosis is a risk factor for PTSD, whether PTSD is a risk factor for psychosis, or whether both disorders represent a continuum response to TLEs (Vauth & Nyberg, 2007). One theory is that exposure to childhood trauma may enhance risk for stress-related disorders (e.g., psychosis, PTSD, depression) via the neuropathology of the stress response system (i.e., alterations of the hypothalamic-pituitary-adrenal [HPA] axis; Matheson et al., 2012).

Traumatic Life Events and Mood Disorders Versus Psychosis

Results conflict as to whether the TLE-psychosis link is more prominent than the TLE-mood disorder link. Nevertheless, depression has been cited as one of the two (the other being PTSD) most common psychiatric sequelae of childhood TLEs (Sideli et al., 2012). Studies have demonstrated a higher prevalence of mood compared to psychotic disorders in samples with TLE histories, such as Cutajar et al.'s (2010b) study, which found 6.4% and 2.9% of their sexually traumatized sample to have an affective versus psychotic disorder. Conversely, studies have found support for a stronger link between TLEs and psychotic disorders than with depressive or bipolar outcomes (Rubino et al., 2009; Spence et al., 2006). In Rubino and colleagues' (2009) study, base rates of any TLE exposure varied greatly across general population (6.1%), major depressive disorder

(14.4%), and schizophrenia (28.7%) samples. Also complicating the issue is that some studies yield similar prevalence rates of TLEs in psychotic and mood disorders (Alvarez et al., 2011; Friedman et al., 2002). TLEs also appear to have a stronger impact on the extended psychosis phenotype compared to mood disorders, as trauma was found to correlate with schizotypy in siblings of individuals with schizophrenia, but not bipolar individuals (Schürhoff et al., 2009), and as TLEs were associated with psychotic symptoms, but not bipolar or major depressive disorder diagnoses (Spauwen, Krabbendam, Lieb, Wittchen, & van Os, 2006). Despite contradictory results, epidemiological studies consistently find that controlling for depressive disorders or symptoms reduces, but does not eliminate, the significant relationship between childhood TLEs and psychotic symptoms (Sideli et al., 2012). An outstanding methodological concern in this literature is assessing and/or controlling for the presence of mood disorders with psychotic features. Only one of the aforementioned studies included this subgroup in their analyses, but individuals with these diagnoses were grouped with other psychotic disorders (Cutajar et al., 2010b). Therefore, it remains unclear if mood disorders with psychotic features represent a distinctly different group than those with discrete mood or psychotic disorders in the context of both the prevalence and clinical impact of TLE histories.

Traumatic Life Events and Substance Versus Psychotic Disorders

Findings indicate that drug and alcohol use are particularly elevated for psychotic individuals with TLE histories, with comorbid substance use and psychotic disorders comorbidity rates ranging from 51% to 96% (Buckley et al., 2009). Further, in sorting out the differential impact of trauma exposure, TLEs have been found to be more common in

the histories of women with comorbid psychosis and substance use than with comorbid severe depression and substance use or substance use alone (Aakre, Brown, Benson, Drapalski, & Gearon, 2014). This study also found that women with comorbid schizophrenia and substance use disorders were four times more likely to meet criteria for PTSD relative to women with severe and chronic depression and substance use. Hence, the overall influence of TLEs appears to be worse for comorbid substance use and psychosis compared to substance use alone with as high as 96% of women with comorbid substance use and schizophrenia spectrum disorders endorsing at least one TLE (Gearon, Kaltman, Brown, & Bellack, 2003). Independent of psychotic disorders, overall prevalence rates of alcohol and substance abuse or dependence have been found to be prevalent in roughly 14% and 9%, respectively, of maltreated samples (Scott, McLaughlin, Smith, & Ellis, 2012).

Cannabis use, which is strongly linked to symptoms and diagnoses of psychosis (Radhakrishnan, Wilkinson, & D'Souza, 2014), has received specific attention in the TLE and psychosis literature. Psychosis may be the result of a synergistic interaction between TLEs and cannabis, with psychosis being a more frequent outcome if cannabis use is part of the lifestyle of the traumatized individual (Harley et al., 2010; Konings et al., 2012). Odds of experiencing psychotic symptoms for youth with TLE histories that used cannabis range from 12.0 (Houston, Murphy, Adamson, Stringer, & Shevlin, 2008) to 20.0 (Harley et al., 2010). Nevertheless, results from the few studies directly comparing psychosis to substance use outcomes following TLEs are equivocal, as ORs are roughly similar (see Table 2).

Traumatic Life Events and Personality Versus Psychotic Disorders

As noted in Table 2, the effect of TLEs appears significant across a range of personality disorders. One disorder that appears to be most directly associated with both TLEs and psychotic symptoms is borderline personality disorder, especially as psychotic symptoms not only are prominent in borderline pathology, but are often associated with trauma experiences (Barnow et al., 2010; Schroeder, Fisher, & Schäfer, 2013). The main effect of TLEs on borderline personality disorder appears particularly prominent, such that the association between sexual abuse and this disorder compared to the association for controls yielded an odds ratio of 6.07, the highest across all disorders assessed although the base rate of this disorder in the traumatized sample was 1.8% (Cutajar et al., 2010b). In a recent study comparing a sample of women with either schizophrenia or borderline personality disorder, TLEs of all types were more prevalent in the latter sample (Tschoeke, Steinert, Flammer, & Uhlmann, 2014). However, both samples in this study were selected based on the experience of auditory visual hallucinations in the past year, making it impossible to ascertain if the links between TLEs and borderline personality disorder persist controlling for psychotic experiences.

In conclusion, it does not appear that specificity exists for TLEs in relation to psychosis compared to other psychiatric conditions. Thus, a fundamental question remains: why do certain individuals develop psychosis versus other disorders, given a TLE history (van Nierop et al., 2014b)? It is imperative that future research investigates the longer-term outcomes of TLEs from a transdiagnostic perspective to reveal the unique mechanisms that influence transition to one disorder versus another. To isolate the variance of specific diagnostic dimensions and to rule out study findings being a function

of comorbid conditions, it is critical that researchers engage in the uncommon practice of not only controlling for co-occurring symptoms when examining the relationship between TLEs and psychosis, but also controlling for psychotic symptoms when assessing the association between TLEs and other disorders (O'Hare, Shen, & Sherrer, 2013).

Equifinality

Equifinality is as important a concept as multifinality in developing and refining identification and treatment options for individuals expressing psychosis. The concept of equifinality suggests that various etiological mechanisms and developmental pathways lead to a single (diagnostic) end state, which fits with current etiological models of psychosis, such that psychosis represents the outcome of a complex interplay of predictors like neurodevelopmental or social risk factors, many of which may be non-overlapping (Debbané & Barrantes-Vidal, 2015; Howes & Murray, 2014). It is likely that TLEs lead to psychosis outcomes through multiple different pathways and that TLEs interact with other variables that are antecedent (e.g., obstetric complications) or consequent to TLEs (e.g., substance use) in increasing psychosis risk.

Several prospective studies of subclinical samples suggest specific pathways to psychosis stemming from TLEs. Fisher et al. (2013) found that one pathway involves exposure to domestic violence prior to age 6 leading to an anxiety disorder at age 10, which subsequently led to psychotic symptoms at age 12.9. Another pathway included exposure to domestic violence prior to age 6 leading to poor self-esteem at 8.5 years of age, which then led to psychotic symptoms at age 12.9. Kramer and colleagues (2014) found that micro-level (i.e., momentary and hourly) increases in negative affect led to micro-level increases in paranoia, and subsequently, these momentary increases in

paranoia were linked to follow-up psychotic symptoms, a pathway that was moderated at the paranoia level by a TLE history. These studies provide critical steps in illustrating unique pathways by which TLEs can impact psychosis outcomes. A remaining gap involves identifying the mechanisms that begin to explain the relationship between trauma and psychosis *once all comorbid symptomatology is accounted for* given the vast diagnostic heterogeneity that can occur post-trauma.

Proposed Mechanisms

Establishing mechanisms that lead to sensitivity and specificity is critical in light of the substantial heterogeneity and overlap in symptom expression of psychotic disorders and disorders comorbid with psychosis (Debbané & Barrantes-Vidal, 2015; van Nierop et al., 2014b). Several theoretical models have been proposed concerning the association between TLEs and psychosis yet empirical data supporting these models is scarce (Bentall & Fernyhough, 2008; van Winkel, van Nierop, Myin-Germeys, & van Os, 2013). Information processing biases, locus of control, stress sensitivity, negative schemas, and dissociation have been proposed as possible mechanisms involved in the relationship between TLEs and psychosis (Anglin, Polanco-Roman, & Lui, 2014; Bendall et al., 2013b; Fisher, Appiah-Kusi, & Grant, 2012; Fisher et al., 2013; Gibson et al., 2014). Nevertheless, there remains little data on these potential explanatory variables and most existing studies have examined these constructs in isolation, obscuring the complex interactions between these variables (Bebbington et al., 2011; Freeman & Fowler, 2009; Fisher et al., 2012; Fisher et al., 2013; Gracie et al., 2007; Perona-Garcelán et al., 2012).

Cognitive Mechanisms

Information Processing Biases

One model of psychosis posits that psychosis manifests as a result of aberrant attribution of salience to otherwise irrelevant stimuli (Kapur, 2003; Roiser, Howes, Chaddock, Joyce, & McGuire, 2013; van Winkel et al., 2013). Trauma fits within this model, as those exposed to TLEs often disproportionately allocate attention to threatening stimuli, which consequently could lead to incorrect inferences in line with paranoid ideation (Sherrer, 2011). These biases in information processing, measured behaviorally (e.g., Emotional Stroop task) or neurophysiologically (e.g., EEG), have been found in traumatized (Caparos & Blanchette, 2014; Wingenfeld et al., 2011), psychotic disordered (Bendall et al., 2013b; Besnier et al., 2010; Kinderman, Prince, Waller, & Peters, 2003; Wiffen et al., 2013), CHR (Rosier et al., 2013; Nieman et al., 2014), and subclinical psychosis samples (Fisher et al., 2014b; Marks, Steel, & Peters, 2012). These populations have been found to have longer reaction times for threatening words, suggesting a general attention bias towards threatening stimuli (Bendall et al., 2013b; Cisler et al., 2011; Wiffen et al., 2013). However, information processing biases have not been explored as a mediator of the TLE-psychosis association.

External Locus of Control

Bentall and Fernyhough (2008) hypothesized that experiences of victimization may trigger an external explanatory style, such that negative events are interpreted as caused by powers external to the self, which, in turn, facilitates threat anticipation and paranoid beliefs. Individuals with psychotic disorders have been found to have a bias toward interpreting private events and experiences with external attributions, such that

they are more likely to believe that their behavior is controlled by outside forces (Bentall & Fernyhough, 2008; Frenkel, Kugelmass, Nathan, & Ingraham, 1995). In fact, Frenkel et al. (1995) found that an externalizing bias was one of the strongest longitudinal predictors of psychotic disorders. Further, among individuals diagnosed with schizophrenia, having an external attribution orientation is associated with poorer prognosis and more severe depressive, negative, and positive symptoms (Hutcheson, Fleming, & Martin, 2014). Both CHR (Thompson, Papas, Bartholomeusz, Nelson, & Yung, 2013) and subclinical levels of psychosis (Cooper et al., 2008; Levine, Jonas, & Serper, 2004; Thompson et al., 2011) have also been linked to significant elevations in measures of external locus of control. The only known study examining the mediating role of this construct in the TLE-psychosis relation was in a general population sample, which found that external locus of control levels prospectively mediated this relation, although only bullying and mothers' reports of harsh parenting and domestic violence in the home were investigated (Fisher et al., 2013). Cumulatively, these studies suggest that external locus of control may be a potential important mediator of the TLE-psychosis link.

Stress Sensitivity

Trauma-exposed (Glaser, van Os, Portegijs, & Myin-Germeys, 2006), psychotic (Lardinois, Lataster, Mengelers, van Os, & Myin-Germeyes, 2011; Myin-Germeys, van Os, Schwartz, Stone, & Delespaul, 2001), CHR (Aiello, Horowitz, Hepgul, Pariante, & Mondelli, 2012; DeVylder et al., 2013), and subclinical psychotic samples (Collip et al., 2013a; Lataster et al., 2009) have been found to have heightened stress sensitivity, as measured by elevated physiological or subjective susceptibility to lab-induced or

environmental stressors. Further, individuals in the CHR phase for psychosis endorse higher levels of subjective stress sensitivity for both life events and daily hassles (Trotman et al., 2014), and perceived stress has also been found to mediate the relation between TLEs and attenuated positive psychotic symptoms (Gibson et al., 2014). Nevertheless, stress sensitivity has been found to be a mediator for the relation between TLEs and a number of mental disorders (Heim & Binder, 2012). Therefore, it is important for future studies to decipher whether potential mediation findings hold after adjusting for other psychological symptoms.

Dissociation

Exposure to TLEs has been conceptualized as inducing dissociative tendencies due to reality discrimination deficits (between internally and externally generated events) that are thought to underlie hallucination-proneness (Anketell et al., 2010; Moskowitz & Corstens, 2008). Dissociation is strongly linked to a history of TLEs (Ogawa, Sroufe, Weinfield, Carlson, & Egeland, 1997), and robust associations have been established between dissociation and psychotic disorders with the belief that TLEs may lead to dissociation, which then facilitates the expression of psychosis (Braehler et al., 2013; Schäfer et al., 2012). The only study assessing dissociation in CHR did not find a significant association between dissociative symptoms and TLEs (Velthorst et al., 2013). In non-clinical samples, higher dissociation was found to mediate the relationship between TLEs and positive psychotic experiences (Anglin, Polanco-Roman, & Lui, 2014; Perona-Garcelán et al., 2012; Varese, Barkus, & Bentall, 2012b). Given the strong link between dissociation and TLEs, it is unclear if dissociation remains an explanatory variable in the TLE-psychosis association when other disorders comorbid with psychosis

that are also associated with dissociative tendencies (e.g., borderline personality disorder, PTSD) are accounted for in a comprehensive model (Pec, Bob, & Raboch, 2014; Stein et al., 2013).

Negative Schemas

Cognitive theories of psychosis purport that early adverse experiences can lead to the manifestation of negative schemas about the self involving vulnerability, humiliation and subordination, which are hypothesized to make psychotic symptom expression more likely in predisposed individuals (Garety, Kuipers, Fowler, Freeman, & Bebbington, 2001). Significant associations have been established between negative schemas (e.g., vulnerability to harm) and positive symptoms in those with schizophrenia spectrum disorders (Bortolon, Capdevielle, Boulenger, Gely-Nargeot, & Raffard, 2013; Fowler et al., 2011). Negative schemas have also been strongly associated with CHR for psychosis (Addington & Tran, 2009), to mediate the relationship between TLEs and subclinical paranoia (Fisher et al., 2012), and to predict to subclinical paranoia and hallucinations (Gracie et al., 2007). Nevertheless, no study has investigated whether negative schemas are a unique mediator of the TLE-psychosis relationship, which is an important question since other comorbid psychopathologies are also known to engage negative schemas (Calvete, Orue, & Hankin, 2013).

Gender Differences in the Traumatic Life Events-Psychosis Association

The few studies that have assessed for sex-specific risk in the TLE-psychosis relation have primarily yielded inconsistent findings (Bendall, Jackson, Hulbert, & McGorry, 2008). Although some studies suggest that gender moderates the relationship between TLEs and established psychosis (Fisher et al., 2009; Gayer-Anderson et al.,

2015) and subclinical psychotic experiences (Gibson et al., 2014), others reveal no sex differences (Shevlin, Murphy, & Read, 2015). Of the studies that explore gender, a more significant TLE-psychosis pathway appears evident for females, whereby risk for psychosis following TLE exposure is more elevated in females versus males diagnosed with psychotic disorders (Bebbington et al., 2011; Cutajar et al., 2010a; Gayer-Anderson et al., 2015). One study found that females with psychotic disorders were significantly more likely to report sexual or physical abuse than their female control counterparts even after conservative adjustments (e.g., affective diagnoses), discrepancies that did not emerge for males (Fisher et al., 2009). Female CHR individuals with sexual abuse histories also were significantly more likely to endorse positive symptoms compared to males (Thompson et al., 2010). The importance of TLEs as a risk factor for psychosis in females is also emphasized by recent findings that there was no significant relationship between TLEs and attenuated positive psychotic symptoms for males in a general population sample of adults experiencing subclinical psychotic symptoms (Gibson et al., 2014).

Animal and human research suggests that females may be more sensitive to stress and trauma. For example, females demonstrate heightened physiological and neurochemical stress reactivity (e.g., quicker release of and higher emission of glucocorticoids), as well as subjective stress sensitivity, compared to males (Goel, Workman, Lee, Innala, & Viau, 2014; Myin-Germeys, Krabbendam, Delespaul, & van Os, 2004). Increases in perceived stress also has been found to mediate the relationship between TLEs and attenuated positive psychotic symptoms for females only (Gibson et al., 2014). Additionally, in animal research, female rats have been found to produce

significantly more corticotropic-releasing factor neurons and demonstrate increased activation of neurons in brain regions involved in threat perception compared to males (Babb, Masini, Day, & Campeau, 2013). Cumulatively, these findings suggest that the females may be predisposed to develop disorders that are closely linked to biological stress dysregulation, such as psychosis, Major Depressive Disorder, and/or PTSD, the latter two of which are twice as prevalent in females (Shea, Walsh, MacMillan, & Steiner, 2005).

Neurobiological Mechanisms

Stress Neurobiology

One of the primary biological mechanisms implicated in the genesis of stress-based psychological disorders (e.g., psychosis, PTSD), as well as proposed to partially account for the trauma and psychosis pathway, is dysregulation of the stress response system, particularly the HPA axis and neurotransmitter systems (i.e., significantly elevated basal cortisol levels, hyper- or hypo-responsivity to stress), as well as hippocampal volume reductions (Ruby et al., 2014; Shea et al., 2005). Current theories suggest that childhood TLEs may activate a cascade of neurobiological changes, including increases in proinflammatory cytokines (Dennison, McKernan, Cryan, & Dinan, 2012), stress sensitization of the HPA axis via glucocorticoid- and striatal-related increases in dopamine (Pruessner, Champagne, Meaney, & Dagher, 2004; Wand et al., 2007), and reductions of the hippocampus, which has a critical role in regulating HPA axis activity (Mondelli et al., 2011). Despite stress cascade theories and findings, no studies have empirically tested if HPA axis hypo- or hyper-activity, as well as

hippocampal reductions, moderate or mediate the relationship between TLEs and psychosis.

Gene-Environment Interactions

It is commonly accepted that TLEs are not the solitary catalyst for psychosis. Instead, it is likely that the interaction of TLE exposure and genetic and neurodevelopmental risk factors (both pre- and post-trauma) leads to maximum probability of psychosis development. For example, a general population study discovered that carriers of the Met allele for brain-derived neurotrophic factor (BDNF) had an increased the likelihood of experiencing positive psychotic symptoms in the context of early childhood adversity (Alemany et al., 2011). Other studies also support gene-environment interactions, whereby specific genetic alterations (e.g., single-nucleotide polymorphisms in FK506 binding protein 5, and variants of the serotonin transporter gene, 5-HTTLPR) moderate the effect of TLEs on the manifestation of psychosis (Aas et al., 2012; Collip et al., 2013b). In individuals with schizophrenia, carriers of a short allele of a serotonin transporter gene who experienced high levels of TLEs demonstrated more cognitive deficits, which are associated with stress sensitivity, than carriers of the long allele (Aas et al., 2012).

Within the trauma and stress literature, genetic polymorphisms linked to HPA axis functioning increased the likelihood of stress-based psychiatric disorders, including depression (Bradley et al., 2008) and PTSD (Binder et al., 2008). Carriers of the Val allele of the catechol-O-methyltransferase (COMT) gene, which is linked to reduced dopamine neurotransmission in the prefrontal cortex and increased dopamine activity in the striatum (Chen et al., 2004), have been found to display marked increases in

psychotic symptoms in response to stress (Stefanis et al., 2007; Simons et al., 2009). These studies on single candidate genes are critical to the gene by environment literature in the psychosis-stress relationship; however, they do not account for much variance, which is consistent with findings that single genes do not play a large etiological role in psychosis. Thus, more recent studies have explored the interactions between multiple genes, although primarily in the context of stress sensitivity (for a review, see Holtzman et al., 2013). Peerbooms and colleagues (2012) found that two genotypes (MTHFR C677T and COMT Val158Met) interacted in psychotic individuals compared to controls, such that those with both genotypes had the greatest reaction to daily stress, as measured by psychotic symptom severity. Although the gene by environment literature is still in early development, specifically in relation to the link between TLEs and psychosis, studies on the stress by psychosis interaction may be particularly informative.

Epigenetics

Epigenetics references changes to an organism that alter gene expression, but not DNA sequence. For instance, certain hormones can impact DNA methylation, which can, in turn, modify protein production in regionally-specific parts of the body, including brain structures (for a review, see Holtzman et al., 2013). While studies exploring the influence of TLEs on psychosis via epigenetic processes hold great promise, no studies have yet been conducted in this realm in vivo in humans, likely due to concerns that peripheral epigenetic changes likely do not reflect epigenetic alterations in the brain. In underscoring the potential role epigenetics may play in early childhood experiences, specifically parental care, one postmortem study of a sample of individuals who completed suicide discovered that an epigenetic change (i.e., increased cytosine

methylation of a glucocorticoid receptor promotor) was linked to childhood abuse (McGowan et al., 2009). Overall, the science of epigenetics has been long recognized as important to the pathogenesis of psychosis, but human in vivo studies are limited by methodological barriers.

Methodological Concerns

Reliability of Self-Report

The retrospective nature of TLE recall and the reporting of psychotic individuals have been questioned for their accuracy and validity (Susser & Widom, 2012). Two findings dispute one of the major concerns in TLE self-reporting, which is over-reporting. First, Varese and colleagues' (2012a) meta-analysis found that the odds of developing psychosis in TLE compared to no TLE groups was the same regardless of whether TLEs were reported pre- or post-psychosis onset. Second, odds for developing psychotic disorders in a community sample of individuals with documented versus undocumented TLEs were similar regardless of group (Cutajar et al., 2010a), and also similar to the odds ratios reported in the meta-analysis based primarily on retrospective TLE recall (Varese et al., 2012a). Such consistent ORs across studies makes over-reporting less likely for those who are psychotic or do not have documented abuse (Bendall et al., 2013a). False negatives may be a greater concern than false positives, perhaps due to reluctance or forgetfulness (Hardt & Rutter, 2004). The evidence collectively suggests that the self-reporting of TLEs among psychotic individuals may be underrepresented, consistent across time, and in alignment with corroborating abuse reports (Fisher et al., 2011).

Study Design

Another methodological concern is that many of the available empirical studies assessing the TLE-psychosis relationship are cross sectional, which raises the issue of reverse causality (e.g., that psychotic experiences may lead to increased TLE exposure; Bendall et al., 2008). Directionality of effect issues also are underscored by alternative explanations that might account for the TLE-psychosis association, such as certain childhood factors that have been independently associated with risk for psychosis like premorbid cognitive difficulties and unusual behaviors (Bearden et al., 2000; Ellman, Yolken, Buka, Torrey, & Cannon, 2009; Niendam et al., 2003) potentially leading to increased risk of victimization during childhood (Sideli et al., 2012). Additionally, study designs that do not include control groups prevent researchers from drawing conclusions about the etiological relevance of TLEs in the pathway to psychosis, which highlights the importance of the many case-control studies that replicate the association between TLEs and the entire psychosis spectrum (Elklit & Shevlin, 2010; Heins et al., 2011; van Dam et al., 2014b).

Traumatic Life Event Measurement

Studies greatly vary in how they measure TLEs, both in terms of type of measurement (e.g., structured interview, self-report), as well as the type, timing, and severity of TLEs assessed (Bendall et al., 2008). These methodological differences impede conclusive statements and potentially explain minimal replications across studies. Varying methods for trauma assessment also yield different TLE disclosure rates, with self-reports tending toward higher rates of disclosure (Bendall et al., 2008). Nevertheless, reliable and valid self-report questionnaires have been developed and widely used over

the years within psychosis research, such as the Childhood Trauma Questionnaire (Bernstein & Fink, 1998).

Conclusions

Clinical Implications

Given the immense societal cost of psychoses, it is imperative that individualized prevention and treatment efforts are developed or current methods refined. The early intervention and practical application prospects for understanding the TLE-psychosis relationship are great. First, in light of the importance of cognitive-based appraisals and schemas, tailoring treatment toward trauma-related cognitions that influence psychotic experiences may prove promising (Sherrer, 2011). Second, therapeutic efforts aimed at ameliorating stress sensitivity and emotional dysregulation are likely also useful interventions that could target comorbidities (e.g., depression, PTSD) and distress related to threat appraisals (Birchwood & Trower, 2006). Third, treatment that directly tackles traumas has been found to be efficacious in treating individuals with comorbid psychotic disorders and PTSD (Dvir, Denietolis, & Frazier, 2013). Overall, a variety of therapeutic avenues are available for clinicians who interface with individuals presenting with psychotic symptoms and who have TLE histories. Equally important is the assessment of TLEs for individuals presenting with psychosis-related concerns, as TLE histories may play an important role in the phenomenology and treatment of psychosis. At the prevention level, community-based interventions aimed at reducing trauma exposure are likely to be critical in lowering the incidence of psychotic disorders (Kelleher et al., 2013). Given the strong link between TLEs and general psychopathology, community

and policy efforts to prevent the incidence of traumatic life experiences, such as abuse, neglect, violence, and peer victimization, are imperative for public health.

Summary

Despite the consistent relationship between TLEs and psychosis, the temporal and dose-response patterns that exist for this association, and the many mechanisms proposed to account for it, exposure to trauma is not necessary or sufficient to cause psychosis. It is likely that TLEs interact with genetic vulnerability and/or other risk factors to produce psychosis outcomes. However, the experience of trauma is not psychosis-specific in terms of psychological sequelae; thus, specificity of TLEs to psychosis is critical to assess in future studies. Further, the genes implicated in the TLE-psychosis pathway are involved in other important domains (e.g., mood as indexed by the serotonin transporter gene), which is consistent with the transdiagnostic complexity that results in the aftermath of TLEs (van Winkel et al., 2013). Nevertheless, the lack of specificity does not undermine the robust association between TLEs and psychosis, and the value of better understanding the factors that explain this relationship. In conclusion, exposure to traumatic life experiences can significantly impact the pathogenesis of psychotic experiences as either a precipitating or exacerbating factor, and can lead to psychosis outcomes through myriad pathways that intersect with other genetic or environmental risk factors.

CHAPTER 2

MANUSCRIPT ONE IN JOURNAL ARTICLE FORM

Abstract

In a large undergraduate sample, we explored whether attentional biases were similar between individuals experiencing attenuated positive psychotic symptoms (APPS) with a history of trauma compared to individuals with a trauma history alone. Participants completed the Emotional Stroop Task and a self-report of APPS. Although reaction time to physical, sexual, and emotional trauma words was associated with trauma exposure, only reaction time to physical abuse and overall trauma words remained significantly associated with trauma status after controlling for age, race, and neutral word reaction time. Contrary to our hypotheses, attenuated psychosis was not associated with reaction time to TLE words and there were no significant interactions between trauma history and attenuated psychosis on reaction time to TLE-salient stimuli. Exploratory analyses revealed that there was a significant relationship between trauma exposure and attentional biases for emotional abuse words when the sample was restricted to individuals identified as potentially higher risk for psychosis. Findings suggest that psychosis risk alone does not appear to exacerbate attentional biases and that trauma history may exert similar influence on attention regardless of psychosis risk. In conclusion, phenotypes associated with trauma may be similar in populations potentially at risk for psychosis.

Introduction

Selective attention toward emotional stimuli, such as negative, threatening, or disorder-specific words or images (e.g., trauma words for PTSD or self-referent negative words for depressive disorders) is a transdiagnostic phenomenon commonly measured by the Emotional Stoop Task (EST; Stroop, 1935; Williams, Mathews, & MacLeod, 1996). Selective attention, also commonly referred to as attentional biases, is the capacity to focus on certain stimuli while simultaneously ignoring irrelevant stimuli, and is often disrupted in people who have a history of experiencing traumatic life events (TLEs), including physical, sexual, and emotional abuse (Caparos & Blanchette, 2014; Cisler et al., 2011; Williams et al., 1996). For example, during the EST, individuals are asked to respond to the ink color of the words, not the meaning of the words. Slower reaction times (RTs) for naming the color of the words (i.e., hypoactive responsivity) are indicative of selective attention biases for the emotional words' meaning.

Difficulties filtering attention for negative emotional stimuli have been associated with a variety of psychological symptoms, including the entire psychosis spectrum, from individuals diagnosed with schizophrenia (Bendall et al., 2013; Wiffen et al., 2013) to individuals in the general population reporting schizotypal symptoms (although the schizotypal sample study found attentional differences only for disgust words, not sadness, anger, or fear words; Yaffee & Walder, 2016). These selective attention biases also have been associated with performance on other tasks associated with attentional deficits across the psychosis continuum, such as the Continuous Performance Test or visual scan pathway tasks (Chen et al., 2015; Freeman, Garety, & Phillips, 2000; van Hooff, Devue, Vieweg, & Theeuwes, 2013). Investigating attentional biases has the

potential to impact identification of those at risk for serious psychopathology such as psychosis, to help researchers and clinicians understand how psychopathology develops and progresses, and subsequently, how to intervene to ameliorate distress (Cisler et al., 2011).

The research on attentional biases and attenuated forms of psychosis is quite limited, especially in comparison to research exploring attentional biases and TLEs. However, studies investigating the effect of TLEs on selective attention tend to focus on the impact of TLEs on PTSD rather than other symptoms that are strongly linked to TLEs, such as depression, anxiety, and psychosis (Green et al., 2010; Varese et al., 2012a). Examining the impact of selective attention in individuals with both a TLE history and experiencing attenuated positive psychotic symptoms (APPS) is an important theoretical question given robust links between TLEs and psychosis and given that etiological underpinnings of both TLEs and psychosis include aberrant attentional focus on stimuli that are otherwise irrelevant to others (Ehlers and Clark, 2000; Roiser et al., 2013; Varese et al., 2012a). Indeed, psychotic and traumatized samples have been found to demonstrate a pattern of hypoactive responsivity on the EST (Cisler et al., 2011). Specifically, delayed or withdrawn attention (measured as slower RTs to emotionally-valenced words compared to neutral words) is considered a consequence of poor attentional control and deficits with orienting, sustaining, and shifting attention away from aversive stimuli (Cisler et al., 2011).

To our knowledge, only two studies have explored the role of selective attention to TLE words in samples with a TLE history and psychosis (Bendall et al., 2013b; Klewchuk, McCusker, Mulholland, & Shannon, 2007). In a sample of individuals with

schizophrenia and a history of sexual trauma (relative to a physical trauma and a non-specific/no trauma group), longer RTs to sexual trauma stimuli were found compared to physical trauma, negative, positive, and neutral word categories. Similar attentional biases to sexual abuse words were found in a sample of individuals diagnosed with a first episode of psychosis and a history of childhood sexual abuse (Bendall et al., 2013b). These studies suggest that individuals with psychotic disorders demonstrate selective attention to words relevant to their experienced TLE consistent with the attentional biases shown in PTSD samples (McNally, Kaspi, Riemann, & Zeitlin, 1990).

Nevertheless, these studies did not include individuals with a history of emotional abuse (or physical abuse in the case of Bendall et al.'s (2013) study), and further, included only patients with diagnosed psychotic disorders rather than individuals experiencing subclinical manifestations of psychosis, such as APPS (van Os & Linscott, 2012). APPS represent less frequent, severe, convincing and/or distressing positive psychotic symptoms measured in non-clinical, general population samples. Individuals experiencing frequent and/or distressing APPS are an important sample to examine, as they can help researchers understand whether behavioral markers present at the diagnostic level might be present earlier on, and thus, be a potential risk factor for disorder onset (Kelleher et al., 2012; van Os & Kapur, 2009). Studying individuals experiencing APPS has become more common due to the implications that findings from this group have for preventing and treating such severe mental disorders as psychosis (van Os & Linscott, 2012). Specifically, those individuals experiencing APPS are at increased risk for psychosis and the same risk factors associated with APPS are linked to full blown psychotic disorders (van Os & Linscott, 2012).

The current study aimed to replicate and expand upon previous findings that individuals with a TLE history (i.e., TLE+ group) will demonstrate attentional biases (i.e., significantly slower RTs) to TLE-related word categories of the EST relative to those without a TLE history (i.e., TLE- group). Consistent with previous work that tempers analyses by considering mean RT to neutral words (Besnier et al., 2010 addresses this issue), we adjusted analyses for RT to neutral words. We hypothesized that there would be differences between the TLE+ and TLE- groups on the EST, such that the TLE+ group would demonstrate significantly longer RTs to TLE-relevant stimuli before and after adjusting for neutral RT (Hypothesis 1). Our second prediction was that there would be an association between RT to TLE-relevant stimuli and two attenuated forms of psychosis (Hypothesis 2). Finally, we hypothesized that there would be an interaction between APPS and TLE groups in attentional biases for TLE-related word categories, with those who have experienced TLEs and APPS experiencing the most attentional biases (Hypothesis 3). Further, for exploratory and descriptive purposes, we restricted our analyses to those endorsing higher levels of attenuated forms of psychosis to determine whether individuals in the TLE+ relative to the TLE- group would demonstrate attentional biases for the TLE-related word categories before and after controlling for neutral RT.

Methods

Participants and Procedure

Undergraduate students (N = 728) between the ages of 18 and 34 (M = 20.09; SD = 2.36) were from a large urban university that is socioeconomically and racially diverse. Participants were recruited from courses across multiple disciplines via an online

recruitment website. The study protocol received Institutional Review Board approval from the university. Informed consent was obtained from all participants prior to participation, for which they received course credit. After consenting, participants were directed to a laboratory computer where they completed the EST and a battery of self-report questionnaires. They were excluded from completing the EST if they reported being color-blind or if they were outside the age range of 18 to 35, beyond the typical age of onset for schizophrenia (American Psychiatric Association, 2013).

Measures

Attentional Biases

Selective attention was measured with the EST (Stroop, 1935; Williams et al., 1996). The classic Stroop task displays color words that vary in ink color (e.g., the word "green" presented in blue ink). The participant is asked to choose the color of the ink displayed in their response while ignoring the semantic content of the word. The manipulation of the task involves attentional competition between task-relevant stimuli (color) and distracting stimuli (semantic content). The EST is a derivative of the original Stroop and involves emotional stimuli disrupting color-naming performance. Converging findings suggest that EST performance is highly correlated with other tasks tapping into emotional attention (Cisler, Bacon, & Williams, 2009).

Prior to completing demographic and self-report psychological symptom measures, the EST task was administered via EPrime software (Schneider, Eschman, & Zuccolotto, 2012) using adapted formatting code from Caparos and Blanchette's (2014) study. Participants were seated approximately 60 cm from a computer screen and given a set of noise-cancelling headphones to wear. Before each trial, a fixation point in the

center of the screen was displayed for a randomly selected period of between 100 ms and 300 ms, after which time a target word appeared printed in capital letters in one of four colors. Participants were asked to respond as quickly as possible to the color of the target word by pressing one of the corresponding keys on the keyboard: '1' for red, '2' for green, '9' for yellow, and '0' for blue. Colors were equally and randomly represented across words, and words were presented in random order. After responding, a blank screen appeared for 200 ms before the next fixation point and trial.

The task began by having participants read a set of instructions, followed by a practice run of 20 neutral words that required the participant to select the correct key before advancing to confirm their understanding of the task. Similar to Bendall et al.'s (2013) study, six words for each of seven categories were repeated in random order (168 words) once the practice trial was complete, although our EST was completely randomized in that each participant received a different word order. Categories included the same words as in Bendall and colleagues' (2013) study: neutral (e.g., SOCKS), threatening (e.g., SPY), negative (e.g., DEFEAT), positive (e.g., PLEASED), sexual abuse (e.g., RAPE), physical abuse (e.g., BRUISE), and emotional abuse (e.g., TEASE). However, for the purposes of this study, only the physical, sexual, and emotional abuse categories, as well as the neutral category as a covariate, were analyzed given that our hypothesis was to investigate whether attentional biases were present for TLE-relevant stimuli (supplementary analyses for threat and negative words are presented in Table 7 of the Expanded Analyses section). This study utilized a randomized design (i.e., the words were presented in a random order for each participant), as in previous studies with psychotic and TLE exposed samples (Bendall et al., 2013; Wittekind, Jelinek, Kellner,

Moritz, & Muhtz, 2010; Witthöft, Borgmann, White, & Dyer, 2015). There were four measured RT outcomes: 1) physical abuse words, 2) sexual abuse words, 3) emotional abuse words, and 4) overall trauma words (i.e., overall RT to the emotional, physical, and sexual abuse words).

Traumatic Life Events

TLEs were assessed via the Childhood Trauma Questionnaire Short-Form (Bernstein et al., 1994; Bernstein & Fink, 1998), which is a self-report inventory for ages 12 or older that taps five types of maltreatment on a five point Likert scale: emotional, physical and sexual abuse, and emotional and physical neglect. Psychometric assessments indicate this scale has good sensitivity and specificity, internal consistency, criterion-related validity, and convergent reliability with clinician-scored abuse in clinical and general population samples (Bernstein & Fink, 1998). Cutoff scores are provided for each scale, including "none to low", "low to moderate", "moderate to severe", and "severe to extreme" exposure. Consistent with other studies, the TLE+ group was comprised of individuals who endorsed at least one of the five TLEs at or above the "moderate to severe" cutoff (i.e., 13 or higher for emotional abuse, 10 or higher for physical abuse, 8 or higher for sexual abuse, 15 or higher for emotional neglect, and 10 or higher for physical neglect) and the TLE- group was comprised of individuals who endorsed scores below the cutoffs (Bendall et al., 2013; Heim et al., 2009; Klewchuk et al., 2007). Internal consistency for each of the five subtypes of abuse ranged from acceptable to excellent (α = 0.74 to 0.93) with the exception of the physical neglect scale, which yielded poor internal consistency (α = 0.60).

Attenuated Psychosis

The 45 positive items of the 92-item Prodromal Questionnaire (PQ) was used to measure the number of APPS endorsed in the past month while not under the influence of drugs, alcohol, or other medications, as well as whether the endorsed symptom was distressing (Loewy, Bearden, Johnson, Raine, & Cannon, 2005; Loewy, Johnson, & Cannon, 2007). The PQ has been found to demonstrate moderate concurrent validity, strong sensitivity and moderate specificity with other semi-structured interviews that assess psychosis (e.g., The Structured Interview for Psychosis-Risk Syndromes, Kline et al., 2012; Miller et al., 2002). The internal consistency among our sample was excellent ($\alpha = 0.92$). In addition to the number of APPS endorsed, we included a second psychosis outcome to indicate potential higher risk for psychosis, which is the endorsement of eight or more APPS as distressing (i.e., D-APPS group). The comparison group, low-D-APPS, was defined as three or fewer distressing APPS endorsed, which corresponds to the mean number of distressing APPS endorsed for the entire sample collected across the study protocol and has been used in previous studies (Cooper, Alm, Olson, & Ellman, 2016; Gibson et al., 2014; Reeves et al., 2014). The comparison groups have differed across several dimensions associated with psychosis in previous studies, such as TLEs, cannabis use, and white matter integrity (Cooper et al., 2016; Gibson et al., 2014; Reeves et al., 2014). Further, distressing items have consistently been found to be more clinically relevant, discriminating between patient and non-patient status for psychotic disorders (Hanssen et al., 2003; Fusar-Poli et al., 2014; Loewy et al., 2005).

Potential Covariates

Race, gender, and age were collected as part of a battery of self-report questionnaires.

Data Analysis

Analysis of variance (ANOVA) tested group differences between categorical predictor and continuous outcome variables, chi-square tested the association between variables that were categorical, and correlations tested the association between variables that were both continuous. Analysis of covariance (ANCOVA) allowed for analyses to be adjusted for covariates, including demographics and neutral word RT. Partial eta squared, a measure of effect size for ANCOVA, indicated the unexplained variation in EST RT plus the variation explained solely by TLE status, parsing out the effect of other covariates in the model. Regression was used to test whether significant interactions existed between TLEs and attenuated psychosis on EST RTs. We adjusted for neutral word RT to account for the potential of general attentional processing delays that might have obscured attentional biases for emotional words (for a discussion of this issue, see Besnier et al., 2010). Demographic variables were controlled for when they were significantly related to both the predictor and outcome variables. Random responding was examined and three participants were considered outliers given their performance on the EST (i.e., rapid RT in conjunction with poor accuracy). Analyses were run with and without these outliers, which did not alter the results in a manner that would change the ultimate conclusions of the study. Thus, results are reported for the full sample. Regardless of whether there was a significant TLE by APPS/D-APPS interaction on EST RT, we wanted to better understand the influence of TLEs on those identified as higher

risk for psychosis. Thus, for descriptive and exploratory purposes, we restricted our main ANCOVA analyses by high- and low-D-APPS status to determine whether there were significant differences between TLE+ and TLE- groups on EST RTs within the high versus low risk for attenuated psychosis groups. Probing insignificant interactions may illuminate important findings that would otherwise be overlooked by neglecting to stratify by groups based on theoretical grounding (Behrens, Winkler, Gorski, Leitzmann, & Heid, 2011; Brambor, Clark, & Golder, 2006).

Results

Descriptive Characteristics

Demographic and clinical characteristics of the sample are presented in Table 3. APPS and EST RT variables were found to be non-normal based on visual inspection of the data, as well as skewness and kurtosis values. Data transformations, including log-transformation for the APPS variable and square root transformations for the EST RT when they were the dependent variables, resulted in approximately normal distributions. Age significantly differed by TLE group, such that TLE+ individuals were older than TLE- participants ($F(1, 726) = 9.26$, $p < 0.01$). Additionally, age was associated with significantly slower RTs to emotional abuse ($r = 0.20$), physical abuse ($r = 0.17$), sexual abuse ($r = 0.20$), and the overall trauma words ($r = 0.20$; p values < 0.0001), but age was not associated with APPS ($p = 0.13$) or D-APPS ($p = 0.18$). Thus, age was controlled for in analyses involving the TLE and EST RT variables. Gender did not differ by TLE status ($p = 0.86$), APPS ($p = 0.24$), D-APPS ($p = 0.26$) or by any of the EST variables: emotional abuse words ($p = 0.49$), physical abuse words ($p = 0.61$), sexual abuse words ($p = 0.80$), and overall trauma words ($p = 0.57$).

Table 3. *Descriptive Characteristics (Manuscript One)*

Demographics	**Overall Sample (*N* = 728)**	**High-D-APPS (*n* = 139)**	**TLE+ (*n* = 244)**	**Low-D-APPS (*n* = 436)**	**TLE- (*n* = 484)**
Male, n (%)	170 (23.40)	28 (20.10)	56 (23.00)	108 (24.80)	114 (23.60)
Age (years), mean (SD) [range]	20.09 (2.36) [18-34]	19.80 (1.82) [18-30]	20.46 (2.71) [18-34]	20.10 (2.47) [18-34]	19.90 (2.16) [18-32]
Race, n (%)					
Non-Hispanic White	372 (51.00)	75 (54.00)	86 (35.00)	223 (51.00)	300 (62.00)
African-American/African	129 (18.00)	19 (14.00)	63 (26.00)	74 (17.00)	77 (16.00)
Asian/Pacific Islander	111 (15.00)	22 (16.00)	50 (20.00)	70 (16.00)	53 (11.00)
Hispanic/Latino	46 (6.00)	9 (6.00)	13 (5.00)	26 (6.00)	24 (5.00)
Multiracial	35 (5.00)	10 (7.00)	16 (7.00)	17 (4.00)	20 (4.00)
Other	35 (5.00)	4 (3.00)	16 (7.00)	26 (6.00)	10 (2.00)
Clinical Characteristics					
TLE+, n, %	244 (33.5)	77 (55.40)	N/A	101 (23.20)	N/A
APPS, mean (SD) [range]	9.91 (7.85) [0-44]	20.84 (6.71) [10-44]	12.47 (8.81) [0-44]	5.49 (4.42) [0-30]	8.61 (6.97) [0-40]
Emotional Abuse Words RT, mean (SE)*	678.14 (2.55)	677.57 (5.12)	703.72 (4.46)	676.43 (121.52)	665.24 (97.62)
Physical Abuse Words RT, mean (SE)*	681.86 (2.83)	677.47 (6.50)	708.33 (5.43)	681.63 (127.57)	668.52 (99.56)
Sexual Abuse Words RT, mean (SE)*	687.79 (2.62)	689.70 (7.81)	712.06 (5.31)	685.14 (122.57)	675.56 (103.01)
Overall Trauma Words RT*, mean (SE)*	682.60 (2.13)	681.58 (5.47)	708.03 (4.20)	681.07 (115.08)	669.77 (90.37)

Note. *Estimated Marginal Means (Adjusted for Neutral RT); **Mean RT to emotional, physical, and sexual abuse words. TLEs = Traumatic Life Events; TLE+ = Participants who endorsed a history of moderate, severe, or extreme trauma; APPS = Attenuated Positive Psychotic Symptoms; High D-APPS = Endorsement of ≥ 8 or more APPS as distressing.

Race significantly differed by TLE status (X^2= 47.74, $p < 0.0001$), APPS ($F(1, 721) = 2.26$, $p = 0.04$) and RT to emotional abuse ($F(6, 721) = 4.66$, $p < 0.001$), physical abuse ($F(6, 721) = 6.08$, $p < 0.001$), sexual abuse ($F(6, 721) = 4.82$, $p < 0.001$), and overall trauma words ($F(6, 721) = 4.17$, $p < 0.001$), but race did not significantly differ by D-APPS status ($p = 0.51$). The African-American and Caucasian racial groups were the only racial groups to differ on both the TLE and EST RT variables, such that African-American participants were significantly more likely to be in the TLE+ group than Caucasian participants (X^2= 33.06, $p < 0.0001$), and had significantly slower mean RTs to all four trauma word categories on the EST than Caucasian participants: emotional abuse words ($F(1, 535) = 21.91$, $p < 0.0001$), physical abuse words ($F(1, 535) = 14.55$, $p < 0.001$), sexual abuse words ($F(1, 535) = 18.02$, $p < 0.0001$), and overall trauma words ($F(1, 535) = 20.57$, $p < 0.0001$). No other racial comparisons were associated with both the predictor (i.e., TLEs, APPS/D-APPS) and outcome (i.e., the EST RT) variables. Therefore, dummy coded race variables were controlled for in analyses involving both TLE and EST RT variables.

Attentional Biases, Traumatic Life Events, and Attenuated Psychosis

TLE+ participants reported significantly more APPS ($F(1, 726) = 34.91$, $p < 0.0001$) and were significantly more likely to be classified as high-D-APPS (X^2= 51.23, $p < 0.0001$) than TLE- participants. Relationships between TLE status and EST RTs adjusting for covariates are presented in Table 4. Results reflect that TLE+ individuals were significantly slower to respond to all four EST outcomes across the entire sample adjusting for age and race. However, only the RT to physical abuse and overall trauma words remained significantly different between TLE+ and TLE- groups after adjusting

for neutral RT (Hypothesis 1). APPS were not significantly associated with the EST RT variables nor were RTs slower for individuals in the high-D-APPS versus low-D-APPS groups (*p*-values > 0.29), a pattern of results that remained after controlling for RT to neutral words (*p*-values > 0.46; Hypothesis 2). There were no TLE by APPS/D-APPS interactions on any of the EST outcomes (*p*-values > 0.31) adjusting for age and race or neutral word RT (*p*-values > 0.42; Hypothesis 3).

Table 4. *Unadjusted and Adjusted ANCOVA Models Examining the Relation Between Traumatic Life Events and Emotional Stroop Reaction Times Within Entire Sample, High Risk for Psychosis, and Low Risk for Psychosis Samples*

EST Word Category*	**Entire Sample (*N* = 728)**		**High-D-APPS sample (*n* = 139)**		**Low D-APPS sample (*n* = 436)**	
	Model 1[a]	**Model 2[b]**	**Model 1[a]**	**Model 2[b]**	**Model 1[a]**	**Model 2[b]**
Emotional Abuse	***F*(1, 719) = 8.31, *p* = 0.004, η^2 = 0.01**	*F*(1, 718) = 3.67, *p* = 0.06, η^2 = 0.01	***F*(1, 132) = 5.40, *p* = 0.02, η^2 = 0.04**	***F*(1, 131) = 4.93, *p* = 0.03, η^2 = 0.04**	*F*(1, 427) = 1.62, *p* = 0.21, η^2= 0.004	*F*(1, 426) = 0.49, *p* = 0.49, η^2 = 0.001
Physical Abuse	***F*(1, 719) = 9.36, *p* = 0.002, η^2 = 0.01**	***F*(1, 718) = 4.87, *p* = 0.03, η^2 = 0.01**	***F*(1, 132) = 4.24, *p* = 0.04, η^2 = 0.03**	*F*(1, 131) = 2.62, *p* = 0.11, η^2 = 0.02	*F*(1, 427) = 2.89, *p* = 0.09, η^2 = 0.01	*F*(1, 426) = 2.02, *p* = 0.16, η^2 = 0.01
Sexual Abuse	***F*(1, 719) = 6.49, *p* = 0.01, η^2 = 0.01**	*F*(1, 718) = 1.84, *p* = 0.18, η^2 = 0.003	*F*(1, 132) = 3.36, *p* = 0.07, η^2 = 0.03	*F*(1, 131) = 1.56, *p* = 0.21, η^2 = 0.01	*F*(1, 427) = 1.40, *p* = 0.24, η^2 = 0.003	*F*(1, 426) = 0.29, *p* = 0.59, η^2 = 0.001
Overall Trauma**	***F*(1, 719) = 9.15, *p* = 0.003, η^2 = 0.01**	***F*(1, 718) = 5.08, *p* = 0.02, η^2 = 0.01**	***F*(1, 132) = 4.77, *p* = 0.03, η^2 = 0.04**	*F*(1, 131) = 3.75, *p* = 0.06, η^2 = 0.03	*F*(1, 427) = 2.22, *p* = 0.14, η^2 = 0.01	*F*(1, 426) = 1.31, *p* = 0.25, η2 = 0.003

Note. *Square root transformed outcomes; a = Adjusted for age and race; b = Adjusted for age, race, and neutral RT; significant results are bolded; η^2= partial eta squared; EST = Emotional Stroop Task; High D-APPS = Endorsement of ≥ 8 or more APPS as distressing; Low D-APPS = Endorsement of ≤ 3 or less APPS as distressing.

Exploratory analyses revealed that RTs to emotional, physical, and overall trauma words were significantly slower for the high-D-APPS group (see Table 4). However, after adjusting for RT to neutral words, differences remained only for emotional abuse words, although effect sizes remained small. Further, after adjusting for RT to neutral

words, there were no significant differences in RT to negative and threat words (see Expanded Analyses, Table 7). Finally, Table 4 reflects that there were no differences between TLE+ and TLE- groups on RT when restricting analyses to the low risk for psychosis group.

Discussion

To the best of our knowledge, this is the first study to explore attentional biases for TLE-related words in a non-clinical sample experiencing attenuated forms of psychosis. Results indicated that TLE+ individuals demonstrate selective attention for all EST trauma words compared to TLE- individuals; however, with conservative adjustments of neutral word RT, only RT to physical abuse and overall trauma words remained significantly different between the TLE groups (Hypothesis 1). Bivariate analyses exploring the link between attentional biases and attenuated psychosis (regardless of TLE status) indicated that, contrary to our hypotheses, EST performance to TLE-related stimuli was not influenced by the number of APPS endorsed or whether an individual was classified as high-D-APPS (Hypothesis 2). Additionally, there were no TLE by attenuated psychosis interactions on EST performance (Hypothesis 3). Lastly, our descriptive analyses indicated that those with a history of moderate to severe or severe to extreme TLE exposure (i.e., TLE+) had significantly longer RTs to emotional abuse words when restricting our analyses only to those individuals identified at potentially higher clinical risk for psychosis (i.e., high D-APPS), whose most commonly endorsed TLE was emotional abuse. Collectively, these results suggest that changes in RTs to trauma-related words in those experiencing APPS likely are more related to a history of trauma than to the emergence of psychotic experiences.

Contrary to our hypothesis, the bivariate relationships between attentional biases to TLE-related words and the attenuated psychosis variables were not significant. This is consistent with recent research that did not find an association between clinical and subclinical levels of positive psychotic symptoms and attentional biases for certain categories, such as words of physical abuse, emotional abuse, threat, and negativity in a first episode sample (Bendall et al., 2013) or threat and negativity words for positive schizotypy (Yaffe & Walder, 2016). As Yaffe and Walder (2016) suggest, it may be reduced variability in APPS scores (compared to a clinical sample) that contribute to the lack of findings. Additionally, our fully randomized design may have obscured findings, as blocked designs have been found to evoke slightly larger emotional interference (Cisler et al., 2011). Overall, these findings suggest that attentional biases within the context of dimensional forms of attenuated psychosis may be more similar to non-clinical samples rather than samples at or above the threshold of florid psychosis, given that the number of APPS endorsed did not magnify the extent of attentional biases above and beyond having a TLE history.

Our exploratory analysis demonstrated that when restricting the sample to individuals at potentially higher risk for psychosis (i.e., high D-APPS) and after conservatively adjusting for age, race, and neutral word RT, the TLE+ group showed attentional biases for emotional abuse words. This was indicated by the high D-APPS group having a significantly longer RT to emotional abuse words, which was their most commonly endorsed TLE. However, the lack of significant interaction between TLEs and attenuated psychosis on EST performance reflects that there is no significant difference between those at potentially higher risk for psychosis and controls. Thus, our exploratory

finding provides descriptive information only about the potential pattern of attentional biases among high risk for psychosis group, and does not imply that these differences are uniquely different from controls.

Nevertheless, this exploratory analysis reflects that there may be a link between TLE exposure and attentional biases specific to content that is relevant to the personal history of the participant, given that attentional biases were present only for the most commonly endorsed TLE of that specific group (i.e., emotional abuse). This is consistent with research finding that EST interference is most strongly elicited when the person has relevant experience with the content of the words (Williams et al., 1996; Caparos & Blanchette, 2014). This tends to be even more the case in samples with higher levels of psychopathology (e.g., PTSD, suicidality) relative to their traumatized counterparts without such symptomatology, such that these individuals are slower to name the colors of words relevant to their personal distress rather than other word categories (Bendall et al., 2013b; Cha et al., 2010; Klewchuk et al., 2007; McNally, et al., 1990). Although the most pronounced interference was for physical abuse words among our entire sample (despite their most commonly endorsed TLE being emotional abuse), individuals in the TLE+ group demonstrated the most interference for emotional abuse words when analyses were restricted to those at putative higher risk for psychosis, which was the most commonly endorsed TLE type in the high D-APPS group.

Therefore, the personal salience of the words may be particularly important when higher levels of current symptoms and associated distress are present; in the case of our study, high-D-APPS status in combination with a TLE history. This is underscored by the lack of significant differences between the TLE+ and TLE- groups for negative and threat

words, suggesting that selective attention did not generalize to all negatively valenced words in this sample. The non-significant findings for selective attention to negative stimuli is consistent with other findings (Yaffe & Walder, 2016), including a study that assessed psychosis in the context of TLE history (Klewchuk et al., 2007).

There are four notable limitations to this study. First, the generalizability of our findings to other non-clinical samples is limited, given this was an undergraduate sample. Similarly, effect sizes were small. However, because one of the foci of this study was to explore risk for psychosis, college-aged individuals were an ideal group to sample. Further, our sample was drawn from a socioeconomically and demographically diverse university comprised of approximately 38,000 students, which enhances generalizability to similar-aged individuals. Future studies exploring the relationship between TLEs and attentional biases controlling for concurrent psychological symptoms is warranted, especially through the lens of individuals with clinically diagnosed psychotic disorders, which may yield differences at a magnitude/effect size that is more clinically meaningful. Second, the relevance of the attentional bias task (i.e., the EST) may not have been personally salient enough for the TLE+ group, which could have influenced the fact that EST performance was not associated with APPS or D-APPS status. Further, it is important that future studies use multiple measures of attentional bias administered across time to ensure measurement reliability. Third, participants reported on TLEs retrospectively, at which point inaccuracy or biases may be contributing to under- or over-reporting. However, several studies have found retrospective TLE reporting to be reliable, valid, and more under- than over-reported across various clinical and non-clinical samples (Hardt & Rutter, 2004; Fisher et al., 2011). Finally, our study used a

cross-sectional design, which limits conclusions about the directionality of our findings. Thus, it would be ideal for longitudinal studies to be conducted that capture attentional biases pre-and post-TLE.

Several strengths of our study warrant attention. To our knowledge, our study is the first to examine selective attention towards personally salient stimuli (i.e., TLE-related words in the TLE+ subsample) in a non-clinical sample experiencing APPS. Our study also included a broader (although still limited) range of TLEs than previous studies (Bendall et al., 2013; Klewchuck et al., 2007), which ideally will be expanded in future studies. Specifically, the finding that TLE exposure is significantly associated with delayed RT to physical abuse words despite adjustment for neutral word RT is unique, as the majority of other studies finding an EST effect either have limited their assessment of TLEs to sexual abuse only or have only studied PTSD samples (Bendall et al., 2013; Caparos & Blanchette, 2014; Klewchuk et al., 2007; for a review, see Cisler et al., 2011). Therefore, it appears that physical abuse words may be particularly likely to elicit selective attention in those individuals who have a TLE history, irrespective of APPS reports, due to the potent combination of their physically intrusive nature and potentially threatening connotation.

Another interesting finding was that individuals identifying as African-American or African were significantly more likely to endorse TLEs, but also to have a higher number of APPS experiences in the past month and to have significantly slower RTs to TLE-related words. Although our research supports the findings of higher rates of TLE exposure (Roberts, Gilman, Breslau, Breslau, & Koenen, 2011; Thompson et al., 2009) and APPS (Cohen & Marino, 2013) among African-American samples, the influence of

race on attentional biases to TLE stimuli has not been explored. Our study provides beginning support for the existence of racial differences for RT to TLE stimuli, such that delayed RT appears most prominent among African-Americans, especially in comparison to Caucasians. These findings could potentially contribute to future studies examining possible mechanisms of racial disparities in psychosis populations.

In sum, our findings suggest that attentional biases for TLE-related stimuli may be present in TLE+ samples regardless of attenuated psychosis experiences and that TLE exposure may impact attention in similar ways across nonclinical and subclinical psychotic samples. Additionally, although experiences of emotional abuse, as well as corresponding stimuli, may evoke attentional processing interferences among individuals at higher risk for psychosis with a TLE history, attenuated psychotic experiences alone do not appear to be related to performance on a task of selective attention. This suggests that attentional biases toward TLE-salient stimuli may be more likely rooted in TLE exposure than to the emergence of attenuated psychosis. It will be important for future studies to determine the exact nature of attentional biases in samples along the psychosis spectrum (e.g., present only in the context of personally relevant stimuli or experiences) so that treatment can be adapted to adjust potential cognitive biases.

CHAPTER 3
MANUSCRIPT TWO IN JOURNAL ARTICLE FORM

Abstract

Several cognitive mechanisms have been proposed to account for the relationship between exposure to traumatic life events (TLEs) and the entire psychosis spectrum. However, few of these mechanisms have been empirically tested, especially not in a more conservative multiple mediation model. The purpose of this study was to examine whether perceived stress, dissociation, negative self-schemas, negative other-schemas, and external locus of control mediated the association between TLEs and attenuated forms of psychosis. An undergraduate sample of 945 individuals completed a battery of self-report questionnaires. Multiple mediation was tested with Hayes' (2013) PROCESS macro. Perceived stress, dissociation, negative self-schemas, and negative other-schemas mediated the relationship between the presence of TLE exposure and increases in two attenuated psychosis outcomes. Additionally, higher levels of external locus of control significantly mediated the relation between TLE exposure and increases in the number of attenuated positive psychotic symptoms endorsed. Targeting stress sensitivity, maladaptive schemas, dissociative tendencies, and externalizing attributional styles may prove useful in the amelioration of risk for psychosis in the aftermath of TLE exposure. Findings underscore the importance of targeting trauma-related cognitions in the prevention or reduction of psychotic-like experiences or disorders.

Introduction

Although genetic factors appear to be substantially related to the etiology of psychotic disorders, evidence suggests that the environment also influences the development and course of psychosis (Schlosser, Pearson, Perez, & Loewy, 2012). Among the environmental contributors to psychotic disorders, traumatic life events (TLEs) have been consistently associated with the entire spectrum of psychosis outcomes, including risk and severity of psychotic disorders and attenuated (i.e., less frequent, severe, distressing or convincing) positive psychotic symptoms (APPS) in nonclinical samples (Gracie et al., 2007; Heins et al., 2011; Spauwen et al., 2006; Thompson et al., 2009). Considered part of the extended psychosis phenotype, APPS have been found to occur in 5-8% of non-clinical populations and have been linked to both risk for developing a psychotic disorder and with many of the same risk factors as psychotic disorders, such as cannabis use and exposure to TLEs (Kaymaz et al., 2012; van Os et al., 2009; van Os & Linscott, 2012).

A recent meta-analysis indicated that the magnitude of the relation between trauma exposure and subclinical psychotic experiences is fairly large (with odds ratios ranging from 3 to 11 depending on the study), regardless of demographic factors and comorbid mental disorders (Janssen et al., 2004; Varese et al., 2012a). The impact of the TLE and psychosis association is emphasized by findings that TLE exposure predates the onset of psychosis (Arseneault et al., 2011; Kelleher et al., 2013; Mackie et al., 2011), and that having a history of TLEs in the context of psychosis is linked to a worse disorder course, such as higher symptomatology, cognitive deficits, and treatment resistance

(Hassan & De Luca, 2015; Schenkel et al., 2005). Collectively, these findings suggest that TLEs are likely to influence the pathways to, and course of, psychotic experiences.

Despite the robust TLE and psychosis association, the unique psychological mechanisms by which trauma influences the development of psychosis remain unclear, although several theoretical models focused on cognitive mechanisms have been suggested (Bentall & Fernyhough, 2008; Morrison, Frame, & Larkin, 2003; Read et al., 2005; van Winkel et al., 2013). Specific underlying mechanisms that have been proposed to account for this relationship include locus of control, stress sensitivity, negative schemas, and dissociation (Anglin, Polanco-Roman, & Lui, 2014; Fisher et al., 2012; Fisher et al., 2013; Gibson et al., 2014). However, the majority of the empirical data has investigated these mechanisms in isolation rather than in combination with one another, the latter of which takes a much more conservative approach (Bebbington et al., 2011; Fisher et al., 2012; Fisher et al., 2013; Freeman & Fowler, 2009; Gracie et al., 2007; Perona-Garcelán et al., 2012).

The importance of perceived stress in the relationship between TLEs and APPS has been highlighted by research showing that many individuals display heightened physiological or subjective reactivity to lab-induced or environmental stressors, particularly individuals who have been exposed to TLEs (Glaser et al., 2006) and those experiencing symptoms along the entire psychosis continuum (Aiello et al., 2012; Collip et al., 2013; Lardinois et al., 2011; Lataster et al., 2009; Myin-Germeys et al., 2001). Further, in a sample similar to the one in the current study, greater perceived stress was found to mediate the association between higher frequency of TLEs and increased frequency of APPS (Gibson et al., 2014). We wished to extend these findings to

determine whether perceived stress remained a significant mediator in the context of other important explanatory variables.

Another cognitive mechanism implicated in the pathogenesis of psychosis stemming from TLEs is negative schemas (i.e., negative global beliefs about oneself, others, and the world). Negative schemas are associated with both strict and broad definitions of psychosis (Bortolon et al., 2013; Fowler et al., 2011; Addington & Tran, 2009) and have been found to predict APPS (Gracie et al., 2007). Negative schemas also have been found to mediate the relationship between TLEs and paranoia (Fisher et al., 2012). Our study intends to expand this research by including other explanatory variables in the mediation model, and by assessing attenuated psychosis more broadly.

Experiencing TLEs also has been hypothesized to lead to dissociative symptoms (e.g., difficulty distinguishing between whether something an individual remembers was reality or a dream) that subsequently lead to psychosis-proneness (Anketell et al., 2010; Moskowitz & Corstens, 2008). Not only have dissociative experiences been consistently associated with a TLE history (Ogawa et al., 1997), but they have been significantly linked to subclinical and clinical psychotic symptoms (Braehler et al., 2013; Schroeder, Langeland, Fisher, Huber, & Schäfer, 2016). Dissociation also has been implicated as a significant independent mediator of the TLE-APPS relationship (Anglin, Polanco-Roman, & Lui, 2014; Perona-Garcelán et al., 2012; Varese et al., 2012b), although to our knowledge, no study has investigated this construct in the context of both attenuated hallucinatory and delusional experiences with a more conservative definition of TLEs (i.e., endorsement of at least moderate to severe exposure), gaps this study addresses.

In addition to increased likelihood of experiencing dissociative symptoms, individuals along the psychosis continuum also appear more likely to make external attributions for their private and public experiences (i.e., manifesting an external locus of control) than those endorsing lower levels of psychotic experiences, to the extent that they interpret their environment as controlled more by outside sources like chance, luck, fate, or powerful others rather than the self (Bentall & Fernyhough, 2008; Candido & Romney, 1990; Cooper et al., 2008; Frenkel et al., 1995; Kaney & Bentall, 1989; Levine, Jonas, & Serper, 2004; Rosenbaum & Hadari, 1985; Thompson et al., 2011). Possessing an external locus of control was found to be one of the strongest longitudinal predictors of psychotic disorder development (Frenkel et al., 1995), has been found to prospectively mediate the relationship between TLE exposure and attenuated psychosis (Fisher et al., 2013), and has been linked to worse disorder phenomenology and prognosis (Ciufolini et al., 2015). Our study appears to be the first to investigate external locus of control as a mediator of the TLE-APPS relationship in the context of many commonly reported TLEs (e.g., emotional, physical, and sexual abuse), as the TLEs measured in the Fisher et al. (2013) mediation study were exposure to bullying, harsh parenting, and domestic violence.

Given that perceived stress, negative schemas, dissociation, and locus of control have been linked to both TLE exposure and the full spectrum of psychotic experiences, we hypothesized that they would each act as independent putative mediators of the association between TLEs and attenuated psychosis, as well as significant explanatory mechanisms in the multiple mediation model, which conservatively adjusts analyses to account for the presence of all other putative mediators in the model.

Methods

Participants and Procedure

Undergraduate students (N = 945) between the ages of 18 and 34 (M = 20.13; SD = 2.47) were from a socioeconomically and racially diverse urban university. Participants were recruited from courses across multiple disciplines via an online recruitment website and received course credit for their participation. The study protocol received Institutional Review Board approval from the university and informed consent was obtained from all participants prior to participation. After consenting, participants were directed to a laboratory computer where they completed a battery of self-report questionnaires and experimental paradigms. The only exclusions were being outside the age range of 18 to 35, beyond the typical age of onset for schizophrenia (American Psychiatric Association, 2013).

Measures

The Childhood Trauma Questionnaire Short-Form (CTQ; Bernstein et al., 1994; Bernstein & Fink, 1998) measured TLEs. The CTQ is a self-report inventory for ages 12 and up that assesses five maltreatment types (emotional, physical and sexual abuse, and emotional and physical neglect) across a five point Likert scale. The CTQ has been found to display good sensitivity and specificity, criterion validity, internal consistency, and convergent reliability across clinical and general population samples (Bernstein & Fink, 1998). Each of the five scales has a cutoff score, including “none to low”, “low to moderate”, “moderate to severe”, and “severe to extreme” exposure. Similar to other studies, the TLE+ group was comprised of individuals who endorsed at least one of the five TLEs at or above the “moderate to severe” cutoff (i.e., 13 or higher for emotional

abuse, 10 or higher for physical abuse, 8 or higher for sexual abuse, 15 or higher for emotional neglect, and 10 or higher for physical neglect) and the TLE- group was comprised of individuals who endorsed scores below the cutoffs (Bendall et al., 2013; Heim et al., 2009; Klewchuk et al., 2007). Internal consistency for each of the five subtypes of abuse ranged from acceptable to excellent ($\alpha = 0.75$ to 0.93) with the exception of the physical neglect scale, which yielded poor internal consistency ($\alpha = 0.59$).

The 45 positive items of the 92-item Prodromal Questionnaire (PQ) were used to measure the number of APPS endorsed in the past month outside the influence of drugs, alcohol, or other medications (Loewy, et al., 2005; Loewy et al., 2007). The PQ also was used to assess the number of APPS additionally endorsed as distressing. This scale has been found to have moderate concurrent validity and specificity and strong sensitivity when compared to other semi-structured interviews that assess psychosis, such as The Structured Interview for Psychosis-Risk Syndromes (Kline et al., 2012; Miller et al., 2002). In addition to the number of APPS endorsed, our second psychosis outcome was more indicative of potential higher risk for psychosis. High D-APPS status equated to the endorsement of eight or more APPS as distressing (i.e., D-APPS group). The low D-APPS was comprised of individuals who endorsed three or fewer distressing APPS, a threshold that corresponds to the mean number of distressing APPS endorsed for the entire sample collected across the study protocol (see Cooper et al., 2016; Gibson et al., 2014; and Reeves et al., 2014 for similar studies). This risk dichotomy has yielded significant differences across various domains associated with psychosis in previous studies, such as TLEs, cannabis use, and white matter integrity (Cooper et al., 2016;

Gibson et al., 2014; Reeves et al., 2014). The distressing component of psychotic-like symptoms has been found to be more clinically relevant, discriminating between patient and non-patient status for psychotic disorders (Hanssen et al., 2003; Fusar-Poli et al., 2014; Loewy et al., 2005). Within our current sample, internal consistency was excellent ($\alpha = 0.92$).

Perceived stress was evaluated with the Perceived Stress Scale (PSS; Cohen, Kamarck, & Mermelstein, 1983). The PSS is a 14-item measure of perceived global stress and coping ability that focuses on the predictability and controllability of events in the past month. This scale has established high concurrent and predictive validity with health outcomes (e.g., colds), psychiatric outcomes (e.g., depression, social anxiety), and with other measures of stress, such as negative affect and impact of life event scales, as well as moderate internal and test-retest reliability with $\alpha= 0.89$ (Cohen et al., 1983; Cohen, 1988; Cohen, Tyrrell, & Smith, 1993; Hewitt, Flett, & Mosher, 1992). Higher PSS scores have discriminated between those at risk for psychosis or with first-episode psychosis and controls, and have been associated with schizotypy (Horan, Brown, & Blanchard, 2007; Mondelli et al., 2010; Palmier-Claus, Dunn, & Lewis, 2012). In the current sample, internal consistency was good ($\alpha = 0.84$).

Negative self-schemas and negative other-schemas were assessed with the Brief Core Schema Scale (BCSS), which is a 24-item, five-point Likert assessment of positive and negative schemas concerning the self and others, such as “I am weak” and “Other people are truthful” (Fowler et al., 2006). This scale has been found to be discrete from traditional measures of self-esteem and mood, to be associated with several psychosis outcomes, to demonstrate good internal consistency ($\alpha\approx 0.85$ for clinical and nonclinical

samples) and test-retest reliability, and moderate to strong concurrent and discriminant validity with self-esteem and depression measures, such as The Calgary Depression Scale for Schizophrenia (Addington & Tran, 2009; Fowler et al., 2006; Stowkowy et al., 2016). The negative-self (six items) and negative-others (six items) scores constituted independent putative mediators for the present study. For our study, internal consistency of the negative-self scale was good ($\alpha = 0.85$) and excellent for the negative-other scale ($\alpha = 0.95$).

Dissociation was measured with the Dissociative Experiences Scale (DES; Bernstein & Putnam, 1986), which is a 28-item instrument that assesses dissociative symptoms and experiences (e.g., "Some people have the experience of being in a familiar place but finding it strange and unfamiliar") on an 11-point scale. The DES is regarded as the gold standard for evaluating dissociation, demonstrating good reliability and validity, and has been associated with various psychosis outcomes (Braehler et al., 2013). The outcome from the DES was the average of the summed score and the internal consistency was excellent ($\alpha = 0.94$).

The Rotter I-E Scale (Rotter, 1966) measured locus of control, a concept that measures individuals' beliefs about how reinforcement is controlled in the world and the degree to which they believe that they can control events happening around them. Higher scores indicate a more external locus of control (i.e., perceiving that reward/ reinforcement is not connected to one's own behavior, but controlled by outside sources). This 23-item instrument has been found to have good test-retest reliability, internal consistency (although in our sample $\alpha = 0.64$), and concurrent validity with other locus of control measures (Lange & Tiggemann, 1981; Zerega, Tseng, & Greever, 1976).

To partially address the issue of specificity of the putative mediators on the TLE-attenuated psychosis relationship, our supplementary analyses tested whether the main mediation model persisted when we controlled for depressive and generalized anxiety symptoms, as well as substance use. Depressive symptoms were measured with the brief version of the Center for Epidemiologic Studies-Depression Scale, which measures the presence and severity of depressive experiences in the past week (Radloff, 1977). Generalized anxiety was assessed with the State Trait Anxiety Inventory Trait Form Anxiety Subscale with a version that excluded items from the depression factor (Bieling, Antony, & Swinson, 1998; Spielberger, Gorsuch, Lushene, Vagg, & Jacobs, 1983). The Drug Use Frequency Measure assessed the frequency of use of various substances in the past three months on a scale ranging from "never" to "daily" (O'Farrell, Fals-Stewart, & Murphy, 2003). Cannabis and other drug use (i.e., amphetamines, opioids/heroin, and hallucinogens) was dichotomized into a "high" versus "low" use category based on a previous study using the same sample (Reeves et al., 2014). All three scales have been found to demonstrate strong psychometric properties, including construct, discriminant, and convergent validity, as well as test-retest reliability (Bieling et al., 1998; O'Farrell et al., 2003; Radloff, 1977; Rule & Traver, 1983; Spielberger et al., 1983).

Statistical Analysis

Due to computer errors, some participant data were missing for the DES (n = 3), Rotter I-E Scale (n = 3), and the BCSS (n = 4). Thus, after listwise deletion, the multiple mediator model included 941 participants. The continuous dependent variable, APPS, was log-transformed (ln + 1 to address zero values) because of positive skew observed via visual inspection. Bivariate analyses among the demographic, predictor (i.e., TLEs)

and outcome (i.e., APPS and D-APPS) variables involved: chi-square tests when both variables were categorical, correlations when both variables were continuous, ANOVA when there was a categorical predictor and continuous outcome, and logistic regression (expressed as odds ratios [ORs]) when there was a continuous predictor and binary outcome. Age, race, and gender were considered confounders if they were related to both the independent and dependent variables.

To examine the indirect effects of the five mediators on the relationship between TLEs and APPS/D-APPS, we used Hayes (2013) regression-based PROCESS macro, which is a non-parametric computational tool that tests multiple mediation via model 4. The PROCESS macro tests the direct and indirect effects, as well as provides point estimates (unstandardized effects) and bias-corrected 95% bootstrapped confidence interval (CI) estimates around the indirect effect. The CIs for the indirect effects that do not include zero are considered significant. As per Hayes' (2013) recommendation, effect sizes were measured with the partially standardized indirect effect of X on Y and were available only for continuous outcome variables (i.e., APPS) in the multiple mediation model (Hayes, 2013). Statistical analyses were conducted using SPSS Version 22.

We ran three supplementary sets of analyses on the main multiple mediation model. First, we controlled for age due to age differences in the grouping of the independent variable. Second, we controlled for comorbid symptoms (e.g., depressive and generalized anxiety symptoms, as well as substance use) to isolate the specificity of the putative mediators for the TLE and attenuated psychosis relationships. Third, we tested alternative models to partially address the limitations of reverse directionality, as suggested by Hayes (2013).

To address reverse directionality, we analyzed supplementary models that swapped the order of the continuous dependent variable (APPS) and the mediator variables. Specifically, APPS was the mediator, each of the constructs originally proposed as mediators were each run as dependent variables in separate PROCESS models, and each of the remaining cognitive styles were added as covariates to mimic the multiple mediation model. For example, we examined whether the relationship between TLEs and perceived stress was mediated by APPS controlling for dissociation, negative self- and other- schemas, and external locus of control in an attempt to match the multiple mediation model, which accounts for the presence of other explanatory variables when testing mediation.

Results

Demographics

Demographic and clinical characteristics for this sample are presented in Table 5. There was no observed difference for gender between those in the TLE- compared to the TLE+ groups ($p = 0.66$) or the low-D-APPS compared to the high-D-APPS groups ($p = 0.08$). Further, gender was not significantly associated with APPS ($p = 0.17$). There was an observed difference among the racial groups depending on TLE status ($X^2 = 55.11$, $p < 0.0001$), but not D-APPS status ($p = 0.13$). Race was not associated with APPS ($p = 0.27$). Older individuals were significantly more likely to be in the TLE+ group ($OR = 1.07$, $p = 0.02$), but age was not significantly different between the low-D-APPS and high-D-APPS groups ($p = 0.10$) nor was it associated with APPS ($p = 0.09$). Therefore, we did not control for gender, race, or age.

Table 5. *Descriptive Characteristics (Manuscript Two)*			
Demographics	**Overall Sample (*N* = 945)**	**High-D-APPS (*n* = 175)**	**Low-D-APPS (*n* = 568)**
Male, n (%)	231 (24.40)	34 (19.40)	147 (25.90)
Age (years), mean (SD) [range]	20.13 (2.47) [18-34]	19.80 (1.82) [18-30]	20.18 (2.64) [18-34]
Race, n (%)			
Non-Hispanic White	520 (55.00)	103 (58.90)	317 (55.80)
African-American/African	169 (17.90)	21 (12.00)	106 (18.70)
Asian/Pacific Islander	145 (15.30)	27 (15.40)	82 (14.40)
Multiracial	48 (5.10)	14 (8.00)	22 (3.90)
Other	63 (6.70)	10 (5.70)	41 (7.20)
Clinical Characteristics, mean (SD) [range]			
APPS	9.92 (7.69) [0-44]	20.35 (6.71) [9-44]	5.72 (4.58) [0-30]
PSS	25.22 (8.14) [2-55]	32.27 (6.98) [18-55]	22.06 (7.15) [2-46]
BCSS-Self	2.84 (3.88) [0-24]	6.18 (4.92) [0-21]	1.50 (2.53) [0-18]
BCSS-Others	6.83 (5.38) [0-24]	9.31 (5.31) [0-24]	5.86 (5.19) [0-24]
DES	2.28 (1.23) [1-8]	3.19 (1.39) [1.18-7.54]	1.89 (0.93) [1-6.79]
Rotter I-E	12.43 (3.56) [3-23]	14.08 (3.85) [5-23]	11.88 (3.44) [3-22]
TLE	0.62 (1.07) [0-5]	1.12 (1.31) [0-5]	0.39 (0.85) [0-5]
TLE+, n, %	312 (33.0)	94 (53.70)	133 (23.40)
Note. TLEs= Traumatic Life Events; TLE+ = Participants who endorsed a history of moderate, severe, or extreme trauma; APPS= Attenuated Positive Psychotic Symptoms; High D-APPS = Endorsement of ≥ 8 or more APPS as distressing; Low D-APPS = Endorsement of ≤ 3 or more APPS as distressing; PSS = Perceived Stress Scale; BCSS = Brief Core Schema Scale; DES = Dissociative Experiences Scale; Rotter I-E = Rotter Internal External Locus of Control Scale.			

Bivariate Analyses

The a paths (TLEs to the mediators) and b paths (mediators to the attenuated psychosis variables), as well as the c path (TLEs to the attenuated psychosis variables), were significant in both the independent and multiple mediation models, with the exception of the path between external locus of control and D-APPS status in the multiple mediation model, which was not significant (see Chapter 4, Table 8 for a correlation matrix for the main independent, mediator, and dependent variables). The a, b, and c paths of the multiple mediation model are represented in Figures 1 and 2. Perceived stress was significantly associated with TLEs ($F[1, 943] = 54.79$, $p < 0.0001$), APPS ($r = 0.43$, $p < 0.0001$), and D-APPS status ($OR = 1.23$, $p < 0.0001$). Dissociation was significantly related to TLEs ($F[1, 940] = 55.08$, $p < 0.0001$), APPS ($r = 0.45$, $p < 0.0001$), and D-

APPS status (*OR* = 2.49, $p < 0.0001$). External locus of control was significantly associated with the predictor variable, TLEs ($F[1, 940] = 8.42$, $p = 0.004$), and both outcome variables, APPS ($r = 0.23$, $p < 0.0001$) and D-APPS status (*OR* = 1.19, $p < 0.0001$). Negative self-schemas also were significantly related to TLEs ($F[1, 939] = 80.02$, $p < 0.0001$) and both attenuated psychosis variables: $r = 0.36$, $p < 0.0001$ for APPS, and *OR* = 1.39, $p < 0.0001$ for D-APPS status. Finally, negative other-schemas were significantly associated with all relevant variables: TLEs ($F[1, 939] = 14.63$, $p < 0.001$), APPS ($r = 0.24$, $p < 0.0001$), and D-APPS status (*OR* = 1.12, $p < 0.0001$). TLE status also was significantly associated with APPS ($F[1, 943] = 44.23$, $p < 0.0001$) and D-APPS status ($X^2 = 57.88$, $p < 0.0001$).

Indirect Effects

Results for the full mediation model are presented in Figures 1 and 2 for each of the attenuated psychosis variables. Indirect effects indicated that greater perceived stress, dissociation, and negative self- and other-schemas were significant putative mediators in the relationship between TLE exposure and both higher APPS endorsement and D-APPS status, with external locus of control also a significant putative mediator for the TLE-APPS relationship (see Table 6). We also explored the independent contribution of each of the mediators in the TLE-attenuated psychosis association. All five variables statistically mediated the association between TLEs and both attenuated psychosis outcomes (see Table 6).

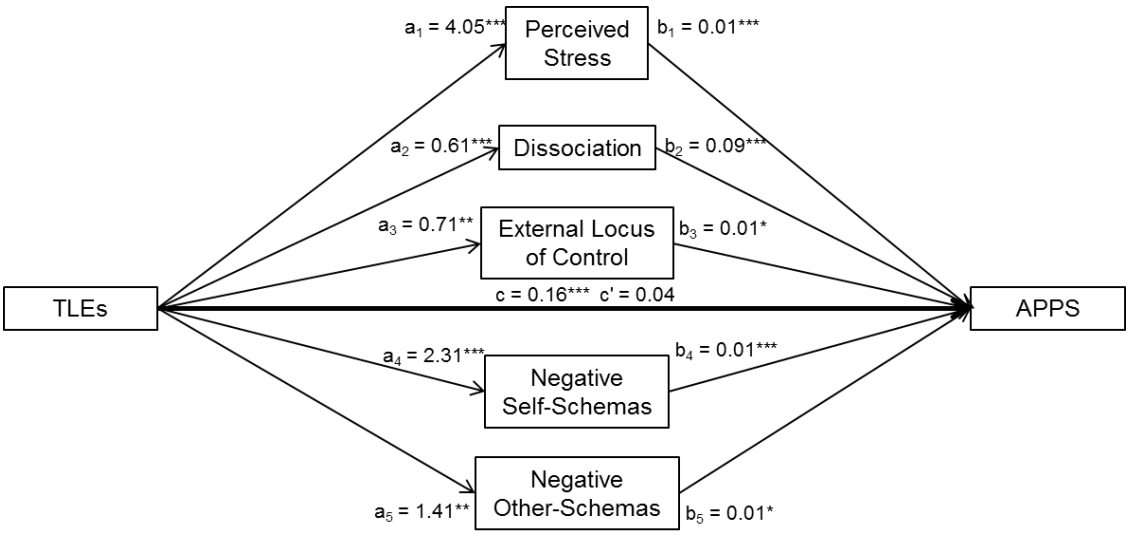

Figure 1. Effect of Multiple Mediators on the Relationship Between Traumatic Life Events and Attenuated Positive Psychotic Symptoms. a = effect of TLEs on mediators; b = effect of mediators on APPS; c = direct effect of TLEs on APPS; c' = indirect effect of TLEs on APPS through the five mediators; *$p < 0.05$; **$p < 0.01$; ***$p < 0.001$. Values are unstandardized coefficients.

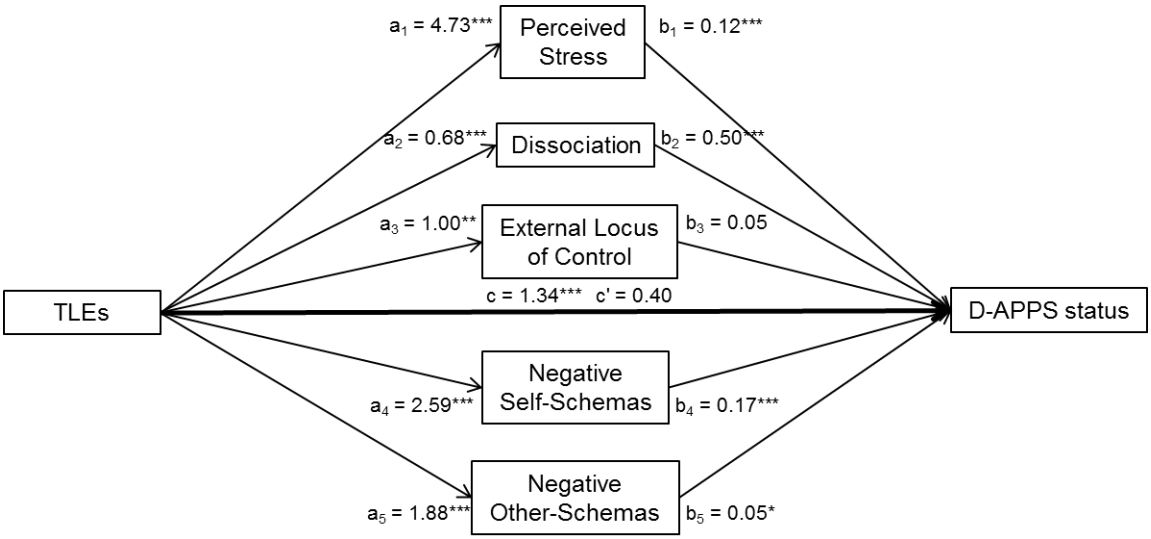

Figure 2. Effect of Multiple Mediators on the Relationship Between Traumatic Life Events and Distressing-Attenuated Positive Psychotic Symptom Status. a = effect of TLEs on mediators; b = effect of mediators on D-APPS status (classification as high-D-APPS [endorsement of ≥8 distressing APPS] versus low-D-APPS [endorsement of ≤3 distressing APPS]); c = direct effect of TLEs on D-APPS status; c' = indirect effect of TLEs on D-APPS status through the five mediators; *$p < 0.05$; **$p < 0.01$; ***$p < 0.001$. Values are unstandardized coefficients.

Table 6. Summary of Indirect Effects from Independent and Multiple Mediation Models

Multiple Mediation Model*	**Unstandardized Estimate**	**95% CI****	**Partially standardized indirect effect**	**95% CI***
TLE→ perceived stress→ APPS	0.04	**0.0227 - 0.0525**	0.10	**0.0623 - 0.1428**
TLE→ dissociation→ APPS	0.05	**0.0368 - 0.0748**	0.15	**0.1036 - 0.2016**
TLE→ external locus of control→ APPS	0.005	**0.0008 - 0.0120**	0.01	**0.0020 - 0.0318**
TLE→ negative self-schemas→ APPS	0.03	**0.0143 - 0.0426**	0.07	**0.0373 - 0.1166**
TLE→ negative other-schemas→ APPS	0.01	**0.0018 - 0.0156**	0.02	**0.0047 - 0.0435**
TLE→ perceived stress→ D-APPS	0.56	**0.3422 - 0.8111**		
TLE→ dissociation→ D-APPS	0.34	**0.1857 - 0.5490**		
TLE→ external locus of control→ D-APPS	0.05	-0.0146 - 0.1639		
TLE→ negative self-schemas→ D-APPS	0.45	**0.2373 - 0.7093**		
TLE→ negative other-schemas→ D-APPS	0.08	**0.0144 - 0.1931**		
Independent Mediation Model	**Unstandardized Estimate**	**95% CI***		
TLE→ perceived stress→ APPS	0.07	**0.0522 - 0.0961**		
TLE→ dissociation→ APPS	0.08	**0.0558 - 0.1048**		
TLE→ external locus of control→ APPS	0.02	**0.0053 - 0.0288**		
TLE→ negative self-schemas→ APPS	0.07	**0.0536 - 0.0927**		
TLE→ negative other-schemas→ APPS	0.02	**0.0101 - 0.0359**		
TLE→ perceived stress→ D-APPS	0.92	**0.6158 - 1.2245**		
TLE→ dissociation→ D-APPS	0.57	**0.3876 - 0.7985**		
TLE→ external locus of control→ D-APPS	0.16	**0.0738 - 0.3032**		
TLE→ negative self-schemas→ D-APPS	0.79	**0.5482 - 1.0773**		
TLE→ negative other-schemas→ D-APPS	0.19	**0.0929 - 0.3051**		

TLE = traumatic life events; APPS = attenuated positive psychotic symptoms; D-APPS = classification as high-D-APPS (endorsement of ≥8 distressing APPS) versus low-D-APPS (endorsement of ≤3 distressing APPS); *Model represents the effect of each mediator *in the context of the other mediators.* **95% Confidence Interval of the indirect effect effects derived from 1,000 bias-corrected bootstrapped samples (log-transformed); CIs that do not include zero are considered significant and are bolded.

Supplementary Analyses: Indirect Effects

Controlling for age when APPS or D-APPS were the outcome did not alter the results (data available upon request). Adjusting analyses for depressive and generalized anxiety symptoms, as well as substance use, indicated that dissociation was the only variable to persist in statistically mediating the TLE-attenuated psychosis relationship (see Table 9). The supplementary analyses addressing issues of reverse directionality (i.e., running five separate models where each of the mediators became the outcome variable, APPS became the mediator, and the remaining four mechanisms were entered as covariates) indicated that there was no evidence of an indirect effect when the model was reorganized with dissociation or locus of control as the outcome variables, suggesting that these variables may potentially be the most likely to represent mediators in the TLE-APPS relationship. Given that significant indirect effects existed for APPS on the TLE-perceived stress and TLE-negative schemas relationship, it is unclear whether these cognitive styles exert their influence as antecedents or consequences of psychotic-like experiences.

Discussion

This is the first study, to our knowledge, to find that multiple cognitive variables are involved in the relationship between TLEs and attenuated psychosis outcomes. Specifically, we found that perceived stress, dissociation, external locus of control, negative self-schemas, and negative other-schemas yielded significant indirect effects (both independently and in the multiple mediator model) on the association between exposure to TLE and APPS/D-APPS status. However, specificity analyses indicated that dissociation was the only significant mediator that held up after adjusting for depressive

and anxiety symptoms, as well as substance use. Additionally, running alternative models that flipped the mediators and dependent variable suggested that perceived stress and negative schemas could be either a predisposing factor for APPS in the aftermath of TLE exposure or the consequence of APPS and TLE exposure, while dissociation and external locus of control appeared to most likely exert their influence as a mediator, rather than outcome, variable when TLE history was the predictor. Cumulatively, these results underscore the salience of dissociation as a critical cognitive style in the TLE-attenuated psychosis relationship since this was the only variable to persist in its significance across all supplementary models.

The results of our main model, which highlight the putative role of dissociation, negative other- and self-schemas, stress sensitivity, and external locus of control, are consistent with research finding the TLE-psychosis relation to be mediated by cognitive based mechanisms (Anglin, Polanco-Roman, & Lui, 2014; Fisher et al., 2012; Fisher et al., 2013; Gibson et al., 2014; Gracie et al., 2007; Varese et al., 2012b). Each of the mediators in the current study has implications for how reality distortions that might emerge in the aftermath of TLEs could influence the onset of psychotic symptoms and experiences. It is imperative that future studies assess whether the proposed cognitive styles are a consequence or antecedent of attenuated psychotic experiences, a time course this study could not rule out due to the cross-sectional design.

Paralleling other studies was our finding that dissociation was a significant putative mediator of the link between TLEs and APPS/D-APPS status (Anglin, Polanco-Roman, & Lui, 2014; Perona-Garcelán et al., 2012; Varese et al., 2012b). Our study extended these findings in that the strength of dissociation as a potential mediator is

underscored by its persistent mediation in the full model, and in that we looked at a higher TLE severity score. Further, we assessed the specificity of this mechanism to attenuated psychosis by controlling for several comorbid symptoms, and dissociation was the only variable to hold up to this conservative adjustment. Several researchers have proposed that individuals may respond to TLEs with dissociative experiences (e.g., derealization, depersonalization) that involve an individual's personality becoming divided into fragmented selves (e.g., a trauma versus current, daily functioning version of themselves; Anketell et al., 2010; Liotti & Gumley, 2008; Van der Hart, Nijenhuis, & Steele, 2006). These split versions of the selves are thought to conflict, with the 'trauma' focused version being experienced as atypical and unfamiliar to the person and inducing psychotic-like interpretations or "tuning out" experiences (Braehler et al., 2013; Van der Hart et al., 2006). Overall, it appears that dissociation may be a critical feature of post-traumatic event processing that makes it more likely that an individual experiences their environment in an unintegrated, disjointed manner, subsequently increasing their vulnerability to psychotic experiences and interpretations of their world.

Perceived stress appears to be important in increasing risk for psychosis, particularly given an adverse life experience history (Lardinois et al., 2011; Gibson et al., 2014; Trotman et al., 2014). One possible interpretation of our results is that as a result of experiencing trauma, heightened levels of perceived stress that correspond to a reduced sense of controllability and predictability may increase vulnerability to psychotic-symptoms or disorders. In a similar vein, it is possible that a diminished sense of power over one's experience may be more likely to manifest or be exacerbated by exposure to TLEs (Erickson, Hedges, Call, & Blair, 2013; Karstoft, Armour, Elklit, & Solomon,

2015). Due to findings from our supplementary analyses testing alternative models, it is possible that stress sensitivity may be a reaction to TLEs that increases risk for APPS (reverse directionality model) or the additive effective of TLE history and psychotic-like experiences (main model). Further, our specificity results highlight the transdiagnostic significance of this construct, such that stress sensitivity may be present in the context of other psychological reactions to TLEs (e.g., depressive, anxious, or substance use reactions) rather than unique to psychotic-like presentations.

Subsequent to experiences of victimization, externalizing explanatory styles may be activated or intensified, which may then lead to anticipating threat or to paranoid interpretations of the world (Bentall & Fernyhough, 2008; van Winkel et al., 2013). Consistent with this possibility, we found that having an externalizing locus of control statistically mediated the TLE-APPS relationship. However, the role of locus of control was not as strong as other mediators, such as perceived stress, dissociation, and negative self-schemas (see Table 6). An additional unexpected finding was that locus of control did not statistically mediate the association between TLEs and D-APPS status, which could be a result of diminished power to detect differences because of the smaller sample size or the potential overlap between other mediator constructs (e.g., negative schemas, perceived stress). Supplementary analyses demonstrated that although locus of control most likely has its place as a putative mediator of the TLE-APPS relationship (rather than the outcome of TLEs and APPS), its effect on this relationship may be diluted by other posttraumatic reactions, such as depression, anxiety, or substance use.

Finally, we found that negative schemas, particularly toward the self rather than others, statistically mediated the TLE-attenuated psychosis relation. This suggests that

negative beliefs about oneself (e.g., I am vulnerable) or the world (e.g., other people are devious) may be likely to emerge post-childhood trauma potentially due to early ingrained lessons about the world as a dangerous place or that one is helpless. These individuals may then be more prone to psychotic-like explanations or filters, which may manifest as a psychotic belief system (Gracie et al., 2007). Specifically, early adversities have been conceptualized to facilitate negative schemas about the self and others involving vulnerability, humiliation, and subordination (e.g., that one is vulnerable to being harmed due to the hostile intentions of others), which are then thought to increase psychotic symptom development in those with genetic predispositions (Garety et al., 2001); however, future studies are necessary to determine whether these mechanisms account for our findings.

Despite these potential interpretations, other models have not been ruled out in this study. Indeed, our supplementary results indicated that negative schemas could exert their influence as a predisposing factor for APPS in the context of a TLE history *or* as the psychological response to having a TLE history and subsequent psychotic-like experiences. It is also important to note that controlling for co-occurring symptoms removed the significant effect of negative schemas as a mediator of the association between TLEs and attenuated psychosis. Thus, future studies are warranted that 1) help determine whether TLEs predate the proposed cognitive mediators, and whether psychotic-like symptoms are a consequence of this admixture of experiences and 2) narrow down on which psychopathologies these mediators exert their most potent influence post-trauma.

The advantages of exploring the aforementioned variables in a full mediation model is that, while each of them have been individually found to mediate the TLE-psychosis link, it is important to determine the independent strength of specific indirect effects in the context of one another. Hayes (2013) contends that examining multiple mechanisms in an integrated model is preferred given that one mediator is not likely to be the sole way through which a predictor has an effect on the outcome. Indeed, it is more likely that the relationship between TLE exposure and psychosis is impacted by various processes, including others that were not measured by the current study (e.g., social defeat, hypothalamic-pituitary-adrenal [HPA] axis dysregulation; van Winkel et al., 2013).

There are several methodological limitations to the current study. Most importantly, the study design was cross-sectional, and thus, reverse directionality cannot be ruled out. The cross-sectional nature of the design does not preclude the existence of other models not tested in this study (e.g., that attenuated psychotic experiences lead to heightened perceived stress, dissociation, external locus of control, and negative self- and other-schemas, which then might make one more susceptible to TLE exposure). Future studies that explore the temporal precedence of TLEs and these five mediators in a longitudinal capacity among a nationally representative or clinical sample are necessary to establish mediation. Nevertheless, previous longitudinal studies implicate a timeline whereby TLEs predate some of the mediators of the current study (e.g., locus of control or self-esteem, the latter which may represent a proxy for negative self-schemas), after which time psychotic-like symptoms have been observed (Fisher et al., 2013). Despite these findings, the temporal nature of the other mediators should be assessed in future

studies. In our study, reversing the direction of the dependent and mediator variables in independent models led to us not being able to rule out the possibility that three of the cognitive styles that were originally proposed as mediators (i.e., negative self- and other-schemas, as well as perceived stress) are a result of psychotic-like experiences rather than antecedents. Nevertheless, these alternative models explored independent, not multiple, mediation. Therefore, it is unclear whether statistical mediation would persist if the five cognitive styles represented five dependent variables adjusted for the effect of one another, a conservative adjustment that our main multiple mediation model tested when the cognitive styles were used as mediators. Future studies considering these cognitive styles as multiple outcome variables (adjusting for one another) are warranted.

An additional limitation is that the sample was comprised of undergraduate students, which may limit how translatable these findings are to general population samples. Nevertheless, the sample was socioeconomically and racially diverse, which may help to counter this limitation. Another limitation involves the retrospective nature of TLE assessment, although concerns about the reliability of TLE recall have been challenged by findings that TLE reporting among psychotic samples tends to be underestimated, stable, and in sync with corroborating reports (Cutajar et al., 2010; Fisher et al., 2011). Finally, assessment of symptoms and TLEs was limited to self-report, which should be addressed in future studies by matching self-report data to experimental- or interview-based measurements of relevant constructs.

In conclusion, this study highlights the importance of several cognitive mechanisms in the relationship between TLEs and attenuated psychosis, which may be amenable to psychological intervention, such as targeting trauma-related cognitions that

are linked to psychotic-like appraisals of oneself, others, and the world (Sherrer, 2011). Various treatment options have been found to be efficacious for reducing some of the negative effects of the mediators shown in this study, such as Schema Therapy to address maladaptive schemas (Young, Klosko, & Weishaar, 2003). Community-based preventative measures to reduce TLE exposure are also warranted given the vast psychological sequelae that have been found to stem from TLEs, such as psychotic-experiences (Kelleher et al., 2013). Nuanced clinical assessments that capture TLE histories and how the content and attribution of the specific TLE may manifest in the phenomenology of psychotic symptoms may also constitute a useful avenue of intervention.

CHAPTER 4

EXPANDED ANALYSES

Supplementary Tables

Table 7. *Unadjusted and Adjusted ANCOVA Models Examining the Relation Between Traumatic Life Events and Emotional Stroop Reaction Times Within Entire Sample, High Risk for Psychosis, and Low Risk for Psychosis Samples (Threat and Negative Words Only)*

EST Word Category*	**Entire Sample (*N* = 728)**		**High-D-APPS sample (*n* = 139)**		**Low D-APPS sample (*n* = 436)**	
	Model 1[a]	**Model 2[b]**	**Model 1[a]**	**Model 2[b]**	**Model 1[a]**	**Model 2[b]**
Threat	***F*(1, 719) = 6.36, *p* = 0.01, η^2 = 0.01**	*F*(1, 718) = 1.75, *p* = 0.19, η^2 = 0.002	*F*(1, 132) = 1.51, *p* = 0.22, η^2 = 0.01	*F*(1, 131) = 0.08, *p* = 0.78, η^2 = 0.001	*F*(1, 427) = 0.90, *p* = 0.34, η^2 = 0.002	*F*(1, 426) = 0.03, *p* = 0.87, η^2 = 0.01
Negative	***F*(1, 719) = 7.12, *p* = 0.01, η^2 = 0.01**	*F*(1, 718) = 2.43, *p* = 0.12, η^2 = 0.003	*F*(1, 132) = 0.19, *p* = 0.66, η^2 = 0.001	*F*(1, 131) = 1.83, *p* = 0.18, η^2 = 0.01	*F*(1, 427) = 4.02, *p* = 0.05, η^2 = 0.01	*F*(1, 426) = 3.94 *p* = 0.05, η^2 = 0.01

Note. *Square root transformed outcomes; a = Adjusted for age and race; b = Adjusted for age, race, and neutral RT; significant results are bolded; η^2= partial eta squared; EST = Emotional Stroop Task; High D-APPS = Endorsement of ≥ 8 or more APPS as distressing; Low D-APPS = Endorsement of ≤ 3 or less APPS as distressing.

Table 8. *Spearman Correlation Matrix*

	1	**2**	**3**	**4**	**5**	**6**	**7**	**8**
1. APPS[1]	--							
2. D-APPS	0.65**	--						
3. TLE+[2]	0.21**	OR= 3.80**	--					
4. PSS	0.43**	0.52**	0.23**	--				
5. DES	0.45**	0.46**	0.24**	0.40**	--			
6. BCSS-Self	0.36**	0.52**	0.28**	0.52**	0.33**	--		
7. BCSS-Others	0.24**	0.27**	0.12**	0.27**	0.24**	0.19**	--	
8. Rotter I-E	0.23**	0.26**	0.09*	0.32**	0.18**	0.24**	0.19**	--

Note. * = p < 0.05; ** = p < 0.01. [1]APPS descriptive data derived from raw score; log-transformed APPS variable used to calculate correlations; [2]Odds Ratio presented since both variables are binary. APPS = Attenuated Positive Psychotic Symptoms; D-APPS = classification as high-D-APPS (endorsement of ≥8 distressing APPS) versus low-D-APPS (endorsement of ≤3 distressing APPS); TLEs= Traumatic Life Events; TLE+ = Participants who endorsed a history of moderate, severe, or extreme trauma; APPS= Attenuated Positive Psychotic Symptoms; PSS = Perceived Stress Scale; BCSS = Brief Core Schema Scale; DES = Dissociative Experiences Scale; Rotter I-E = Rotter Internal External Locus of Control Scale.

Table 9. *Multiple Mediator Model Controlling for Comorbid Psychological Symptoms (depressive and generalized anxiety symptoms, as well as substance use)*

Model	Unstandardized Estimate	95% CI*	Partially standardized indirect effect	95% CI*
TLE→ perceived stress→ APPS	< 0.0001	-0.0025 - 0.0014	-0.0001	-0.0086 - 0.0045
TLE→ dissociation→ APPS	0.02	**0.0090 - 0.0338**	0.07	**0.0295 - 0.1114**
TLE→ external locus of control→ APPS	-0.0002	-0.0033 - 0.0017	-0.001	-0.0112 - 0.0058
TLE→ negative self-schemas→ APPS	-0.001	-0.0056 - 0.0049	-0.002	-0.0191 - 0.0166
TLE→ negative other-schemas→ APPS	0.001	-0.0009 - 0.0056	0.003	-0.0031 - 0.0186
TLE→ perceived stress→ D-APPS	0.01	-0.0166 - 0.0734		
TLE→ dissociation→ D-APPS	0.11	**0.0311 - 0.2486**		
TLE→ external locus of control→ D-APPS	0.001	-0.0162 - 0.0476		
TLE→ negative self-schemas→ D-APPS	0.07	-0.0131 - 0.1968		
TLE→ negative other-schemas→ D-APPS	0.03	-0.0080 - 0.1036		

Note. TLE = traumatic life events; APPS = attenuated positive psychotic symptoms; D-APPS = classification as high-D-APPS (endorsement of ≥8 distressing APPS) versus low-D-APPS (endorsement of ≤3 distressing APPS); *Model represents the effect of each mediator in the context of the other mediators. **95% Confidence Interval of the indirect effect effects derived from 1,000 bias-corrected bootstrapped samples (log-transformed); CIs that do not include zero are considered significant and are bolded.

BIBLIOGRAPHY

Aakre, J. M., Brown, C. H., Benson, K. M., Drapalski, A. L., & Gearon, J. S. (2014). Trauma exposure and PTSD in women with schizophrenia and coexisting substance use disorders: Comparisons to women with severe depression and substance use disorders. *Psychiatry Research*, *220*(3), 840-845.

Aas, M., Djurovic, S., Athanasiu, L., Steen, N. E., Agartz, I., Lorentzen, S., ... & Melle, I. (2012). Serotonin transporter gene polymorphism, childhood trauma, and cognition in patients with psychotic disorders. *Schizophrenia Bulletin*, *38*(1), 15-22.

Addington, J., & Tran, L. (2009). Using the brief core schema scales with individuals at clinical high risk of psychosis. *Behavioural and Cognitive Psychotherapy*, *37*(02), 227-231.

Addington, J., Stowkowy, J., Cadenhead, K. S., Cornblatt, B. A., McGlashan, T. H., Perkins, D. O., ... & Cannon, T. D. (2013). Early traumatic experiences in those at clinical high risk for psychosis. *Early Intervention in Psychiatry*, *7*(3), 300-305.

Aiello, G., Horowitz, M., Hepgul, N., Pariante, C. M., & Mondelli, V. (2012). Stress abnormalities in individuals at risk for psychosis: a review of studies in subjects with familial risk or with "at risk" mental state. *Psychoneuroendocrinology*, *37*(10), 1600-1613.

Afifi, T. O., Mather, A., Boman, J., Fleisher, W., Enns, M. W., MacMillan, H., & Sareen, J. (2011). Childhood adversity and personality disorders: results from a nationally representative population-based study. *Journal of Psychiatric Research*, *45*(6), 814-822.

Alemany, S., Arias, B., Aguilera, M., Villa, H., Moya, J., Ibáñez, M. I., ... & Fañanás, L. (2011). Childhood abuse, the BDNF-Val66Met polymorphism and adult psychotic-like experiences. *The British Journal of Psychiatry*, *199*(1), 38-42.

Alemany, S., Goldberg, X., van Winkel, R., Gastó, C., Peralta, V., & Fañanás, L. (2013). Childhood adversity and psychosis: examining whether the association is due to genetic confounding using a monozygotic twin differences approach. *European Psychiatry*, *28*(4), 207-212.

Alvarez, M. J., Roura, P., Osés, A., Foguet, Q., Sola, J., & Arrufat, F. X. (2011). Prevalence and clinical impact of childhood trauma in patients with severe mental disorders. *The Journal of Nervous and Mental Disease*, *199*(3), 156-161.

American Psychiatric Association (APA). (2013). Diagnostic and statistical manual of mental disorders: DSM-5 (5th ed.). Arlington, VA: American Psychiatric Publishing, Inc.

Anglin, D. M., Polanco-Roman, L., & Lui, F. (2014). Ethnic variation in whether dissociation mediates the relation between traumatic life events and attenuated positive psychotic symptoms. *Journal of Trauma & Dissociation, 16*(1), 68-85.

Anketell, C., Dorahy, M. J., Shannon, M., Elder, R., Hamilton, G., Corry, M., ... & O'Rawe, B. (2010). An exploratory analysis of voice hearing in chronic PTSD: Potential associated mechanisms. *Journal of Trauma & Dissociation, 11*(1), 93-107.

Arseneault, L., Cannon, M., Fisher, H. L., Polanczyk, G., Moffitt, T. E., & Caspi, A. (2011). Childhood trauma and children's emerging psychotic symptoms: a genetically sensitive longitudinal cohort study. *American Journal of Psychiatry, 168*(1), 65-72.

Babb, J. A., Masini, C. V., Day, H. E. W., & Campeau, S. (2013). Sex differences in activated corticotropin-releasing factor neurons within stress-related neurocircuitry and hypothalamic–pituitary–adrenocortical axis hormones following restraint in rats. *Neuroscience, 234*, 40-52.

Barnow, S., Arens, E. A., Sieswerda, S., Dinu-Biringer, R., Spitzer, C., & Lang, S. (2010). Borderline personality disorder and psychosis: a review. *Current Psychiatry Reports, 12*(3), 186-195.

Bearden, C. E., Rosso, I. M., Hollister, J. M., Sanchez, L. E., Hadley, T., & Cannon, T. D. (2000). A prospective cohort study of childhood behavioral deviance and language abnormalities as predictors of adult schizophrenia. *Schizophrenia Bulletin, 26*(2), 395-410.

Bebbington, P. E., Bhugra, D., Brugha, T., Singleton, N., Farrell, M., Jenkins, R., ... & Meltzer, H. (2004). Psychosis, victimisation and childhood disadvantage Evidence from the second British National Survey of Psychiatric Morbidity. *The British Journal of Psychiatry, 185*(3), 220-226.

Bebbington, P., Jonas, S., Kuipers, E., King, M., Cooper, C., Brugha, T., ... & Jenkins, R. (2011). Childhood sexual abuse and psychosis: data from a cross-sectional national psychiatric survey in England. *The British Journal of Psychiatry, 199*(1), 29-37.

Bechdolf, A., Thompson, A., Nelson, B., Cotton, S., Simmons, M. B., Amminger, G. P., ... & Yung, A. R. (2010). Experience of trauma and conversion to psychosis in an ultra-high-risk (prodromal) group. *Acta Psychiatrica Scandinavica, 121*(5), 377-384.

Bendall, S., Jackson, H. J., Hulbert, C. A., & McGorry, P. D. (2008). Childhood trauma and psychotic disorders: a systematic, critical review of the evidence. *Schizophrenia Bulletin, 34*(3), 568-579.

Bendall, S., Alvarez-Jimenez, M., Nelson, B., & McGorry, P. (2013a). Childhood trauma and psychosis: new perspectives on aetiology and treatment. *Early Intervention in Psychiatry*, *7*(1), 1-4.

Bendall, S., Hulbert, C. A., Alvarez-Jimenez, M., Allott, K., McGorry, P. D., & Jackson, H. J. (2013b). Testing a model of the relationship between childhood sexual abuse and psychosis in a first-episode psychosis group: the role of hallucinations and delusions, posttraumatic intrusions, and selective attention. *The Journal of Nervous and Mental Disease*, *201*(11), 941-947.

Bentall, R. P., & Fernyhough, C. (2008). Social predictors of psychotic experiences: specificity and psychological mechanisms. *Schizophrenia Bulletin*, *34*(6), 1012-1020.

Bentall, R. P., Wickham, S., Shevlin, M., & Varese, F. (2012). Do specific early-life adversities lead to specific symptoms of psychosis? A study from the 2007 the Adult Psychiatric Morbidity Survey. *Schizophrenia Bulletin*, *38*(4), 734-740.

Bentall, R. P., de Sousa, P., Varese, F., Wickham, S., Sitko, K., Haarmans, M., & Read, J. (2014). From adversity to psychosis: pathways and mechanisms from specific adversities to specific symptoms. *Social Psychiatry and Psychiatric Epidemiology, 49*(7), 1011-1022.

Bernstein, D. P., Fink, L., Handelsman, L., Foote, J., Lovejoy, M., Wenzel, K., ... & Ruggiero, J. (1994). Initial reliability and validity of a new retrospective measure of child abuse and neglect. *The American Journal of Psychiatry, 151*, 1132-1136.

Bernstein, D. P., & Fink, L. (1998). *Childhood trauma questionnaire: A retrospective self-report: Manual*. Psychological Corporation.

Bernstein, E. M., & Putnam, F. W. (1986). Development, reliability, and validity of a dissociation scale. *The Journal of Nervous and Mental Disease, 174*(12), 727-735.

Besnier, N., Kaladjian, A., Mazzola-Pomietto, P., Adida, M., Fakra, E., Jeanningros, R., & Azorin, J. M. (2010). Differential responses to emotional interference in paranoid schizophrenia and bipolar mania. *Psychopathology, 44*(1), 1-11.

Bieling, P. J., Antony, M. M., & Swinson, R. P. (1998). The State--Trait Anxiety Inventory, Trait version: structure and content re-examined. *Behaviour Research and Therapy, 36*(7), 777-788.

Binder, E. B., Bradley, R. G., Liu, W., Epstein, M. P., Deveau, T. C., Mercer, K. B., ... & Ressler, K. J. (2008). Association of FKBP5 polymorphisms and childhood abuse with risk of posttraumatic stress disorder symptoms in adults. *JAMA*, *299*(11), 1291-1305.

Birchwood, M., & Trower, P. (2006). The future of cognitive–behavioural therapy for psychosis: not a quasi-neuroleptic. *The British Journal of Psychiatry*, *188*(2), 107-108.

Bonoldi, I., Simeone, E., Rocchetti, M., Codjoe, L., Rossi, G., Gambi, F., ... & Fusar-Poli, P. (2013). Prevalence of self-reported childhood abuse in psychosis: A meta-analysis of retrospective studies. *Psychiatry Research*, *210*(1), 8-15.

Bortolon, C., Capdevielle, D., Boulenger, J. P., Gely-Nargeot, M. C., & Raffard, S. (2013). Early maladaptive schemas predict positive symptomatology in schizophrenia: A cross-sectional study. *Psychiatry Research*, *209*(3), 361-366.

Bradley, R. G., Binder, E. B., Epstein, M. P., Tang, Y., Nair, H. P., Liu, W., ... & Ressler, K. J. (2008). Influence of child abuse on adult depression: moderation by the corticotropin-releasing hormone receptor gene. *Archives of General Psychiatry*, *65*(2), 190-200.

Braehler, C., Valiquette, L., Holowka, D., Malla, A. K., Joober, R., Ciampi, A., ... & King, S. (2013). Childhood trauma and dissociation in first-episode psychosis, chronic schizophrenia and community controls. *Psychiatry Research*, *210*(1), 36-42.

Bryer, J. B., Nelson, B.A., Miller, J.B., & Krol, P.A. (1987). Childhood sexual and physical abuse as factors in psychiatric illness. *American Journal of Psychiatry*, *144*(11), 1436-1430.

Buckley, P. F., Miller, B. J., Lehrer, D. S., & Castle, D. J. (2009). Psychiatric comorbidities and schizophrenia. *Schizophrenia Bulletin*, *35*(2), 383-402.

Calvete, E., Orue, I., & Hankin, B. L. (2013). Transactional relationships among cognitive vulnerabilities, stressors, and depressive symptoms in adolescence. *Journal of Abnormal Child Psychology*, *41*(3), 399-410.

Caparos, S., & Blanchette, I. (2014). Emotional Stroop interference in trauma-exposed individuals: A contrast between two accounts. *Consciousness and Cognition, 28*, 104-112.

Candido, C. L., & Romney, D. M. (1990). Attributional style in paranoid vs. depressed patients. *British Journal of Medical Psychology*, *63*(4), 355-363.

Centers for Disease Control and Prevention (2014, May 13). Prevalence of Individual Adverse Childhood Experiences. Retrieved from http://www.cdc.gov/violenceprevention/acestudy/prevalence.html

Cha, C. B., Najmi, S., Amir, N., Matthews, J. D., Deming, C. A., Glenn, J. J., ... & Nock, M. K. (2016). Testing the efficacy of attention bias modification for suicidal thoughts: findings from two experiments. *Archives of Suicide Research,* (Epub ahead of print).

Chen, J., Lipska, B. K., Halim, N., Ma, Q. D., Matsumoto, M., Melhem, S., ... & Egan, M. F. (2004). Functional analysis of genetic variation in catechol-O-methyltransferase (COMT): effects on mRNA, protein, and enzyme activity in postmortem human brain. *The American Journal of Human Genetics, 75*(5), 807-821.

Chen, X., Zhang, Z. H., Song, Y., Yuan, W., Liu, Z. X., & Tang, M. Q. (2015). A paired case control comparison of ziprasidone on visual sustained attention and visual selective attention in patients with paranoid schizophrenia. *European Review for Medical and Pharmacological Sciences, 19*(16), 2952-2956.

Cisler, J. M., Bacon, A. K., & Williams, N. L. (2009). Phenomenological characteristics of attentional biases towards threat: A critical review. *Cognitive Therapy and Research*, *33*(2), 221-234.

Cisler, J. M., Wolitzky-Taylor, K. B., Adams, T. G., Babson, K. A., Badour, C. L., & Willems, J. L. (2011). The emotional Stroop task and posttraumatic stress disorder: a meta-analysis. *Clinical Psychology Review*, *31*(5), 817-828.

Ciufolini, S., Morgan, C., Morgan, K., Fearon, P., Boydell, J., Hutchinson, G., ... & Murray, R. (2015). Self esteem and self agency in first episode psychosis: Ethnic variation and relationship with clinical presentation. *Psychiatry Research, 227*(2), 213-218.

Cohen, C. I., & Marino, L. (2013). Racial and ethnic differences in the prevalence of psychotic symptoms in the general population. *Psychiatric Services, 64,*1103–1109.

Cohen, S., Kamarck, T., & Mermelstein, R. (1983). A global measure of perceived stress. *Journal of Health and Social Behavior, 24,* 385-396.

Cohen, S. (1988). Psychosocial models of the role of social support in the etiology of physical disease. *Health Psychology*, *7*(3), 269-297.

Cohen, S., Tyrrell, D. A., & Smith, A. P. (1993). Negative life events, perceived stress, negative affect, and susceptibility to the common cold. *Journal of Personality and Social Psychology*, *64*(1), 131-140.

Collip, D., Wigman, J. T., Myin-Germeys, I., Jacobs, N., Derom, C., Thiery, E., ... & van Os, J. (2013a). From epidemiology to daily life: linking daily life stress reactivity to persistence of psychotic experiences in a longitudinal general population study. *PloS One*, *8*(4), e62688.

Collip, D., Myin-Germeys, I., Wichers, M., Jacobs, N., Derom, C., Thiery, E., ... & van Winkel, R. (2013b). FKBP5 as a possible moderator of the psychosis-inducing effects of childhood trauma. *The British Journal of Psychiatry*, *202*(4), 261-268.

Cooper, F., Morgan, C., Morgan, K., Dazzan, P., Doody, G., Hutchinson, G., ... & Fearon, P. (2008). Locus of control and psychotic-like symptoms in the Aesop study. *Schizophrenia Research*, *102*(1), 135.

Cooper, S., Alm, K.H., Olson, I., & Ellman, L.E. (2016). White matter integrity in individuals with attenuated positive psychotic symptoms. *Early Intervention in Psychiatry.* Epub ahead of print - DOI: 10.1111/eip.12306

Cutajar, M. C., Mullen, P. E., Ogloff, J. R., Thomas, S. D., Wells, D. L., & Spataro, J. (2010a). Schizophrenia and other psychotic disorders in a cohort of sexually abused children. *Archives of General Psychiatry*, *67*(11), 1114-1119.

Cutajar, M. C., Mullen, P. E., Ogloff, J. R., Thomas, S. D., Wells, D. L., & Spataro, J. (2010b). Psychopathology in a large cohort of sexually abused children followed up to 43 years. *Child Abuse & Neglect*, *34*(11), 813-822.

Daalman, K., Diederen, K. M. J., Derks, E. M., van Lutterveld, R., Kahn, R. S., & Sommer, I. E. (2012). Childhood trauma and auditory verbal hallucinations. *Psychological Medicine, 42*(12), 2475-2484.

Debbané, M., & Barrantes-Vidal, N. (2015). Schizotypy from a developmental perspective. *Schizophrenia Bulletin*, *41*(2), S386-S395.

Dennison, U., McKernan, D., Cryan, J., & Dinan, T. (2012). Schizophrenia patients with a history of childhood trauma have a pro-inflammatory phenotype. *Psychological Medicine, 42*(09), 1865-1871.

DeVylder, J. E., Ben-David, S., Schobel, S. A., Kimhy, D., Malaspina, D., & Corcoran, C. M. (2013). Temporal association of stress sensitivity and symptoms in individuals at clinical high risk for psychosis. *Psychological Medicine, 43*(02), 259-268.

Dominguez, M.D., Saka, M. C., Lieb, R., Wittchen, H. U., van Os, J. (2010). Early expression of negative/disorganized symptoms predicting psychotic experiences and subsequent clinical psychosis: a 10-year study. *American Journal of Psychiatry, 167*(9), 1075-1082.

Duhig, M., Patterson, S., Connell, M., Foley, S., Capra, C., Dark, F., … & Scott, J., (2015). The prevalence and correlates of childhood trauma in patients with early psychosis. *The Australian and New Zealand Journal of Psychiatry,* doi: 10.1177/0004867415575379.

Dvir, Y., Denietolis, B., & Frazier, J. A. (2013). Childhood trauma and psychosis. *Child and Adolescent Psychiatric Clinics of North America, 22*(4), 629-641.

Ehlers, A., & Clark, D. M. (2000). A cognitive model of posttraumatic stress disorder. *Behaviour Research and Therapy, 38*(4), 319-345.

Elklit, A., & Shevlin, M. (2010). Female sexual victimization predicts psychosis: a case-control study based on the Danish Registry System. *Schizophrenia Bulletin, 37*(6), 1305-1310.

Ellman, L. M., Yolken, R. H., Buka, S. L., Torrey, E. F., & Cannon, T. D. (2009). Cognitive functioning prior to the onset of psychosis: the role of fetal exposure to serologically determined influenza infection. *Biological Psychiatry, 65*(12), 1040-1047.

Erickson, L. D., Hedges, D. W., Call, V. R., & Bair, B. (2013). Prevalence of and Factors Associated With Subclinical Posttraumatic Stress Symptoms and PTSD in Urban and Rural Areas of Montana: A Cross-Sectional Study. *The Journal of Rural Health, 29*(4), 403-412.

Fisher, H., Morgan, C., Dazzan, P., Craig, T. K., Morgan, K., Hutchinson, G., ... & Fearon, P. (2009). Gender differences in the association between childhood abuse and psychosis. *The British Journal of Psychiatry, 194*(4), 319-325.

Fisher, H. L., Jones, P. B., Fearon, P., Craig, T. K., Dazzan, P., Morgan, K., ... & Morgan, C. (2010). The varying impact of type, timing and frequency of exposure to childhood adversity on its association with adult psychotic disorder. *Psychological Medicine, 40*(12), 1967-1978.

Fisher, H. L., Craig, T. K., Fearon, P., Morgan, K., Dazzan, P., Lappin, J., ... & Morgan, C. (2009). Reliability and comparability of psychosis patients' retrospective reports of childhood abuse. *Schizophrenia Bulletin, 37*(3), 546-553.

Fisher, H. L., Appiah-Kusi, E., & Grant, C. (2012). Anxiety and negative self-schemas mediate the association between childhood maltreatment and paranoia. *Psychiatry Research, 196*(2), 323-324.

Fisher, H. L., Schreier, A., Zammit, S., Maughan, B., Munafò, M. R., Lewis, G., & Wolke, D. (2013). Pathways between childhood victimization and psychosis-like

symptoms in the ALSPAC birth cohort. *Schizophrenia Bulletin*, *39*(5), 1045-1055.

Fisher, H. L., McGuffin, P., Boydell, J., Fearon, P., Craig, T. K., Dazzan, P., ... & Morgan, C. (2014a). Interplay between childhood physical abuse and familial risk in the onset of psychotic disorders. *Schizophrenia Bulletin*, *40*(6), 1443-1451.

Fisher, J. E., Miller, G. A., Sass, S. M., Silton, R. L., Edgar, J. C., Stewart, J. L., ... & Heller, W. (2014b). Neural correlates of suspiciousness and interactions with anxiety during emotional and neutral word processing. *Frontiers in Psychology*, *5*, 1-14.

Freeman, D., Garety, P. A., & Phillips, M. L. (2000). An examination of hypervigilance for external threat in individuals with generalized anxiety disorder and individuals with persecutory delusions using visual scan paths. *The Quarterly Journal of Experimental Psychology: Section A*, *53*(2), 549-567.

Fowler, D., Freeman, D., Smith, B., Kuipers, E., Bebbington, P., Bashforth, H., ... & Garety, P. (2006). The Brief Core Schema Scales (BCSS): psychometric properties and associations with paranoia and grandiosity in non-clinical and psychosis samples. *Psychological Medicine*, *36*(06), 749-759.

Fowler, D., Hodgekins, J., Garety, P., Freeman, D., Kuipers, E., Dunn, G., ... & Bebbington, P. E. (2011). Negative cognition, depressed mood, and paranoia: a longitudinal pathway analysis using structural equation modeling. *Schizophrenia Bulletin*, *38*(5), 1063-1073.

Freeman, D., & Fowler, D. (2009). Routes to psychotic symptoms: trauma, anxiety and psychosis-like experiences. *Psychiatry Research*, *169*(2), 107-112.

Frenkel, E., Kugelmass, S., Nathan, M., & Ingraham, L. J. (1995). Locus of control and mental health in adolescence and adulthood. *Schizophrenia Bulletin*, *21*(2), 219-226.

Friedman, S., Smith, L., Fogel, D., Paradis, C., Viswanathan, R., Ackerman, R., & Trappler, B. (2002). The incidence and influence of early traumatic life events in patients with panic disorder: a comparison with other psychiatric outpatients. *Journal of Anxiety Disorders*, *16*(3), 259-272.

Fusar-Poli, P., Yung, A. R., McGorry, P., & van Os, J. (2014). Lessons learned from the psychosis high-risk state: towards a general staging model of prodromal intervention. *Psychological Medicine*, *44*(01), 17-24.

Galletly, C., Van Hooff, M., & McFarlane, A. (2011). Psychotic symptoms in young adults exposed to childhood trauma—A 20 year follow-up study. *Schizophrenia Research*, *127*(1), 76-82.

Garety, P. A., Kuipers, E., Fowler, D., Freeman, D., & Bebbington, P. E. (2001). A cognitive model of the positive symptoms of psychosis. *Psychological Medicine*, *31*(02), 189-195.

Gayer-Anderson, C., Fisher, H.L., Fearon, P., Hutchinson, G., Morgan, K., Dazzan, P., …Morgan, C. (2015). Gender differences in the association between childhood physical and sexual abuse, social support and psychosis. *Social Psychiatry and Psychiatric Epidemiology*, doi: 10.1007/s00127-015-1058-6.

Gearon, J. S., Kaltman, S. I., Brown, C., & Bellack, A. S. (2003). Traumatic life events and PTSD among women with substance use disorders and schizophrenia. *Psychiatric Services, 54,* 523-528.

Gibson, L. E., Anglin, D. M., Klugman, J. T., Reeves, L. E., Fineberg, A. M., Maxwell, S. D., ... & Ellman, L. M. (2014). Stress sensitivity mediates the relationship between traumatic life events and attenuated positive psychotic symptoms differentially by gender in a college population sample. *Journal of Psychiatric Research*, *53,* 111-118.

Glaser, J. P., van Os, J., Portegijs, P. J., & Myin-Germeys, I. (2006). Childhood trauma and emotional reactivity to daily life stress in adult frequent attenders of general practitioners. *Journal of Psychosomatic Research*, *61*(2), 229-236.

Gray, M. J., Litz, B. T., Hsu, J. L., & Lombardo, T. W. (2004). Psychometric properties of the life events checklist. *Assessment*, *11*(4), 330-341.

Green, J. G., McLaughlin, K. A., Berglund, P. A., Gruber, M. J., Sampson, N. A., Zaslavsky, A. M., & Kessler, R. C. (2010). Childhood adversities and adult psychiatric disorders in the national comorbidity survey replication I: associations with first onset of DSM-IV disorders. *Archives of General Psychiatry*, *67*(2), 113-123.

Goel, N., Workman, J. L., Lee, T. T., Innala, L., & Viau, V. (2014). Sex differences in the HPA axis. *Comprehensive Physiology, 4,* 1121-1155.

Gracie, A., Freeman, D., Green, S., Garety, P. A., Kuipers, E., Hardy, A., ... & Fowler, D. (2007). The association between traumatic experience, paranoia and hallucinations: a test of the predictions of psychological models. *Acta Psychiatrica Scandinavica*, *116*(4), 280-289.

Hanssen, M., Peeters, F., Krabbendam, L., Radstake, S., Verdoux, H., & van Os, J. (2003). How psychotic are individuals with non-psychotic disorders? *Social Psychiatry and Psychiatric Epidemiology*, *38*(3), 149-154.

Hardt, J., & Rutter, M. (2004). Validity of adult retrospective reports of adverse childhood experiences: review of the evidence. *Journal of Child Psychology and Psychiatry, 45*(2), 260-273.

Harley, M., Kelleher, I., Clarke, M., Lynch, F., Arseneault, L., Connor, D., ... & Cannon, M. (2010). Cannabis use and childhood trauma interact additively to increase the risk of psychotic symptoms in adolescence. *Psychological Medicine, 40*(10), 1627-1634.

Hassan, A. N., & De Luca, V. (2015). The effect of lifetime adversities on resistance to antipsychotic treatment in schizophrenia patients. *Schizophrenia Research, 161*(2-3), 496-500.

Hayes, A. F. (2013). Introduction to mediation, moderation, and conditional process analysis: A regression-based approach. Guilford Press.

Heim, C., Nater, U. M., Maloney, E., Boneva, R., Jones, J. F., & Reeves, W. C. (2009). Childhood trauma and risk for chronic fatigue syndrome: association with neuroendocrine dysfunction. *Archives of General Psychiatry, 66*(1), 72-80.

Heim, C., & Binder, E. B. (2012). Current research trends in early life stress and depression: Review of human studies on sensitive periods, gene–environment interactions, and epigenetics. *Experimental Neurology, 233*(1), 102-111.

Heins, M., Simons, C., Lataster, T., Pfeifer, S., Versmissen, D., Lardinois, M., ... & Myin-Germeys, I. (2011). Childhood trauma and psychosis: a case-control and case-sibling comparison across different levels of genetic liability, psychopathology, and type of trauma. *American Journal of Psychiatry, 168*(12), 1286-1294.

Hewitt, P. L., Flett, G. L., & Mosher, S. W. (1992). The Perceived Stress Scale: Factor structure and relation to depression symptoms in a psychiatric sample. *Journal of Psychopathology and Behavioral Assessment, 14*(3), 247-257.

Holtzman, C. W., Trotman, H. D., Goulding, S. M., Ryan, A. T., Macdonald, A. N., Shapiro, D. I., ... & Walker, E. F. (2013). Stress and neurodevelopmental processes in the emergence of psychosis. *Neuroscience, 249*, 172-191.

Horan, W. P., Brown, S. A., & Blanchard, J. J. (2007). Social anhedonia and schizotypy: the contribution of individual differences in affective traits, stress, and coping. *Psychiatry Research, 149*(1), 147-156.

Houston, J. E., Murphy, J., Adamson, G., Stringer, M., & Shevlin, M. (2008). Childhood sexual abuse, early cannabis use, and psychosis: testing an interaction model based on the National Comorbidity Survey. *Schizophrenia Bulletin, 34*(3), 580-585.

Hovens, J. G. F. M., Giltay, E. J., Wiersma, J. E., Spinhoven, P., Penninx, B. W. J. H., & Zitman, F. G. (2012). Impact of childhood life events and trauma on the course of depressive and anxiety disorders. *Acta Psychiatrica Scandinavica, 126*(3), 198-207.

Howes, O. D., & Murray, R. M. (2014). Schizophrenia: an integrated sociodevelopmental-cognitive model. *The Lancet, 383*(9929), 1677-1687.

Hutcheson, C., Fleming, M. P., & Martin, C. R. (2014). An examination and appreciation of the dimensions of locus of control in psychosis: issues and relationships between constructs and measurement. *Journal of Psychiatric and Mental Health Nursing*, *21*(10), 906-916.

Janssen, I., Krabbendam, L., Bak, M., Hanssen, M., Vollebergh, W., Graaf, R. D., & Os, J. V. (2004). Childhood abuse as a risk factor for psychotic experiences. *Acta Psychiatrica Scandinavica*, *109*(1), 38-45.

Kaney, S., & Bentall, R. P. (1989). Persecutory delusions and attributional style. *British Journal of Medical Psychology*, *62*(2), 191-198.

Kapur, S. (2003). Psychosis as a state of aberrant salience: a framework linking biology, phenomenology, and pharmacology in schizophrenia. *American Journal of Psychiatry*, *160*(1), 13-23.

Karstoft, K. I., Armour, C., Elklit, A., & Solomon, Z. (2015). The role of locus of control and coping style in predicting longitudinal PTSD-trajectories after combat exposure. *Journal of Anxiety Disorders*, *32*, 89-94.

Kaymaz, N., Drukker, M., Lieb, R., Wittchen, H. U., Werbeloff, N., Weiser, M., ... & van Os, J. (2012). Do subthreshold psychotic experiences predict clinical outcomes in unselected non-help-seeking population-based samples? A systematic review and meta-analysis, enriched with new results. *Psychological Medicine*, *42*(11), 2239-2253.

Kelleher, I., Harley, M., Lynch, F., Arseneault, L., Fitzpatrick, C., & Cannon, M. (2008). Associations between childhood trauma, bullying and psychotic symptoms among a school-based adolescent sample. *The British Journal of Psychiatry*, *193*(5), 378-382.

Kelleher, I., Murtagh, A., Molloy, C., Roddy, S., Clarke, M. C., Harley, M., & Cannon, M. (2012). Identification and characterization of prodromal risk syndromes in young adolescents in the community: a population-based clinical interview study. *Schizophrenia Bulletin, 38*(2), 239-246.

Kelleher, I., Keeley, H., Corcoran, P., Ramsay, H., Wasserman, C., Carli, V., ... & Cannon, M. (2013). Childhood trauma and psychosis in a prospective cohort study: cause, effect, and directionality. *American Journal of Psychiatry*, *170*(7), 730-741.

Kessler, R. C., Davis, C. G., & Kendler, K. S. (1997). Childhood adversity and adult psychiatric disorder in the US National Comorbidity Survey. *Psychological Medicine*, *27*(05), 1101-1119.

Klewchuk, E. M., McCusker, C. G., Mulholland, C., & Shannon, C. (2007). Cognitive biases for trauma stimuli in people with schizophrenia. *British Journal of Clinical Psychology*, *46*(3), 333-345.

Kinderman, P., Prince, S., Waller, G., & Peters, E. (2003). Self-discrepancies, attentional bias and persecutory delusions. *British Journal of Clinical Psychology*, *42*(1), 1-12.

Kline, E., Wilson, C., Ereshefsky, S., Denenny, D., Thompson, E., Pitts, S. C., ... & Schiffman, J. (2012). Psychosis risk screening in youth: a validation study of three self-report measures of attenuated psychosis symptoms. *Schizophrenia Research*, *141*(1), 72-77.

Konings, M., Stefanis, N., Kuepper, R., De Graaf, R., Have, M. T., van Os, J., ... & Henquet, C. (2012). Replication in two independent population-based samples that childhood maltreatment and cannabis use synergistically impact on psychosis risk. *Psychological Medicine*, *42*(01), 149-159.

Kraan, T., Velthorst, E., Smit, F., de Haan, L., & van der Gaag, M. (2015). Trauma and recent life events in individuals at ultra high risk for psychosis: Review and meta-analysis. *Schizophrenia Research, 160,* 143-149.

Kramer, I., Simons, C. J., Wigman, J. T., Collip, D., Jacobs, N., Derom, C., ... & Wichers, M. (2014). Time-lagged moment-to-moment interplay between negative affect and paranoia: new insights in the affective pathway to psychosis. *Schizophrenia Bulletin*, *40*(2), 278-286.

Lange, R. V., & Tiggemann, M. (1981). Dimensionality and reliability of the Rotter IE locus of control scale. *Journal of Personality Assessment*, *45*(4), 398-406.

Lardinois, M., Lataster, T., Mengelers, R., van Os, J., & Myin-Germeys, I. (2011). Childhood trauma and increased stress sensitivity in psychosis. *Acta Psychiatrica Scandinavica*, *123*(1), 28-35.

Larsson, S., Andreassen, O. A., Aas, M., Røssberg, J. I., Mork, E., Steen, N. E., ... & Lorentzen, S. (2013). High prevalence of childhood trauma in patients with

schizophrenia spectrum and affective disorder. *Comprehensive Psychiatry*, *54*(2), 123-127.

Lataster, T., Wichers, M., Jacobs, N., Mengelers, R., Derom, C., Thiery, E., ... & Myin-Germeys, I. (2009). Does reactivity to stress cosegregate with subclinical psychosis? A general population twin study. *Acta Psychiatrica Scandinavica*, *119*(1), 45-53.

Lataster, J., Myin-Germeys, I., Lieb, R., Wittchen, H. U., & van Os, J. (2012). Adversity and psychosis: a 10-year prospective study investigating synergism between early and recent adversity in psychosis. *Acta Psychiatrica Scandinavica*, *125*(5), 388-399.

Levine, E., Jonas, H., & Serper, M. R. (2004). Interpersonal attributional biases in hallucinatory-prone individuals. *Schizophrenia Research*, *69*(1), 23-28.

Linscott, R. J., & van Os, J. (2010). Systematic reviews of categorical versus continuum models in psychosis: evidence for discontinuous subpopulations underlying a psychometric continuum. Implications for DSM-V, DSM-VI, and DSM-VII. *Annual Review of Clinical Psychology*, *6*, 391-419.

Liotti, G.,Gumley, A. (2008). An Attachment Perspective on Schizophrenia: The Role of Disorganized Attachment, Dissociation and Mentalization. In A. Moskowitz, I. Schäfer, & M.J. Dorahy (Eds.) *Psychosis, Trauma and Dissociation* (117-133). Chichester, UK: John Wiley & Sons, Ltd.

Lobbestael, J., Arntz, A., & Bernstein, D. P. (2010). Disentangling the relationship between different types of childhood maltreatment and personality disorders. *Journal of Personality Disorders*, *24*(3), 285-295.

Loewy, R. L., Bearden, C. E., Johnson, J. K., Raine, A., & Cannon, T. D. (2005). The prodromal questionnaire (PQ): preliminary validation of a self-report screening measure for prodromal and psychotic syndromes. *Schizophrenia Research*, *79*(1), 117-125.

Loewy, R. L., Johnson, J. K., & Cannon, T. D. (2007). Self-report of attenuated psychotic experiences in a college population. *Schizophrenia Research*, *93*(1), 144-151.

Mackie, C. J., Castellanos-Ryan, N., & Conrod, P. J. (2011). Developmental trajectories of psychotic-like experiences across adolescence: impact of victimization and substance use. *Psychological Medicine*, *41*(01), 47-58.

Marks, E. M., Steel, C., & Peters, E. R. (2012). Intrusions in trauma and psychosis: information processing and phenomenology. *Psychological Medicine*, *42*(11), 2313-2323.

Matheson, S. L., Shepherd, A. M., Pinchbeck, R. M., Laurens, K. R., & Carr, V. J. (2012). Childhood adversity in schizophrenia: a systematic meta-analysis. *Psychological Medicine, 43*(02), 225-238.

McCarthy-Jones, S., Green, M. J., Scott, R. J., Tooney, P. A., Cairns, M. J., Wu, J. Q., ... & Carr, V. (2014). Preliminary evidence of an interaction between the FOXP2 gene and childhood emotional abuse predicting likelihood of auditory verbal hallucinations in schizophrenia. *Journal of Psychiatric Research, 50*, 66-72.

McGowan, P. O., Sasaki, A., D'Alessio, A. C., Dymov, S., Labonté, B., Szyf, M., ... & Meaney, M. J. (2009). Epigenetic regulation of the glucocorticoid receptor in human brain associates with childhood abuse. *Nature Neuroscience, 12*(3), 342-348.

McLaughlin, K. A., Green, J. G., Gruber, M. J., Sampson, N. A., Zaslavsky, A. M., & Kessler, R. C. (2010). Childhood adversities and adult psychiatric disorders in the national comorbidity survey replication II: associations with persistence of DSM-IV disorders. *Archives of General Psychiatry, 67*(2), 124-132.

McNally, R. J., Kaspi, S. P., Riemann, B. C., & Zeitlin, S. B. (1990). Selective processing of threat cues in posttraumatic stress disorder. *Journal of Abnormal Psychology, 99*(4), 398.

Miller, T. J., McGlashan, T. H., Rosen, J. L., Somjee, L., Markovich, P. J., Stein, K., & Woods, S. W. (2002). Prospective diagnosis of the initial prodrome for schizophrenia based on the Structured Interview for Prodromal Syndromes: preliminary evidence of interrater reliability and predictive validity. *American Journal of Psychiatry, 159*(5), 863-865.

Mondelli, V., Dazzan, P., Hepgul, N., Di Forti, M., Aas, M., D'Albenzio, A., ... & Pariante, C. M. (2010). Abnormal cortisol levels during the day and cortisol awakening response in first-episode psychosis: the role of stress and of antipsychotic treatment. *Schizophrenia Research, 116*(2), 234-242.

Mondelli, V., Cattaneo, A., Di Forti, M., Handley, R., Hepgul, N., Miorelli, A., ... & Pariante, C. M. (2011). Stress and inflammation reduce brain-derived neurotrophic factor expression in first-episode psychosis: a pathway to smaller hippocampal volume. *The Journal of Clinical Psychiatry, 72*(12), 1677-1684.

Morrison, A. P., Frame, L., & Larkin, W. (2003). Relationships between trauma and psychosis: a review and integration. *British Journal of Clinical Psychology, 42*(4), 331-353.

Moskowitz, A., & Corstens, D. (2008). Auditory hallucinations: Psychotic symptom or dissociative experience? *Journal of Psychological Trauma, 6*(2-3), 35-63.

Myin-Germeys, I., van Os, J., Schwartz, J. E., Stone, A. A., & Delespaul, P. A. (2001). Emotional reactivity to daily life stress in psychosis. *Archives of General Psychiatry, 58*(12), 1137-1144.

Myin-Germeys, I., Krabbendam, L., Delespaul, P. A. E. G., & van Os, J. (2004). Sex differences in emotional reactivity to daily life stress in psychosis. *Journal of Clinical Psychiatry, 65*, 805-809.

Neria, Y., Bromet, E. J., Sievers, S., Lavelle, J., & Fochtmann, L. J. (2002). Trauma exposure and posttraumatic stress disorder in psychosis: findings from a first-admission cohort. *Journal of Consulting and Clinical Psychology, 70*(1), 246.

Nieman, D. H., Ruhrmann, S., Dragt, S., Soen, F., van Tricht, M. J., Koelman, J. H., ... & de Haan, L. (2014). Psychosis prediction: stratification of risk estimation with information-processing and premorbid functioning variables. *Schizophrenia Bulletin*, *40*(6), 1482-1490.

Niendam, T. A., Bearden, C. E., Rosso, I. M., Sanchez, L. E., Hadley, T., Nuechterlein, K. H., & Cannon, T. D. (2003). A prospective study of childhood neurocognitive functioning in schizophrenic patients and their siblings. *American Journal of Psychiatry, 160*(11), 2060-2062.

Ogawa, J. R., Sroufe, L., Weinfield, N. S., Carlson, E. A., & Egeland, B. (1997). Development and the fragmented self: Longitudinal study of dissociative symptomatology in a nonclinical sample. *Development and Psychopathology*, *9*(04), 855-879.

O'Hare, T., Shen, C., & Sherrer, M. (2013). Differences in trauma and posttraumatic stress symptoms in clients with schizophrenia spectrum and major mood disorders. *Psychiatry Research*, *205*(1), 85-89.

O'Farrell, T. J., Fals-Stewart, W., & Murphy, M. (2003). Concurrent validity of a brief self-report drug use frequency measure. *Addictive Behaviors 28*(2), 327-337.

Palmier-Claus, J. E., Dunn, G., & Lewis, S. W. (2012). Emotional and symptomatic reactivity to stress in individuals at ultra-high risk of developing psychosis. *Psychological Medicine*, *42*(05), 1003-1012.

Pec, O., Bob, P., & Raboch, J. (2014). Dissociation in schizophrenia and borderline personality disorder. *Neuropsychiatric Disease and Treatment, 10*, 487-491.

Peerbooms, O., Rutten, B. P. F., Collip, D., Lardinois, M., Lataster, T., Thewissen, V., ... & van Winkel, R. (2012). Evidence that interactive effects of COMT and MTHFR moderate psychotic response to environmental stress. *Acta Psychiatrica Scandinavica*, *125*(3), 247-256.

Perona-Garcelán, S., Carrascoso-López, F., García-Montes, J. M., Ductor-Recuerda, M. J., López Jiménez, A. M., Vallina-Fernández, O., ... & Gómez-Gómez, M. T. (2012). Dissociative experiences as mediators between childhood trauma and auditory hallucinations. *Journal of Traumatic Stress*, *25*(3), 323-329.

Pruessner, J. C., Champagne, F., Meaney, M. J., & Dagher, A. (2004). Dopamine release in response to a psychological stress in humans and its relationship to early life maternal care: a positron emission tomography study using [11C] raclopride. *The Journal of Neuroscience, 24(*11), 2825-2831.

Radhakrishnan, R., Wilkinson, S. T., & D'Souza, D. C. (2014). Gone to pot–a review of the association between cannabis and psychosis. *Frontiers in Psychiatry, 5*, doi: 10.3389/fpsyt.2014.00054.

Radloff, L. S. (1977). The CES-D scale a self-report depression scale for research in the general population. *Applied Psychological Measurement, 1*(3), 385-401.

Raune, D., Kuipers, E., & Bebbington, P. (2009). Stressful and intrusive life events preceding first episode psychosis. *Epidemiologia e Psichiatria Sociale, 18*(03), 221-228.

Read, J., Agar, K., Argyle, N., & Aderhold, V. (2003). Sexual and physical abuse during childhood and adulthood as predictors of hallucinations, delusions and thought disorder. *Psychology and Psychotherapy: Theory, Research and Practice, 76*(1), 1-22.

Read, J., van Os, J. V., Morrison, A. P., & Ross, C. A. (2005). Childhood trauma, psychosis and schizophrenia: a literature review with theoretical and clinical implications. *Acta Psychiatrica Scandinavica*, *112*(5), 330-350.

Reeves, L. E., Anglin, D. M., Heimberg, R. G., Gibson, L. E., Fineberg, A. M., Maxwell, S. D., ... & Ellman, L. M. (2014). Anxiety mediates the association between cannabis use and attenuated positive psychotic symptoms. *Psychiatry Research, 218*(1), 180-186.

Roberts, A. L., Gilman, S. E., Breslau, J., Breslau, N., & Koenen, K. C. (2011). Race/ethnic differences in exposure to traumatic events, development of post-traumatic stress disorder, and treatment-seeking for post-traumatic stress disorder in the United States. *Psychological Medicine, 41*(1), 71–83.

Roiser, J. P., Howes, O. D., Chaddock, C. A., Joyce, E. M., & McGuire, P. (2013). Neural and behavioral correlates of aberrant salience in individuals at risk for psychosis. *Schizophrenia Bulletin, 39*(6), 1328-1336.

Rosenbaum, M., & Hadari, D. (1985). Personal efficacy, external locus of control, and perceived contingency of parental reinforcement among depressed, paranoid, and normal subjects. *Journal of Personality and Social Psychology, 49*(2), 539-547.

Rotter, J. B. (1966). Generalized expectancies for internal versus external control of reinforcement. *Psychological Monographs: General and Applied, 80*(1), 1-28.

Rubino, I. A., Nanni, R. C., Pozzi, D. M., & Siracusano, A. (2009). Early adverse experiences in schizophrenia and unipolar depression. *The Journal of Nervous and Mental Disease, 197*(1), 65-68.

Ruby, E., Polito, S., McMahon, K., Gorovitz, M., Corcoran, C., & Malaspina, D. (2014). Pathways Associating Childhood Trauma to the Neurobiology of Schizophrenia. *Frontiers in Psychological and Behavioral Science, 3*(1), 1-17.

Santiago, P. N., Ursano, R. J., Gray, C. L., Pynoos, R. S., Spiegel, D., Lewis-Fernandez, R., ... & Fullerton, C. S. (2013). A systematic review of PTSD prevalence and trajectories in DSM-5 defined trauma exposed populations: intentional and non-intentional traumatic events. *PloS One, 8*(4), e59236.

Schenkel, L. S., Spaulding, W. D., DiLillo, D., & Silverstein, S. M. (2005). Histories of childhood maltreatment in schizophrenia: relationships with premorbid functioning, symptomatology, and cognitive deficits. *Schizophrenia Research, 76*(2), 273-286.

Schlosser, D. A., Pearson, R., Perez, V. B., & Loewy, R. L. (2012). Environmental risk and protective factors and their influence on the emergence of psychosis. *Adolescent Psychiatry, 2*(2), 163-171.

Schneider, W., Eschman, A., & Zuccolotto, A. (2012). E-Prime User's Guide. Pittsburgh: Psychology Software Tools, Inc.

Schreier, A., Wolke, D., Thomas, K., Horwood, J., Hollis, C., Gunnell, D., ... & Harrison, G. (2009). Prospective study of peer victimization in childhood and psychotic symptoms in a nonclinical population at age 12 years. *Archives of General Psychiatry, 66*(5), 527-536.

Schroeder, K., Fisher, H. L., & Schäfer, I. (2013). Psychotic symptoms in patients with borderline personality disorder: prevalence and clinical management. *Current Opinion in Psychiatry, 26*(1), 113-119.

Schroeder, K., Langeland, W., Fisher, H. L., Huber, C. G., & Schäfer, I. (2016). Dissociation in patients with schizophrenia spectrum disorders: What is the role of different types of childhood adversity? *Comprehensive Psychiatry, 68*, 201-208.

Schäfer, I., Fisher, H. L., Aderhold, V., Huber, B., Hoffmann-Langer, L., Golks, D., ... & Harfst, T. (2012). Dissociative symptoms in patients with schizophrenia: relationships with childhood trauma and psychotic symptoms. *Comprehensive Psychiatry*, *53*(4), 364-371.

Schürhoff, F., Laguerre, A., Fisher, H., Etain, B., Méary, A., Soussy, C., ... & Leboyer, M. (2009). Self-reported childhood trauma correlates with schizotypal measures in schizophrenia but not bipolar pedigrees. *Psychological Medicine*, *39*(03), 365-370.

Scott, K. M., McLaughlin, K. A., Smith, D. A., & Ellis, P. M. (2012). Childhood maltreatment and DSM-IV adult mental disorders: comparison of prospective and retrospective findings. *The British Journal of Psychiatry*, *200*(6), 469-475.

Shea, A., Walsh, C., MacMillan, H., & Steiner, M. (2005). Child maltreatment and HPA axis dysregulation: relationship to major depressive disorder and post traumatic stress disorder in females. *Psychoneuroendocrinology*, *30*(2), 162-178.

Sherrer, M. V. (2011). The role of cognitive appraisal in adaptation to traumatic stress in adults with serious mental illness: A critical review. *Trauma, Violence, & Abuse*, *12*(3), 151-167.

Shevlin, M., Dorahy, M. J., & Adamson, G. (2007). Trauma and psychosis: an analysis of the National Comorbidity Survey. *The American Journal of Psychiatry*, *164*(1), 166-169.

Shevlin, M., Houston, J. E., Dorahy, M. J., & Adamson, G. (2008). Cumulative traumas and psychosis: an analysis of the national comorbidity survey and the British Psychiatric Morbidity Survey. *Schizophrenia Bulletin*, *34*(1), 193-199.

Shevlin, M., Murphy, J., & Read, J. (2015). Testing complex hypotheses using secondary data analysis: is the association between sexual abuse and psychosis moderated by gender in a large prison sample?. *Journal of Criminal Psychology*, *5*(2).

Sideli, L., Mule, A., La Barbera, D., & Murray, R. M. (2012). Do child abuse and maltreatment increase risk of schizophrenia? *Psychiatry Investigation*, *9*(2), 87-99.

Simons, C. J. P., Wichers, M., Derom, C., Thiery, E., Myin-Germeys, I., Krabbendam, L., & van Os, J. (2009). Subtle gene–environment interactions driving paranoia in daily life. *Genes, Brain and Behavior*, *8*(1), 5-12.

Soosay, I., Silove, D., Bateman-Steel, C., Steel, Z., Bebbington, P., Jones, P. B., ... & Marnane, C. (2012). Trauma exposure, PTSD and psychotic-like symptoms in post-conflict Timor Leste: an epidemiological survey. *BMC Psychiatry*, *12*(1), 229.

Spauwen, J., Krabbendam, L., Lieb, R., Wittchen, H. U., & van Os, J. (2006). Impact of psychological trauma on the development of psychotic symptoms: relationship with psychosis proneness. *The British Journal of Psychiatry, 188*(6), 527-533.

Spence, W., Mulholland, C., Lynch, G., McHugh, S., Dempster, M., & Shannon, C. (2006). Rates of childhood trauma in a sample of patients with schizophrenia as compared with a sample of patients with non-psychotic psychiatric diagnoses. *Journal of Trauma & Dissociation, 7*(3), 7-22.

Spielberger, C.D., Gorsuch, R.L., Lushene, R., Vagg, P.R., & Jacobs, G.A. (1983). Manual for the State-Trait Anxiety Inventory. Consulting Psychologists Press, Palo Alto, CA.

Stain, H. J., Brønnick, K., Hegelstad, W. T., Joa, I., Johannessen, J. O., Langeveld, J., ... & Larsen, T. K. (2014). Impact of interpersonal trauma on the social functioning of adults with first-episode psychosis. *Schizophrenia Bulletin, 40*(6), 1491-1498.

Stein, D. J., Koenen, K. C., Friedman, M. J., Hill, E., McLaughlin, K. A., Petukhova, M., ... & Kessler, R. C. (2013). Dissociation in posttraumatic stress disorder: evidence from the world mental health surveys. *Biological Psychiatry, 73*(4), 302-312.

Stefanis, N. C., Henquet, C., Avramopoulos, D., Smyrnis, N., Evdokimidis, I., Myin-Germeys, I., ... & van Os, J. (2007). COMT Val158Met moderation of stress-induced psychosis. *Psychological Medicine, 37*(11), 1651-1656.

Stowkowy, J., Liu, L., Cadenhead, K. S., Cannon, T. D., Cornblatt, B. A., McGlashan, T. H., ... & Woods, S. W. (2016). Core schemas in youth at clinical high risk for psychosis. *Behavioural and Cognitive Psychotherapy, 44*(02), 203-213.

Stroop, J. R. (1935). Studies of interference in serial verbal reactions. *Journal of Experimental Psychology, 18*(6), 643-662.

Susser, E., & Widom, C. S. (2012). Still searching for lost truths about the bitter sorrows of childhood. *Schizophrenia Bulletin, 38*(4), 672-675.

Thompson, J. L., Kelly, M., Kimhy, D., Harkavy-Friedman, J. M., Khan, S., Messinger, J. W., ... & Corcoran, C. (2009). Childhood trauma and prodromal symptoms among individuals at clinical high risk for psychosis. *Schizophrenia Research, 108*(1-3), 176-181.

Thompson, A., Nelson, B., McNab, C., Simmons, M., Leicester, S., McGorry, P. D., ... & Yung, A. R. (2010). Psychotic symptoms with sexual content in the "ultra high risk" for psychosis population: frequency and association with sexual trauma. *Psychiatry Research, 177*(1), 84-91.

Thompson, A., Sullivan, S., Lewis, G., Zammit, S., Heron, J., Horwood, J., ... & Harrison, G. (2011). Association between locus of control in childhood and psychotic symptoms in early adolescence: results from a large birth cohort. *Cognitive Neuropsychiatry*, *16*(5), 385-402.

Thompson, A., Papas, A., Bartholomeusz, C., Nelson, B., & Yung, A. (2013). Externalized attributional bias in the Ultra High Risk (UHR) for psychosis population. *Psychiatry Research*, *206*(2), 200-205.

Thompson, A. D., Nelson, B., Yuen, H. P., Lin, A., Amminger, G. P., McGorry, P. D., ... & Yung, A. R. (2014). Sexual trauma increases the risk of developing psychosis in an ultra high-risk "prodromal" population. *Schizophrenia Bulletin*, *40*(3), 697-706.

Trauelsen, A. M., Bendall, S., Jansen, J. E., Nielsen, H. G. L., Pedersen, M. B., Trier, C. H., ... & Simonsen, E. (2015). Childhood adversity specificity and dose-response effect in non-affective first-episode psychosis. *Schizophrenia Research*, *165*(1), 52-59.

Trotman, H. D., Holtzman, C. W., Walker, E. F., Addington, J. M., Bearden, C. E., Cadenhead, K. S., ... & McGlashan, T. H. (2014). Stress exposure and sensitivity in the clinical high-risk syndrome: Initial findings from the North American Prodrome Longitudinal Study (NAPLS). *Schizophrenia Research*, *160*(1), 104-109.

Tschoeke, S., Steinert, T., Flammer, E., & Uhlmann, C. (2014). Similarities and Differences in Borderline Personality Disorder and Schizophrenia With Voice Hearing. *The Journal of Nervous and Mental Disease*, *202*(7), 544-549.

van Dam, D. S., Van Der Ven, E., Velthorst, E., Selten, J. P., Morgan, C., & De Haan, L. (2012). Childhood bullying and the association with psychosis in non-clinical and clinical samples: a review and meta-analysis. *Psychological Medicine*, *42*(12), 2463-2474.

van Dam, D. S., van Nierop, M., Viechtbauer, W., Velthorst, E., van Winkel, R., Bruggeman, R., ... & Wiersma, D. (2014a). Childhood abuse and neglect in relation to the presence and persistence of psychotic and depressive symptomatology. *Psychological Medicine*, *45*(7), 1363-1377.

van Dam, D. S., Korver-Nieberg, N., Velthorst, E., Meijer, C. J., & de Haan, L. (2014b). Childhood maltreatment, adult attachment and psychotic symptomatology: a study in patients, siblings and controls. *Social Psychiatry and Psychiatric Epidemiology*, *49*(11), 1759-1767.

Van der Hart, O., Nijenhuis, E., & Steele, K. (2006). The haunted self: Structural dissociation and the treatment of chronic traumatization. New York: Norton.

van Hooff, J. C., Devue, C., Vieweg, P. E., & Theeuwes, J. (2013). Disgust-and not fear-evoking images hold our attention. *Acta Psychologica, 143*(1), 1-6.

van Nierop, M., Lataster, T., Smeets, F., Gunther, N., van Zelst, C., de Graaf, R., ... & van Winkel, R. (2014a). Psychopathological mechanisms linking childhood traumatic experiences to risk of psychotic symptoms: analysis of a large, representative population-based sample. *Schizophrenia Bulletin, 40* (Suppl 2), S123-S130.

van Nierop, M., Viechtbauer, W., Gunther, N., van Zelst, C., de Graaf, R., Ten Have, M., ... & van Winkel, R. (2014b). Childhood trauma is associated with a specific admixture of affective, anxiety, and psychosis symptoms cutting across traditional diagnostic boundaries. *Psychological Medicine, 45*(6), 1277-1288.

van Os, J., & Kapur, S. (2009). Schizophrenia. *The Lancet, 374*, 635-645.

van Os, J., Linscott, R. J., Myin-Germeys, I., Delespaul, P., & Krabbendam, L. (2009). A systematic review and meta-analysis of the psychosis continuum: evidence for a psychosis proneness–persistence–impairment model of psychotic disorder. *Psychological Medicine, 39*(02), 179-195.

van Os, J., & Linscott, R. J. (2012). Introduction: the extended psychosis phenotype—relationship with schizophrenia and with ultrahigh risk status for psychosis. *Schizophrenia Bulletin, 38*(2), 227-230.

van Winkel, R., van Nierop, M., Myin-Germeys, I., & van Os, J. (2013). Childhood trauma as a cause of psychosis: linking genes, psychology, and biology. *Canadian Journal of Psychiatry*, *58*(1), 44-51.

Varese, F., Smeets, F., Drukker, M., Lieverse, R., Lataster, T., Viechtbauer, W., ... & Bentall, R. P. (2012a). Childhood adversities increase the risk of psychosis: a meta-analysis of patient-control, prospective-and cross-sectional cohort studies. *Schizophrenia Bulletin*, *38*(4), 661-671.

Varese, F., Barkus, E., & Bentall, R. P. (2012b). Dissociation mediates the relationship between childhood trauma and hallucination-proneness. *Psychological Medicine, 42*(05), 1025-1036.

Vauth, R., & Nyberg, E. (2007). Untreated PTSD in schizophrenia-unrecognized risk factor for recovery and course of illness? *Fortschritte der Neurologie-Psychiatrie*, *75*(8), 463-472.

Velikonja, T., Fisher, H. L., Mason, O., & Johnson, S. (2014). Childhood trauma and schizotypy: a systematic literature review. *Psychological Medicine, 45*(5), 947-963.

Velthorst, E., Nelson, B., O'Connor, K., Mossaheb, N., de Haan, L., Bruxner, A., ... & Thompson, A. (2013). History of trauma and the association with baseline symptoms in an Ultra-High Risk for psychosis cohort. *Psychiatry Research*, *210*(1), 75-81.

Wand, G. S., Oswald, L. M., McCaul, M. E., Wong, D. F., Johnson, E., Zhou, Y., ... & Kumar, A. (2007). Association of amphetamine-induced striatal dopamine release and cortisol responses to psychological stress. *Neuropsychopharmacology*, *32*(11), 2310-2320.

Weathers, F. W., & Keane, T. M. (2007). The criterion A problem revisited: Controversies and challenges in defining and measuring psychological trauma. *Journal of Traumatic Stress*, *20*(2), 107-121.

Whitfield, C. L., Dube, S. R., Felitti, V. J., & Anda, R. F. (2005). Adverse childhood experiences and hallucinations. *Child Abuse & Neglect*, *29*(7), 797-810.

Wiffen, B. D., O'Connor, J. A., Russo, M., Falcone, M. A., Joseph, C., Kolliakou, A., ... & David, A. S. (2013). Do psychosis patients with poor insight show implicit awareness on the emotional stroop task? *Psychopathology*, *47*(2), 93-100.

Williams, J. M. G., Mathews, A., & MacLeod, C. (1996). The emotional Stroop task and psychopathology. *Psychological Bulletin*, *120*(1), 3-24.

Wingenfeld, K., Riedesel, K., Petrovic, Z., Philippsen, C., Meyer, B., Rose, M., ... & Spitzer, C. (2011). Impact of childhood trauma, alexithymia, dissociation, and emotion suppression on emotional Stroop task. *Journal of Psychosomatic Research*, *70*(1), 53-58.

Wittekind, C. E., Jelinek, L., Kellner, M., Moritz, S., & Muhtz, C. (2010). Intergenerational transmission of biased information processing in posttraumatic stress disorder (PTSD) following displacement after World War II. *Journal of Anxiety Disorders*, *24*(8), 953-957.

Witthöft, M., Borgmann, E., White, A., & Dyer, A. (2015). Body-related attentional biases in patients with posttraumatic stress disorder resulting from childhood sexual abuse with and without co-occurring borderline personality disorder. *Journal of Behavior Therapy and Experimental Psychiatry*, *46*, 72-77.

Yaffe, B., & Walder, D. J. (2016). Schizotypy and specificity of negative emotions on an emotional Stroop paradigm in the general population. *Psychiatry Research*, *239*, 291-300.

Young, J. E., Klosko, J. S. and Weishaar, M. E. (2003). Schema Therapy: a practitioner's guide. New York: Guilford Press.

Zerega, W. D., Tseng, M. S., & Greever, K. B. (1976). Stability and concurrent validity of the Rotter internal-external locus of control scale. *Educational and Psychological Measurement, 36*(2), 473-475.