



## DOCTORAL THESIS

### **Specific, Cumulative, and Co-Occurring Social Adversities: Pathways to Psychotic-like Experiences across a Dimensional Psychosis Phenotype Spectrum.**

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Specific, Cumulative, and Co-Occurring Social  
Adversities:  
Pathways to Psychotic-like Experiences  
across a Dimensional Psychosis Phenotype  
Spectrum.

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**I confirm that the word count of this thesis is less than 100,000 words excluding the title page, contents, acknowledgements, abstract, tables, figures, appendices and references**

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### **Summary**

Measurement models assessing psychotic-like experiences across a dimensional psychosis phenotype spectrum should include distress if experiences are said to lie on a continuum of normality within the general population. Distress should be a component with psychotic experiences if it is this feature that is associated with transition across pathways to more severe psychotic experiences. The current thesis revealed a 3-factor model (positive, negative and disorganised dimensions) best fitted the data sample (NESARC Wave 2, N=34,653). Moreover, distress associated with frequency of experiences produced an equivalent 3-factor model fit to one without distress.

Previous research has provided circumstantial evidence that childhood abuse is linked to psychotic experiences in both clinical and healthy populations. Prior to the onset of psychotic experiences, individuals tend to have encountered one if not several stressful or adverse events. As such, the current research tested three specific pathway models to further assess such links. A multivariate regression model, person-centered model, and a multivariate regression mediation model explored specific adversities, cumulative adversities, co-occurring histories of trauma and adversities, loneliness and their pathways to three PLE dimension

Findings suggest cumulative adversities rather than singular traumatic events increased the influence of psychotic experiences across all three dimensions of PLE's. Specific adversities, co-occurring adversities, and social withdrawal are involved in the pathway to psychotic-like experiences in a general population sample. Also, individuals with histories of high-risk traumas are more likely to experience increased PLE's in a dose-response pattern. Furthermore, loneliness partially and fully mediates specific adversity pathways to PLE's. The current findings demonstrate the dimensionality of psychotic experiences in a large general population sample, and directions for future research models to incorporate both categorical and dimensional perspectives.

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# **Chapter 1:**

## **Theoretical Introduction**

### **And Research Aims**

#### **Section 1**

##### **1.1 Introduction to Chapter 1**

The overall aim of the present chapter is to review theory, and specific empirical research to date on social explanations into the aetiology of the psychosis phenotype. The present chapter will have two sections; in brief, the first section will provide theory on specific literature and associated empirical research on the theoretical underpinnings. Additionally, on the development and statistical approaches that have aided in research to explain pathways from social adversities along the psychosis phenotype using a broader dimensional approach. Next, section 2, will provide a brief overview of the research aims pertaining to each chapter, following with and the rationale behind the current thesis.

Section 1 will provide a brief overview of historical roots of categorical medical models to the movement in the last few decades to dimensional models, specifically addressing the aetiology of psychosis. Next, a description and empirical evidence of the psychosis phenotype will be discussed leading to an outline of methods used to assess the underlying structure of the psychosis phenotype and broader models of the psychosis phenotype. Following this, there will be an overview on various mechanisms involved in the pathways linking childhood trauma, social defeating experiences, multiple adversities and psychotic-like experiences, and their link to specific adversities will also be addressed. The issues of loneliness as a mediator, and its link to the emergence of variations in experiences across the psychosis phenotype

will be addressed. In conclusion, this introductory chapter will outline the main objectives of each chapter pertaining to the present thesis.

## **1.2 The Movement from Categorical to Dimensional Psychosis Phenotypes**

Research has moved on since Kraepelin (1919) originally hypothesised that schizophrenia fell under an umbrella term used for mental illness known as ‘dementia praecox’ analogous to a terminal dementia illness. Bleuler (1911/1950) first devised the word ‘schizophrenia’ arguing traits common in those with schizophrenia were present long before diagnosis. Next, Rado (1953) introduced the term ‘schizotype’ to describe healthy individuals who displayed symptoms like those seen in individuals with schizophrenia but without a clinical diagnosis. Later, Meehl (1962) described the term ‘schizotypy’ proposing a ‘taxon’ model suggesting certain traits comparable to schizophrenia were evident in the general population. Originally, Meehl conceptualised schizotypy as dichotomous, suggesting an “all or nothing approach” proposing that behaviours were displayed by a unique group of individuals’, with a defect in their genes (Meehl, 1990). However, Lenzenweger, added modifications to Meehls concept proposing schizotypy may involve a mixture of various genes (Lenzenweger, 2010).

In contrast, Claridge’s model, which is a fully dimensional perspective, suggested these schizotypal personality traits as normal personality dimensions (Claridge at al., 1996). Claridges’ alternative model of schizotypy postulates that instead of schizotypy being quasi-dimensional, it is normally distributed in healthy populations, perhaps because of a mixture of genes, society, and personality. For example, psychotic-like symptoms are often evaluated using measures of schizotypal personality traits in the general population, as these traits have been found to

distributed along a continuum of severity from healthy to those reaching clinical manifestation (Shevlin, Murphy, Dorahy, & Adamson, 2007; van Os, Linscott, Myin-Germeys, Delespaul & Krabbendam, 2009), whereby psychotic symptoms displayed by individuals with clinically defined psychosis are extreme versions of everyday behaviour carried out by the normal population (Claridge & Beech, 1995). However, researchers continue to dispute the link between schizotypy and clinically defined psychosis (Tarbox & Pogue-Gele, 2011), emphasising important factors uncovered by research; such as symptoms and their associated distress that determines such transitions (van Os et al., 2009).

Several authors (Bentall, 2003; Bentall et al., 2014; Bentall, 2009; Read, Bentall, & Fosse, 2009; Read, 2013) have suggested the heterogenous 'concept' of schizophrenia should be obliterated, due to poor classification and unmerited evidence of 'specific' causes such as genetics. The authors highlight the lack of consideration medical models have for the adverse effects histories of trauma have on individuals experiencing such phenomenon. Traditional taxonomies of disorders create an array of classification issues through categorising disorders that exist on a dimensional spectrum, thus leading to improper diagnosis and impeding on treatment (Kotov et al., 2011; Kotov et al., 2017). Also, disorders are heterogeneous, and the nature of symptoms are also heterogeneous, therefore creating difficulty in terms of correct classification, leading to improper diagnosis. As such, endeavouring to move away from medical models that primarily focused on genetics, contemporary models of the psychosis phenotype are continuously highlighting social explanations, such as trauma, chronic/toxic stress in childhood, and a diversity of social adversities to explain the emergence of psychotic experiences in both clinical and non-clinical

populations (Bentall, 2005; Bentall, Wickham, Shevlin, & Varese, 2012; Shevlin et al., 2007; Catalan et al., 2017; Garner & Shonkoff, 2012; Shonkoff & Garner, 2012).

### **1.2.1 The Psychosis Phenotype- Dimensionality**

Proponents of the phenomenological continuity of the psychosis phenotype suggest that a dimension of measurable psychotic symptoms/experiences exist in the general population along a continuum of symptom severity, with healthy individuals reporting psychotic-like experiences along a hypothetical spectrum of dimensionality to clinical manifestation (Murphy, McBride, Fried & Shevlin, 2017; Linscott & van Os, 2010; van Os et al., 2009; Rössler et al., 2011). Robust evidence for a dimensional psychosis phenotype has been provided in a meta-analysis by Linscott & van Os (2013), with findings suggesting one-fifth of individuals who experience psychotic like experiences have persistent symptoms while approximately 7% risk developing psychotic disorders. Therefore, a large proportion of individuals who report such experiences may never transit to a clinical psychotic disorder. Noteworthy, psychotic experiences are predominately fleeting and attenuated manifestations of psychosis observable in healthy populations with 1 in 10 individuals displaying such symptoms, without need for treatment, further justifying evidence for dimensional models (Linscott & van Os, 2013; Shevlin, Dorahy, Adamson, 2007; Bentall, 2014).

The dimensional psychosis phenotype covers a range of phenomena with interchangeable terms often used to describe an array of similar experiences in the general population. For example, terms such as psychotic-like experiences (PLE's), sub-clinical psychotic experiences (PE's), schizotypy, schizotypal-like experiences each refer to different points along a bell-shaped hypothetical continuum. However, it has been suggested using interchangeable terms complicates the interpretation of



literature leading to inconsistent findings (Lee et al., 2016). Attempting to argue for better consistency, the authors compiled a systematic review on studies (N=76) using interchangeable terms. Overall, 41 measurements were used across the studies signalling the large proportion of measurements, however none with a precise measure of PLE's in the general population. Almost 70% of the research studies used PLE's quantitatively, a large proportion used schizotypal measures to assess psychotic-like experiences in healthy populations successfully. Therefore, although schizotypal measurements are trait based, they fundamentally capture psychotic-like experiences, which as unstable and symptom based. To date, there is no precise 'operational' measurement model assigned to PLE's in the general population (Fonseca-Pedrero et al., 2017), and schizotypal traits are valid indicators for measuring symptoms across the psychosis phenotype. The use of taxometric models of schizotypy, using analogous dimensional methods are being used to assess psychotic experiences across larger healthy populations to test the dimensional psychosis phenotype. For example, Raine's (1991) 'The Schizotypal Personality Questionnaire' (SPQ) was initially based on categorical representation. It has been revised (SPQ-Brief Revised Updated; Davidson, Hoffman, & Spaulding, 2016) and used to assess the underlying nature of the dimensional psychosis phenotype (van Os & Reininghaus, 2016). Furthermore, quite recently, Murphy et al. (2017) successfully used made use of 16 schizotypal personality disorder items from the AUDADIS-IV as an analogue for measuring PLE's in assessing dimensional and broader models of the psychosis phenotype. Thus, the phenomena will be referred to as 'psychotic-like experiences' (PLE's) over the course of the present thesis will also use the AUDADIS-IV as an analogue for PLE's in a large population data set. As such, using different terms for similar experiences

across the psychosis phenotype seems reasonable until an operational measurement for PLE's is put in place.

### **1.2.2 A Psychosis Phenotype Spectrum: Merging Categorical & Dimensional Approaches**

The vast epidemiological evidence of the existence of a psychosis phenotype spectrum of dimensionality has brought about a movement in psychosis research with suggestions to obsolete the emphasis of categorical 'medical models' approach to psychopathology (Bentall et al., 2014; Bentall, 2014; Read et al., 2009). However, notwithstanding evidence supporting the dimensional nature of psychotic phenomena, the debate continues; primarily concerning whether the psychosis phenotype applies to individuals with a genetic pre-disposition to schizophrenia (quasi-dimensional) or whether it applies to the population (Claridge & Davies, 2013). As such, literature and empirical evidence involving a paradigm combining dimensional and categorical perspectives are gaining interest (Ahmed, Buckley & Mabe, 2012). Such attempts are evident in the latest edition (version 5) of The Diagnostic and Statistical Manual of Mental Disorders (DSM-V), with a brief mention of dimensionality, however, this adaption is restricted to the appendix of the manual (Goldberg, 2014). Considering this, several researchers (van Os, Reininghaus & Meyer-Lindenberg., 2016; Bentall et al., 2014) suggest further justification for combining categorical and dimensional models due to the complexity of the psychosis phenotype and difficulty investigating the various mechanisms for several reasons. The authors suggest overemphasis in the literature on clinical manifestation of psychosis when it is only representing the severe end of the psychosis continuum. Also, the high comorbidity between disorders and symptoms verifies the lack of specification of the classification of measurements and

diagnostic regimes in psychopathology research and psychiatric medicine. For example, methods outlined in most recent Diagnostic Statistics Manual (DSM-V) suggest two individuals with a diagnosis of schizophrenia can display completely different symptoms, in several different ways (Read, 2013). As such, using this as an example of such complexities in how individuals are still psychiatrically assessed reflects the difficulties in how disorders have been classified. Hence, incorrect or uncertain diagnosis because of the complex nature of the high comorbidity between different disorders and symptoms (Bentall et al., 2014). Such complexities in diagnosing disorders has led to complications in the appropriate treatments necessary for individuals based on their specific needs. For example, anti-psychotic treatments with often debilitating side-effects when other less severe treatments could suffice at helping individuals to cope or alleviate symptoms (Read, 2013).

Considering this, and acknowledging medical models, such as the genetic and biological processes that explain psychosis and expanding on social explanations that have led to progression to contest strict categorical explanations of psychosis in recent year requires further attention. What is more, a move towards more person-centered and stringent means of diagnostic and measurement tools in both non-clinical and clinical populations across a dimensional psychosis spectrum. Therefore, adaptations to categorical models to improve classification of disorders and symptoms to increase reliability and validity of diagnosis and measures of psychotic experiences in both clinical and non-clinical populations. Such attempts through the provision of guidelines into updated nosology research for researchers to explore new hypothesis are evident. For example, a new approach referred to as 'HiTOP' (Hierarchical Taxonomy of Psychopathology) has been developed by Kotov et al. (2017) detailing

shortcomings in present diagnostic research. Additionally, issues in how disorders are classified, future directions, and proposed hypothesis for researchers to begin rigorously testing.

Essentially, providing more detailed and rigorous assessment is applied to new and upcoming research, aiding development of protocols for improved treatments for those with psychotic disorders, and the prevention and intervention in those displaying symptoms at stages along dimensional psychosis spectrum (Bentall, 2014).

### **1.2.3 Global/Broader Models of Psychopathology**

Global models of psychopathology suggest using more complex psychometric methodologies improves validity through identifying specific components underlying disorder, due to the high comorbidity between diagnoses. As such, this has led to ongoing advancements such as the application of alternative models to assess the underlying structure of symptoms. Research suggest that using more complex psychometric methodologies increases the reliability and validity through identifying specific components underlying the nature of different disorders and symptoms (Kotov et al., 2011).

Factor analysis is the most commonly used method to classify such systems through identifying higher order dimensions through exploration of comorbidity among disorders. As such, factor analysis has emerged with dimensions of psychopathology. For example, one type focused on factor analysis of covariation between diagnosis, unveiling 3 factors (internalising, externalising and psychosis) (Krueger, 1999). Initial assessments uncovered the first two factors, with additional empirical research extending to include a third psychosis factor (Kotov et al., 2011). The ‘internalisation’ dimension is characterised by negative emotions such as anxiety

and depression, OCD, eating disorders and sexual dysfunction, and their comorbidity. The 'externalisation' dimension is characterised by substance abuse, ADHD, conduct disorder, anti-social, and the comorbidity between them. The third factor, a 'thought' spectrum is characterised by a psychotic element, and bipolar (I) and cluster 'A' personality disorders (Krueger & Markon, 2006; Kotov et al., 2011).

Further exploration using bi-factor modelling to consider possible important distinctions between disorders, whereby internalising was found to compartmentalise into fear and distress sub-dimensions (Krueger, 1999; Krueger, Markon, Patrick, Benning, & Kramer, 2007). Also, the authors demonstrated that the internalising spectrum bi-factored into two emotion factors (fear and distress) representative of manifestations for internalising disorders. The fear component represents features related to phobias and anxiety sensitivity, including disorders characterised by phobias, generalised anxiety disorders and OCD. The distress component represents features related to disorders characterised by tendencies to experience psychological distress such as PTSD, and generalised anxiety disorders.

The 'externalisation' spectrum was demonstrated to model into a bi-factor with all variables measured on the general externalising factor and specific sub-types loaded onto two factors, 'callous aggression' and 'substance misuse'. The callous aggression factor was found to be characterised by relational aggression and lack of empathy. The second factor was characterised by substance abuse and related issues. The general factor characterised by impulsiveness lack of control and taking lack of responsibility (Krueger et al., 2007).

The extended third spectrum, the psychosis dimension was initiated by Kotov and colleagues (2011) using a sample (N=628) of new inpatients with psychosis

assessed longitudinally over 10 years. In applying CFA to the final sample (N=469), the authors uncovered three clusters/groups including a specific psychosis spectrum. Furthermore, extending on this research, Kotov et al. (2011b) replicated their previous study using an outpatient clinical sample (N=2900) analysed across 25 disorders. Again, they found three spectra emerged; internalisation, externalization and a psychosis dimension.

Analysis of patterns of comorbidity among symptoms are used to classify disorders through identifying the underlying structure. Statistical methods classifying the underlying structure of systems used to measure PLE's in the general population have primarily used factor analysis, and confirmatory factory analysis. However, another type of classification reaching popularity to assess the existence of a general factor of psychopathology is bi-factor modelling whereby one general factor drives a certain degree of commonality among variables thus permitting the direct testing of specific dimension (Gignac, 2016; Reininghaus, Priebe, Bentall, 2013).

Using the NESARC-Wave 2 (34,653), authors (Shevlin, McElroy, Bentall, Reininghaus & Murphy, 2016) tested several competing factor models including bi-factor modelling in a large general population sample, as opposed to clinical samples therefore extending on previous clinical model to include the dimensionality. They found the bi-factor model comprised of a general psychosis factor and five specific factors (positive, negative, disorganised, mania and depression) produced the best fit suggesting a transdiagnostic psychosis dimension underlies the nature of disorders.

#### **1.2.4 The Structure of PLE's on a Dimensional Psychosis Phenotype.**

Notwithstanding epidemiological evidence there are issues pertaining to the underlying structure of the psychosis phenotype and more recent broader dimensional

psychosis phenotypes. The difficulty in classifying complex systems involves interpreting structures to distinguish covariation between different experiences and whether they lie on a spectrum ranging from healthy to severe depending on how symptoms interfere with functioning, coping mechanisms or need for clinical care. Therefore, it is necessary for more reliable and valid instruments to assess the dimensional psychosis phenotype (Mason, 2015). As such, the need for rigorous statistical assessments towards more novel measurements to better classify disorders and their symptoms across the dimensional psychosis phenotype spectrum (Shevlin et al., 2016).

Factor analysis has produced defined structures of symptoms/experiences that are highly correlated and have repeatedly produced models with 3 higher order (negative, positive and disorganised) or 4 distinct factors of psychotic experiences (cognitive-perceptual, paranoid, negative and disorganised) in both clinical and non-clinical population (Raine et al., 1994, Stefanis et al., 2004; Davidson et al., 2016). Raine and colleagues (1994) model has been replicated with other researchers supporting a 3-factor model (Claridge et al., 1996; Lin et al., 2013), while others support a 4-factor model. For example, recently, Barron, Swami, Towell, Hutchinson and Morgan (2015) examined the factor structure of the SPQ using two samples from the general population (N=635). The first sample comprised of a British white London sample (N=351, and a second African-Caribbean sub-sample (N=284). They found a 4-factor structure best fit the data. Furthermore, predictive and criterion validity for a 3-factor structure has been established through research (Raine et al., 1994; Compton et al., 2009; Cohen et al., 2010; Fonseca-Pedrero et al., 2011; Davidson et al., 2016). Additionally, cross culturally the factor structure of measurement models remains

stable. For example, Fonseca-Pedrero et al. (2017) collated data (N=27,000) from 12 countries, across 21 locations to assess the underlying nature of psychotic experiences cross culturally using CFA. Their findings revealed three and four factor models best fitted the data at a sub-scale level, cross culturally.

### **1.3 Broader Models of the Dimensional Psychosis Phenotype-Distress of Experiences on a Spectrum of Severity?**

The main characteristic differences that have consistently emerged between those with a clinical diagnosis and healthy individuals experiencing such symptoms are; how often symptoms occur, the level of intrusiveness and the associated distress, if any, caused by symptoms (American Psychiatric Association, 2013). Distress is more often associated with experiences closer to the severe end of the psychotic spectrum in comparison to sub-clinical experiences which tend to be less distressing and less likely to interfere with quality of life, without need for treatment (Murphy et al., 2017). Therefore, if sub-clinical PLE's lie on a hypothetical continuum with psychotic symptoms, the structure incorporating associated distress into frequency of sub-clinical experiences should also reflect that of individuals with a clinical disorder (Shevlin, Boyda, Houston & Murphy, 2015; Shevlin et al., 2017). Incorporating distress in statistical measurement models assessing the underlying structure should uncover whether dimensionality across the data is reflective of one that does not incorporate distress, therefore expanding on evidence of a broader dimensional psychosis phenotype and if distress is linked to severity of experiences in healthy populations.

This hypothesis postulates a broader dimensional psychosis phenotype of the underlying nature of crossing thresholds from healthy to severe psychotic experiences.



For example, Murphy et al. (2017) using the NESARC, wave 2 data set uncovered a network of dimensional psychosis phenotype severity by assessing experiences on a continuum and whether severity of PE's involved frequency without distress and secondly, frequency with distress. They found experiencing paranoia to be central in the interplay between psychotic experiences in the large general population sample. In addition, to test the hypothesis further, the researchers split the data into two sets to assess if including PE's devoid of distress would match a network with distressing experiences; one assessing 'no PE versus PE with or without associated distress' and a second network model assessing versus 'no PE or non-distressing PE' versus 'PE with or without associated distress'. They found similarities between both networks, however, the network incorporating distress showed increased connections between the PE's in the network.

#### **1.4 Social Explanations for the Psychosis Phenotype**

Evidence of a link between childhood traumatic events, adversities and the dimensional psychosis phenotype is clear. However, to date, there is no precise mechanism into the aetiology of psychotic-like experiences (Bentall, 2014). However, biological and genetic perspectives once predominately mainstay and superior in psychopathology, advancements towards potential pathways using a combination of explanations to uncover mechanisms that lead to psychotic experiences is progressing. Moreover, the precise mechanisms to how and why such symptoms emerge, and thus the best way forward for diagnosis and treatment. It is mainstay in research with some advocates of social, biological, and genetic hypothesis, encapsulating views on specific approaches. However, research has begun testing potential pathways using a combination of approaches in explaining possible mechanism underlying the

development of psychotic experiences. For example, several models of psychosis, the dopamine hypothesis (DA), the traumagenic neurodevelopmental (TN) model (Read, 2001), the social defeat (SD) hypothesis of schizophrenia (Selten & Cantor-Graae, 2005), cognitive models of psychosis, the social deafferentation hypothesis (Hoffman, 2007; 2008), and socio-cognitive model of loneliness (Cacioppo & Hawkley, 2009) are among a myriad of models attempting to seek the best explanations of the aetiology of psychosis.

#### **1.4.1 The Dopamine Hypothesis**

From a biological perspective, the most established psychosis hypothesis initially proposed the disorder was due to hyperactivity in DA transmission recognised initially from medical discovery that antipsychotics worked to treat psychopathologies such as psychosis by blocking dopamine receptors in the brain. Thus, the Dopamine (DA) hypothesis of psychosis can be partially explained by changes in dopamine function in the brain. Positive symptoms of psychosis can arise because of too much dopamine activity.

Empirical evidence testing the theory behind the ‘dopamine hypothesis’ has surged in recent years in trauma and psychosis research. The hypothesis initially stemmed from the realization that medications used to treat psychopathologies such as psychosis worked by blocking dopamine receptors in the brain. Since then, it is becoming paramount in psychosis research that experiencing trauma may lead to deficits in brain structures and neurological systems and thus, ultimately play havoc with the hypothalamic-pituitary-adrenal axis (HPA axis), a protagonist for normal stress response (Read et al., 2014). Furthermore, this chronic repeated stress may

subsequently lead to symptoms of psychosis. This dysregulation of the hypothalamic pituitary adrenal axis (HPA axis) may cause elevated densities in dopamine receptors and thus dopamine release much like that found in psychotic individuals (Walker & Diforio, 1997). In addition, social defeat in humans also leads to dopamine dysregulation and sensitisation of the mesolimbic dopamine system (Collip, Myin-Germeys, & van Os, 2008).

#### **1.4.2 The Traumagenic Neurodevelopmental Model**

The traumagenic neurodevelopmental (TN) model (Read, 2001) incorporates both psychological and biological components to pin-point anomalies present in the brains of children subjected to traumas such as sexual abuse and/or neglect, and subsequently similar brain deficits in those with a clinical diagnosis of schizophrenia. Read (2001) developed the model proposing a more robust explanation than the previous diathesis-stress model suggesting the DS model focused disproportionately on genetics to explain stress hypersensitivity due to stressful environments. The TN model suggests that experiencing traumatic events causes elevated stress sensitivity leading to hyperactivity of the HPA axis, thus creating disturbances in levels of dopamine and serotonin transmission. Read (2001; 2014) suggests such brain changes evident in certain individuals may be due to traumatic events. Read (2001; 2014) provided an extensive update on empirical evidence in support of the TN model. As such, in testimony of the model, since its postulation over 13 years ago, approximately 125 publications have directly or indirectly supported the integrity of its mechanisms.

In one such study, directly supporting the TN model, authors, Lataster, Myin-Germeys, Lieb, Wittchen and van Os (2012) used data a general population sample (N=3021). The sample was taken from the Early Developmental Stages of

Psychopathology Study (EDSP) assessed longitudinally over 3 years. The authors found a relationship between experiencing early adversities linked to experiencing recent adversities. They found heightened risk of psychotic disorder in those with traumatic histories and elevated stress sensitivity to recent adversities, thus providing evidence for the synergistic effects of cumulative adversities on psychosis.

### **1.4.3 Cognitive Models of Psychosis**

Cognitive models of psychosis suggest the mechanisms underlying PLE's may be due to cognitive processes playing an important role in their maintenance (Freeman, 2007; Peters et al., 2017). Maher (1974) first postulated delusional thought as an abnormal perceptual process. Correspondingly, it is not necessarily the symptom or experience that leads to severity that warrants clinical intervention but the individual's appraisal and whether it causes them distress (Peters et al., 2017; Brett, Heriot-Maitland, McGuire & Peters, 2014; Garety, Bebbington, Fowler, Freeman & Kuipers, 2007). Also, it has been suggested the main difference between individuals in clinical populations experiencing symptoms depends on the level of distress associated with the symptom (Stip & Letourneau, 2009). For example, several studies have shown that distress caused by frequency of psychotic-like experiences increases the shift towards psychosis (Krabbendam & van Os, 2005). Furthermore, authors (Peters et al., 1999; 2004; 2016) emphasise distress caused by delusions distinguishes healthy and clinical outcomes in individuals experiencing symptoms. Thus, they suggest that not only does the actual delusion appear on this continuity of normality, but the level of distress it causes, preoccupation with the experience and conviction that it is held.

Furthermore, in relation to cognitive models of psychotic experiences, the focus is on the mechanisms that potentially lead an individual who has previously been threatened to inaccurately have a distorted view of their environment. For example, chronic exposure or repeated threats and personal intrusion may lead the individual to mistrust, suspect and over analyse situations by zooming in on the adverse experience and applying this to future social interactions (Peters et al., 2017; Garety et al., 2001). Furthermore, it has been established that intrinsic perception of traumatic experiences is indicative of the risk for psychosis (Bak et al. 2005; Bentall et al., 2007) possibly through elevated reactions to future stress indicative of sensitization (Lardinois, Lataster, Mengelers, van Os & Myin-Germeys, 2011).

#### **1.4.4 The Social Defeat Hypothesis**

The Social Defeat (SD) hypothesis postulated by Selten and Colleagues encapsulates links between social adversities and psychotic disorder; suggesting a commonality between the environment and psychosis due to consequences of constant social defeat. Furthermore, per the SD hypothesis, feelings of subordination in society can dysregulate brain neurotransmitters related to behaviour and cognition. The social defeat (SD) hypothesis of schizophrenia (Selten & Cantor-Graae, 2005) proposed to uncover further mechanisms that may lead to psychotic experiences in individuals who have suffered from childhood traumatic experiences. Moreover, social defeat studies have established using animal model's evidence of sensitization of the mesolimbic dopaminergic system resulting in elevated levels of dopamine in the cortex (Tidey & Miczek, 1997). Furthermore, some researchers have suggested social defeat to be linked to psychotic experiences via changing patterns in dopamine levels in humans (Selten, van Os & Cantor Graae, 2016; Collip et al., 2008).

Animal studies have been predominately applied to the mechanisms of social defeating experiences involved in psychopathologies in humans. However, it is imperative research ensues caution when comparing animal studies to that of humans. This finding is evident in the resident-intruder paradigm. The task involved placement of an intruder rodent into the territory of a resident rodent until submissive behaviour was observed. To measure sensitization the task was repeated consecutively for several days. Findings showed chronic social defeat, via submissiveness induced in the intruder rodent (Björkqvist, 2001). In relation to humans, authors (Selten, van der Ven, Rutten, & Cantor-Graae, 2013) suggest that certain risk factors are involved in the pathway to psychotic experiences including urbanicity, migration, low educational attainment, cannabis use, and having experienced abuse in childhood. These factors influence ostracism from society, potentially leading to social isolation, and thus elevating the risk of psychosis.

#### **1.4.5 The Social Deafferentation Hypothesis**

Hoffman (2007; 2008) put forward the social deafferentation hypothesis; suggesting thoughts emanated during periods of isolation permits the brain to build a false picture of reality to make sense of pertaining issues. This model of psychosis purports that social isolation may be the primary factor that is central to the development of psychosis in individuals predisposed to psychosis. The hypothesis suggests social isolation can lead to processing of false information fill a gap in an overactive mind due to deprivation of information. Therefore, essentially the social deafferentation hypothesis postulates biases in the way the brain cognitively misinterprets stimuli in the absence of social interaction. Extending and in line with the original social deafferentation hypothesis, Murphy et al. (2013) using a sample

(N=8590) from the British Psychiatric Morbidity Survey explored whether social avoidance mediated the link between sex abuse and PLE's.

#### **1.4.6 Socio-Cognitive Models of Loneliness**

Cacioppo and Hawkley (2009) proposed a socio-cognitive model of loneliness characterised by threat sensitivity and decreased sensitivity to social reward. As such, this is related to the development and maintenance of loneliness. Some individuals choose solitude, therefore indicative of objective social isolation, whereas subjective loneliness involves certain levels of distress. Thus, building on the cognitive theory of loneliness, Hawkley and Cacioppo (2009) suggest a cyclic loneliness model. Moreover, the cycle begins with the development of cognitive disturbances due to elevated sensitivity as a response to loneliness due to decreased or no social interaction. As a result, the lonely individual ends up interpreting meaning from non-meaningful stimulus, which is referred to as aberrant salience (van Os, Kenis, & Rutten, 2010). However, other theorists (Hawkley & Cacioppo, 2009) postulate more dynamics are involved, suggesting an evolutionary approach; a mixture of biological, environmental and genes all play a role in loneliness or subjective isolation.

### **1.5 Pathways from Social Adversities to PLE**

#### **1.5.1 Childhood Trauma and Psychotic-like Experiences**

Several theories surround the aetiology of psychosis and sub-clinical psychotic experiences, with contemporary models striving towards social explanations, such as traumatic experiences in childhood, and social adversities (van Os, Reininghaus & Meyer-Lindenberg, 2017; Bentall et al., 2012; Shevlin et al., 2007, Linscott & van Os, 2013). Social explanations illustrated through on-going research findings have

repeatedly revealed that individuals across the psychosis phenotype displaying psychosis and/or sub-clinical or psychotic-like experiences have experienced adversities, such as childhood trauma. Such associations have also been found in the general population with findings that childhood trauma and adversities in adulthood are linked to increased psychotic-like experiences (Varese et al., 2012; Velikonja et al., 2014). Furthermore, this evidence has been illustrated in a meta-analysis (Varese et al., 2012) including individuals from both clinical and the general populations. The meta-analysis covering 41 studies comprised of cohort studies, cross-sectional and case-control studies. The overall findings inclusive of all studies revealed an increased likelihood risk to psychosis due to childhood adversity was found to be (OR=2.72 95% CL= 2.54-3.31), with a population risk of over 30%. The case control studies revealed the patient case group in comparison to the control group (N=2048, 1856, respectively) had nearly 3 times increased likelihood (OR= 2.72, 95% CL=1.90-3.88) of having a history of childhood abuse. Additionally, the general population studies revealed an increased risk for psychotic experiences of almost 3 times of in those with a history of early traumas (OR=2.99, 95% CL=2.12-4.20). Finally, the cohort studies revealed an odd ratio of 2.75 risk to psychosis.

Using a clinical sample, researchers, Matheson, Shepherd, Pinchbeck, Laurens and Carr (2013) provided a meta-analytic review of 25 studies using Medline, Embase and PsycINFO; with findings uncovering nearly 4 times increase in the rates of childhood trauma in contrast to controls with schizophrenia (OR 3.6, 95% CL 2.08-6.23). Recently, Reeder et al. (2017) on evaluating the relationship between trauma and psychosis using a clinical sample (N=296) from a UK Early Intervention Service found 60% reported experiencing a trauma in childhood, with 66% of this sample



reporting having experienced more than one trauma. Additionally, nearly 25% of the traumas were interpersonal. However, almost 20% of the patient sample had not been asked about their history of abuse, showing the need for proper evaluation in patient assessments.

Epidemiological evidence suggests demographic risk factors both common in individuals displaying sub-clinical experiences and individuals displaying psychosis at a clinical level, including but not limited to childhood trauma, substance misuse, single status, being part of a minority ethnic group, and lower educational attainment (Linscott & van Os, 2010; 2013). Furthermore, traumatic experiences have been found to be associated with psychotic-like experiences across the spectrum, from psychotic disorder in clinical populations to psychotic-like experiences in healthy populations (Gibson, Alloy & Ellman, 2016; Velikonja, Fisher, Mason & Johnson, 2014). For example, studies have found that growing up in a chaotic environment and experiencing adversity in early life is related to the emergence of psychotic-experiences later in childhood and early adolescence, with findings that interpersonal childhood traumatic experiences in comparison to other traumas have been found to be related to an increase in psychotic symptoms (Arseneault et al., 2011).

### **1.5.2 Social defeating Experiences and Psychotic-like Experiences**

Research has shown that psychotic-like experiences and psychosis are not limited to environmental adversities such as childhood trauma but also related to social defeat due to minority status in society (Pascoe & Smart-Richman, 2009; Cantor-Graae et al., 2005; Veling et al., 2006; Selten & Cantor-Graae, 2016). Social defeat may be defined as the negative feeling of subordination or exclusion due to

discrimination, following acceptance via acquiescence leading to feelings of being socially defeated (Selten & Cantor-Graae, 2005; Selten, van der Ven, Rutten, & Cantor-Graae, 2013).

Research has suggested those with same sex orientation preference were found to have between roughly 2.3 to 2.5 increase odds of risk to psychosis than heterosexual individuals (Gevonden, Selten, Myin-Germeys & De Graaf, 2013). Using two separate healthy population samples (NEMESIS-1, N=5927) and (NEMESIS-2, N=5308) the researchers found a significant association, with an increase in the level of lifetime multiple incidence of psychotic experience in individuals with a preference for same sex orientation (OR 2.56, 95% CL 1.71-3.84) and (OR 2.30, 95% CL 1.42-3.71) for the first and second sample, respectively. Furthermore, lesbians, gays and bisexuals who suffered several types of discrimination were 4 times more likely to abuse substances than those who did not suffer the same discrimination (Gevonden et al., 2013).

### **1.5.3 Demographic Risk Factors and Psychotic-like Experiences**

There are several demographic risk variables that have been found to increase the risk to psychosis, and psychotic-like experiences. As previously mentioned briefly, the psychosis phenotype involves risk factors common in individuals displaying psychotic experiences along the dimensional continuum (Linscott & van Os, 2010; 2013). For example, gender, cannabis use, being unemployed, of single status, ethnic minority groups, low educational attainment have been found to be related to increased risk to psychosis in those with a history of adversities in childhood, and those subjected to social defeat (Mojtabai, 2006; van Os et al., 2009; Selten & Cantor, 2005; 2007). In addition, research studies have inconsistently revealed that sub-

clinical PLE's are related to males and younger individuals, and lower educational attainment (Calkins et al., 2014; Rössler, Hengartner, Angst, & Ajdacic-Gross, 2012; Rössler, Ajdacic-Gross, Rodgers, Haker and Muller, 2016).

#### **1.5.4 Cumulative Adversities and PLE's**

Research suggests approximately one third of mental health disorders in adults may be a consequence of traumatic events experienced during childhood (Kessler et al., 2010). Research has established that multiple traumas in childhood increase negative psychological outcomes in comparison to one trauma (Finkelhor, Ormrod, & Turner, 2007; Finkelhor, Ormrod, & Turner, 2009; Longdon, Sampson & Read, 2016; Finkelhor, Turner, Hamby, & Ormrod, 2011). Relative to single traumas, a staggering prevalence rate of approximately 25% of individuals have been subjected to some form of sexual or physical abuse in childhood (Gilbert et al., 2009; Radford, Corral, Bradley & Fisher, 2013). However, to date prior research has mainly centred on one off traumatic events, a certain trauma, and the frequency a traumatic event (Evans, Li & Whipple, 2013).

Furthermore, in conjunction with childhood trauma, further adverse social experiences in adulthood have been found to elevate the risk of psychotic experiences. For example, in a meta-analytic review, using 14 studies over 5 five decades, between 1968 and 2012 to examine the link between traumatic life events and the development of psychosis and psychotic-like experiences, authors (Beards et al., 2013) reported an odds ratio OR of 3.19; 95% CL 2.15-4.75 between adversities and the development of psychosis. Therefore, findings suggest those with psychosis or PLE's were nearly 3 times more likely than controls to have re-experienced adversity.

### **1.5.5 Specific Adversities and Pathways to Psychotic-like Experiences**

Certain types of trauma have been found to be related to specific experiences (Scott, Smith, Ellis, 2010; Shevlin et al., 2007; van Dam et al., 2015; Arseneault et al., 2011; Wigman et al., 2012; Kelleher et al., 2013) with one recent study showing that all forms of childhood trauma were related to sub-clinical PLE's (Rössler et al., 2016). According to van Dam (2015) the stressful nature of interpersonal abuse may potentially change brain systems that increase stress response while neglect does not directly lead to stress response, thus resulting in different pathways to psychosis. The authors found increased exposure to childhood trauma to be related to increased severity of the symptoms experienced. Using a longitudinal sample as part of the Genetic Risk and Outcome of Psychosis Project, authors (van Dam et al., 2015) assessed psychotic patients (N=1119), their siblings (N=1057), and controls (N=589), on their histories of childhood trauma type and symptoms of psychotic disorder. The findings revealed a dose-response link between sub-clinical negative and positive psychosis experiences and childhood traumas (abuse and neglect). More specifically they found abuse to be related to more positive experiences than negative, and neglect to be equally related to positive and negative symptoms.

Recently, McGrath et al. (2017) performed a cross-national analysis using data from the WHO World Health Surveys (N=23, 998) to assess the link between traumas in childhood and psychotic-like experiences. The findings revealed increased odds of being just over two times more likely (OR=2.3) to experience psychotic-like experiences due to any one trauma. Different types of traumas vary in their likelihood, with sexual abuse showing the highest (OR=4, 95% CL 2.6-6.3), followed by nearly 3 times increased likelihood for physical abuse (OR=2.8%), and neglect (OR=2.2).

Furthermore, relative to specific traumas, the authors found sexual abuse to be related to early onset of symptoms in early, occurring before adolescence with increased odds of 8.5 times more likely (OR 8.5, 95% CL 3.6-20.2) and onset in later adulthood to be nearly three times more likely (OR). However, at a population level prevalence rates for the link between psychotic like experiences and trauma for the overall sample was just over 30%, with physical abuse specifically emerging with the highest rate at just over 8%.

### **1.6 Clusters of Similar Trauma Histories: A Person-Centered Approach**

Rather than focusing on variables to account for the relationship between adversities and pathways to psychopathologies, a person-centred approach rather than a variable centred approach allows the possibility of exploring histories of multiple traumatic events a person has been exposed to (Collin & Lanza, 2010). It is important to explore latent classes of co-occurring trauma histories to explore if they have a differential effect on psychopathology (Cutajar et al., 2010). Latent class analysis (LCA) is a statistical person-centred method that clusters groups of individuals into latent classes with the assumption that the association among indicators (traumatic events) are considered by a class/group variable, thus contrasting with variable centred statistical techniques. Also, LCA is probabilistic permitting the model to be replicated with an independent sample (Muthen, 2006; 2008; Muthen & Muthen, 2002).

Person-centered approaches such as LCA are increasingly being used to explore heterogeneity in trauma-based research. With an increasing demand to assess the complex processes that link individual trauma profiles to psychopathologies, this method is useful primarily for diagnosis and subsequent treatments relative to those with histories of abuse, such as trauma focused therapies. As such, in the last decade,

there has a surge in the application of LCA in research. For example, in the period between 2002 and 2013 as indicated by a PsychInfo search there was approximately 70% increase in LCA mentioned in publications (Wurpts & Geiser, 2014).

There has been an increased use of LCA to uncover traumatic life events, or histories of cumulative abuse and applying multivariate analysis to explore the assigned classes relationship to psychopathologies, and symptoms across the psychosis phenotype spectrum such as PLE's, and PTSD, using adult and adolescent samples (Berzenski & Yates, 2011; Shevlin, Murphy, Elklit, Murphy & Hyland, 2017; Berzenski & Yates, 2011; Houston et al., 2011; Shevlin et al, 2012; Shevlin & Elklit, 2008; Curran, Adamson, Stringer, Rosato, & Leavey, 2016).

For example, one such study used LCA to explore the heterogeneity of individuals with similar histories of co-occurring traumas, and the relationship between those groups of individuals. Using a sample from the National Comorbidity Survey (N=5877), authors, Houston et al. (2011) explored 10 trauma items including childhood abuse, and both interpersonal and non-interpersonal traumas in adulthood. They found a 4-class solution best fit the data. 3% of individuals were grouped into a high-risk trauma class, 21% into a high-risk non-interpersonal trauma group, and 14% were assigned to a 'high childhood neglect, non-interpersonal, rape and molestation' group and the remainder of the sample were assigned to a baseline group. Further analysis using multinomial regression of class assignment suggest exposure to co-occurring adversities increased risk for psychotic experiences in a dose response manner reflecting severity of trauma and increased risk.

### **1.7 Mechanisms involved in the process from Cumulative Traumas to PLE's: The Mediating Role of Loneliness**

Research in recent years has been putting emphasis in literature that loneliness is a serious psychological issue and one of the most prevalent psychological issues in society with approximately 20% of people in the United States suffering from this often-unnoticed adversity (Cacioppo & Patrick, 2008; Meltzer et al., 2013; Snell, 2017; Shankar, McMunn, Demakakos, Hamer & Steptoe, 2017). As such, it has been suggested, more than two-thirds of individuals with clinically defined psychosis have admitted to experiencing loneliness 'sometimes' or 'most of the time' (Badcock, 2015). Also, psychotic individuals are almost 6 times more likely to have a lifetime prevalence of loneliness in comparison to healthy controls (Meltzer et al, 2013). Moreover, research has shown that the development of psychosis may be encouraged if the individual is socially isolated before symptoms develop (Murphy, Shevlin, Adamson, Houston, 2013; Hoffman, 2008).

In search of social explanation into specific pathways to psychosis, research has been highlighting the adverse effects of social isolation (Sündermann, Onwumere, Kane, Morgan, & Kuipers, 2014), and the mediating role of subjective loneliness as a link between childhood trauma and psychosis (Shevlin, McElroy, & Murphy, 2015). For example, Shevlin et al. (2015) using a nationally representative sample of the UK population (N=13214). The authors found that childhood abuse and several psychopathologies were mediated by loneliness. Moreover, loneliness significantly predicted psychosis (OR=3.87, 95% CL 1.93-7.76) when used as a mediator between childhood abuse (sexual and physical) and psychosis.

## **Section 2 Research Rationale- Gaps in the Literature and How Each Chapter will Address each Gap**

### **1.8 The Current Thesis**

The focus of the current research is to assess trauma in childhood, social defeating circumstances, and links to psychotic-like experiences in the general population. In doing so, the present research endeavours to address the theoretical and methodological gaps in relation to childhood trauma and social defeating experiences, and whether these adversities cluster in groups of individuals in a large representative US sample. The present thesis will use the schizotypal personality measurement utilised in the NESARC wave 2 data set as an analogue to capture psychotic-like experiences in the general population. Subsequently, Chapter 2 aims to present an overview of the measurements and statistical techniques that will be used in the current thesis. The data used (N=34,653) in the present chapter was drawn from Wave 2 of the National Epidemiologic Survey on Alcohol and Related condition (NESARC). 16 items taken from Section 10 of the NESARC on Schizotypal Personality Disorder assessed were taken from the Alcohol Use Disorder and Associated Disabilities Interview Schedule (AUDADIS-IV) to determine psychiatric disorders, based on Diagnostic and Statistical Manual of Mental Disorders-Fourth Edition (DSM-IV). This measurement will be an analogue for assessing psychotic-like experiences in a large general population sample. The chapter will outline the design of the study, the recruitment procedure and data collection techniques that were used to in the secondary analysis of the NESARC wave 2. Ethical issues and methodological limitations will be discussed. Furthermore, a detailed description of the measures used and the psychometric properties of each will be provided. Following this, four empirical chapters will be conducted to achieve this aim, each



building on previous chapters. The concluding chapter will discuss the main findings, limitations, with suggestions as to how the findings may be applied to future research. Furthermore, each chapter will follow a sequential pattern to explore and empirically test the relationship between psychotic-like experiences and links to traumas in childhood and social defeating experiences.

### **1.9 How each Empirical Chapter Will Address Gaps in The Literature**

Chapters 3-6 will use different statistical modelling techniques to address gaps evident in literature to date. Firstly, chapter 3 will assess a broader model of the dimensional psychosis phenotype by objectively using confirmatory factor analysis to assess the underlying structure of psychotic-like experiences in a large general population data set. Unlike previous studies that have focused on measuring the frequency of psychotic experiences, the current thesis will focus on a more stringent measure; the cognitive appraisal of the actual experiences, notably whether it causes the person distress. Previous literature has overlooked this important feature, which is defined in clinical presentation or pre-clinical manifestation of psychosis. The present thesis will address this gap by including it in a confirmatory factor analysis using a general population sample.

This question will be addressed by using two separate models, of PLE items grouped into (1) 'frequency-only' and (2) incorporating 'distress' associated with 'frequency of experiences'. Moreover, the present study predicts that a 3-factor model structure will provide the best model fit and incorporating distress will mirror the first group, retaining stability, capturing a broader model of the 'dimensional psychosis phenotype'. Furthermore, chapter 3 will assess if gender will be invariant across the data.

Previous research has focused primarily on specific traumas in childhood and associated later psychopathology. Chapter 4 will address this gap in the literature by focusing on specific accumulative social adversities; childhood trauma and social defeating experiences. Specifically, the focus is childhood traumas, social defeating experiences because of accepting discrimination because of being in a minority group in society, in this case religion, weight, physical disability, sexual orientation, gender, and race and psychotic-like experiences in a large population sample. Adapting the original SD hypothesis, the present aim is to assess the various links from a dimensional psychosis phenotype perspective, representative of a large general population sample. Exposure to early adversity may stimulate feelings of instability in relationships later in life, creating a trigger for the individual to automatically mistrust their social environment (Read, van Os, Morrison & Ross, 2005). Thus, chronic stress due to severe exposure to abuse, neglect, and various childhood traumas has detrimental negative influence on brain development and can induce a toxic stress response that may persist throughout life (Shonkoff & Garner, 2012). The present thesis aims to unearth new research into mirroring risk factors in clinical populations with psychotic like experiences in assessing social defeat and childhood trauma accumulatively in a large general population sample.

To address this gap, chapter 4 will evaluate two model constructs of the relationship between all childhood trauma variables, social defeat, and demographic variables in a model, separately with PLE dimensions. Following this, a model construct will be provided in a second stage simultaneously, combining all variables into a multivariate regression model.

Furthermore, there is a gap in the research on patterns of adversities that specific groups of people with similar histories of adversities. Previous studies have addressed

this using different types of trauma (mainly cluster of childhood trauma) but to date there has not been a study exploring this using childhood trauma and social defeating experiences. The present thesis will address this gap. More specifically, the main objective will be to explore if distinct profiles of individuals subjected to an array of traumas or specific traumas in childhood, and/or specific social defeating experiences occur in a large population of healthy individuals, and whether this is related to psychotic-like experiences in a healthy population. The present thesis proposes to assess social defeating experiences and their link to psychotic-like experiences. Moreover, if social defeating circumstances, such as religion, sexual orientation, gender, weight, and race are associated with psychotic like experiences in healthy populations along this hypothetical bell curve. Socially defeating experiences occur across the spectrum of risk factors linked to psychotic experiences, environmental risk factors fall along this continuum regardless of genetic, biological predisposition to such phenomenon. The social defeat variables in the present thesis were chosen due to accessibility in the NESARC Wave 2 and based on prior research that associated links between psychosis social defeat in ethnic minority groups (Selten & Cantor-Graae, 2005; Bourque, van der Ven, & Malla, 2011). For example, research studies have found increased rates of psychosis have been found in ethnic minority groups who have experienced social defeat (Selten & Cantor-Graae, 2005; Bourque et al., 2011; Morgan et al., 2010). However, to date, in terms of their relationship to psychotic-like experiences, social defeating experiences have been under researched. Refer to Chapter 2, pg 94 for a more detailed discussion on social defeating experiences.

Chapter 5 will explore the research gap discussed above by assessing whether the probability of experiencing childhood traumas and social defeat are distributed

evenly in a large healthy population sample; whether homogenous subgroups may explain the heterogeneity of adverse social experiences. This will be addressed using latent class analysis (LCA) to identify whether clusters/latent classes of individuals exist in a general population sample. Also, the relationship between the latent classes and background variables will be assessed (sex, age, marital status, ethnicity, cannabis usage, employment, educational attainment).

The issue of loneliness is becoming paramount in research and how it is related to poor mental health. A gap was noted in the literature on the mediating role loneliness might play in those who have experienced childhood trauma and/or later social defeating experiences and whether this links to increased psychotic experiences in a general population. Chapter 6 will address this research gap using a multivariate mediation statistical technique that will explore if loneliness mediates the pathways from childhood traumas and social defeating experiences to the three dimensions of psychotic-like experiences. Moreover, if the addition of this variable will increase or reduce the estimate effects. As such, adding to ‘The Social Deafferentation hypothesis’ (Hoffman 2007; 2008) proposing thoughts emanated during periods of isolation allows the brain to cognitively build a false picture of reality to fill a void. This hypothesis purports that social isolation may be a primary factor central to the development of psychosis-like experiences in individuals predisposed to psychosis. Moreover, the hypothesis suggests loneliness may encourage processing of false information to fill a gap in an overactive mind due to deprivation of real information.

Finally, this will lead into a discussion of the overall findings in Chapter 7 addressing possible advancements that can be made for interventions to alleviate or decrease risk factors associated with psychotic-like experiences prior to advancement

along the hypothetical continuum. Therefore, as suggested by Bentall (2014) genetics cannot be changed, however, interventions to decrease further risk factors such as environmental adversities can, therefore the present thesis aims to add to social explanations for future interventions.

## **Chapter 2**

### **Methodology**

#### **2.1 Brief Introduction to Chapter 2**

The present chapter will provide an extensive overview of Wave 2 of the National Epidemiological Survey on Alcohol and Related Conditions (NESARC) and a brief overview of WAVE 1; as it is the back bone of the data set used in the present study. A detailed rationale, study design, the sampling techniques used, and the characteristics of the sample, and the reliability and validity of the relevant measures that were administered to NESARC wave 2 respondents will be discussed. Following this, there will be a discussion of the measures that will be used to test the various hypotheses that constitute this project. Moreover, the remainder of the chapter will discuss the advantages and disadvantages of using secondary data analysis to achieve research aims.

##### **2.1.1 The NESARC- Rationale for Using this Data-set**

The present study utilises data drawn from the 2004-2005 National Epidemiologic Survey of Alcohol and Related Conditions (NESARC Wave 2). Details regarding the study design, methodology and data collection processes are available in greater detail elsewhere. The NESARC is a prospective cohort study which was conducted in the United States of America two separate waves (Wave 1, 2001; Grant, Kaplan, Shepard, & Moore, 2003) and (Wave 2 ,2005; Grant & Kaplan, 2005). The NESARC was funded by the NIAAA. Moreover, the fieldwork was conducted by the U.S census board. The main aim of the NESARC was to examine the prevalence of AUD's and associated disabilities in the general population. Wave

2 allowed the assessment overtime. However, variables introduced in Wave 2, made it possible to assess other disorders and associations, therefore, allowing opportunity to conduct valuable research for the present thesis using a large representative data set. In addition, the NESARC Wave 2 was chosen for the current thesis on the basis it measured not only the frequency of psychotic-like experiences incorporated in Section 10, 'Usual Feelings and Actions', of the AUDADIS-IV, but also asked a further question for each item on whether the experience caused the respondent associated distress.

### **2.1.2 Sampling strategy**

The NESARC Wave 1 comprised of 43,093 nationally representative sample of civilian, non-institutionalised U.S. adults over 18, including Hawaii, Columbia, and Alaska. The targeted population consisted of the general population; those living in households, military personnel living at base, and those in schools, shelters, hotels and motels (Grant et al., 2003a). Of the 43,093 participants taken from Wave 1, 1403 had passed away, 781 were deported or suffered from a mental or physical impairment, and 950 entered armed forces. The overall sample size of Wave 2 NESARC data was 34, 653 (Grant & Dawson, 2006).

### **2.1.3 Sample details**

A complex multistage sample design with stratification and clustering of the target population was used by the NESARC to select the sample. For example, sampling weights for respondents in Wave 2 were computed to confirm the sample weights were a stable representation of the US population age over 20 years old post accounting for sample attribution since Wave 1. The NESARC sampling frame made use of The CENSUS 2000-2001 Supplementary Survey (C2SS). The C2SS is a large national survey of 78300 households which used the American Community Survey

(ACS) to collect social, demographic and household information throughout the U.S (Grant & Dawson, 2006).

A multistage stratified sampling design whereby primary sampling units (PSU's) were stratified in accordance with demographics and subsequently utilised to acquire NESARC data (Chen et al., 2006). Within the NESARC sampling design there was a total of 2000 PSU's representative of 3142 counties and county-equivalents in the U.S (Grant & Dawson, 2006). 655 self-representing PSU's were chosen due to their size, with the remainder designated as non-self-representing stratified within each state by demographics (Stetser et al., 2002). 401 were self-representing and 254 were non-self-representing PSU's. Moreover, to safeguard respondents' identification, 401 SRS and the 254 NSR PSU's were combined into 305 SR and 130 NSR PSU's, resulting in a final NESARC PSU sample of 435 PSU's (Grant et al., 2003a; Grant & Dawson, 2006) In the 2<sup>nd</sup> Stage of sampling, Blacks and Hispanics and adults aged 18-24 were oversampled. At the final stage, one person was randomly selected from each household. Further details pertaining to the NESARC sampling design, implementation and methodology can be found elsewhere in more detail (Hasin et al., 2007; Grant et al., 2009). Also, see "Source and Accuracy Statement for Wave 1 of the 2001-2002 National Epidemiological Survey on Alcohol and Related Conditions" (Grant et al., 2003b).

#### **2.1.4 Data collection**

Potential respondents were contacted via writing by the U.S. Census Bureau and were subsequently given information on the nature and confidentiality of the study. One adult over the age of 18 was selected for the interview and gave informed consent prior to responding to the survey. The overall response rate was 81%. On



obtaining informed consent, interviewers administered the Alcohol Use Disorder and Associated Disabilities Interview Schedule (AUDADIS-IV; Grant et al., 2003), a structured diagnostic interview from the National Institute on Alcohol abuse and Alcoholism (Grant et al., 1995; Hasin et al., 1997; Grant et al, 2003; Ruan et al, 2008) was developed to increase measurement of substance use and mental illnesses in large population survey and subsequently the survey instrument used in the NESARC. Questions related to diagnosis of mood, anxiety, personality, and psychosis along with alcohol use disorders and drug abuse and dependence were asked. The second Wave of the NESARC, wave 2, will be used cross-sectionally will be the sole focus of the present thesis asked additional questions including three additional personality disorders; including PLE's. However, this trait-based measurement will be used in the present thesis as an analogue for psychotic-like experience in the general population. Diagnosis of the PLE's in the AUDAIS IV required evaluating long term patterns of function (APA. 1994). The research protocol received ethical review and approval from the U.S Census Bureau and U.S. Office of Management and Budget (Hasin, Liu, Alderson, & Grant, 2006). For access to further information on the NESARC study design and implementation see Grant et al. (2008). However, this personality disorder measurement will only serve as an analogue for psychotic-like experiences in this large general population representative sample.

Both surveys for both Wave 1, and Wave 2, were conducted by interviewers from the U.S Census Bureau, using computer assisted interviewing (CAPI) (Grant et al., 2003a). The survey took approximately one hour to complete and was carried out face to face using CAPI. Moreover, the Alcohol Use Disorder and Associated Disabilities Interview Schedule-Diagnostic and Statistical Manual of Mental Disorders, Fourth Edition (DSM-IV), version (AUDADIS-IV), was developed to

advance measurement of substance use and mental disorders in large population surveys (Grant et al., 1995; Hasin et al., 1997; Grant Dawson, & Stinson, 2003). To ensure that there weren't any concerns regarding the possibility of assessing diagnosis of psychosis in healthy population surveys, a diagnosis of schizophrenia or psychosis was given to respondents who gave answered 'yes' to the following question "Did a doctor or other health professional ever diagnose you with schizophrenia or a psychotic illness or episode?" The use of this statement as a method to rule out possible psychosis has been previously validated by Supina and Pattern (2006).

The reliability of AUDADIS-IV personality disorder diagnoses and symptoms scales was assessed a large test-retest studies conducted as part of the Wave 1 and Wave 2 NESARC surveys. The test-retest reliability of the Schizotypal Personality Disorder (used as an analogue for PLE's in the present thesis) section has been reported as .67 (Ruan et al., 2008). The reliability of the measure used in the NESARC has been supported with an internal consistency of the PLE's section of the NESARC data is .83 (Ahmed et al., 2012).

## **2.2 Measures used in the present thesis**

### **2.2.1 Measures**

The dependent/outcome variables utilised in the present study were namely; Psychotic-like experiences-Section 10, NESARC, wave 2. All NESARC Wave 2 respondents were asked a series of questions to assess symptoms of PLE's; moreover, they were asked about how they felt or acted most of the time throughout their lives. This measurement was used as an analogue for psychotic-like experiences; sub-clinical psychotic experiences at a general population level.

Sixteen items were taken primarily from Section 10, 'Usual Feelings and Actions', of the AUDADIS-IV. Table 2.1 shows the items that were selected for the present analysis. Items were recoded into binary variables in which subjects either endorsed the screener question and the specific symptom (1) endorsed or (0) did not endorse screener question or specific symptom.

Table 2.1 16 items taken from Section 10, NESARC wave 2 measuring PLE's

Factor	Item	Level	Description
Positive	Section 10, Item 41	Cognitive/Perceptual	Have you had personal experiences with the supernatural
	Section 10, Item 43	Cognitive/Perceptual	Have you had the sense that some force is around you, even though you cannot see anyone
	Section 10, Item 42	Cognitive/Perceptual	Have you believed that you have a "sixth sense" that allows you to know and predict things that others can't
	Section 10, Item 44	Cognitive/Perceptual	Have you often seen auras or energy fields around people
	Section 10, Item 40	Cognitive/Perceptual	Have you ever felt that you could make things happen just by making a wish or thinking about them
	Section 10, Item 38	Cognitive/Perceptual	Have you often had the feeling that things that have no special meaning to most people are really meant to give you a message
	Section 10, Item 53	Cognitive/perceptual	Have you often thought that objects or shadows are really people or animals, or that noises are actually people's voices
Negative	Section 10, Item 49	Interpersonal	Have you had trouble expressing your emotions and feelings
	Section 10, Item 48	Interpersonal	Have you rarely shown emotion
	Section 10, Item 47	Interpersonal	Have you often felt nervous when you are with other people even if you have known them for a while
	Section 10, Item 50	Interpersonal	Have you ever felt suspicious of people, even if you have known them for a while
	Section 10, Item 39	Interpersonal	When you are around people, have you often had a feeling that you are being watched or stared at
	Section 10, Item 46	Interpersonal	Have there been very few people that you're really close to outside of your immediate family
Disorganised	Section 10, Item 52	Disorganisation	Have people thought you act strangely
	Section 10, Item 51	Disorganisation	Have people thought you have strange ideas
	Section 10, Item 45	Disorganisation	Have people thought you are odd, eccentric or strange

### **2.2.2 Demographic variables**

Gender was recoded into male (1) and female (0)

Ethnicity/Race included five categories; (1) white, non-Hispanic, (2) Black, non-Hispanic, (3) American, Indian/Alaska Native, (4), Asian/Native Hawaiian/other pacific islander, non-Hispanic, (5) Hispanic, any race. In the present thesis, these responses were recoded into dichotomous variables: (0) for white (1) for all other responses.

Migration was recoded into a binary variable (0) US citizen (1) Migrants.

Marital Status included 6 categories, (1) married, (2) living with someone as if married (3) widowed, (4) divorced, (5) separated (6) never married recoded into (0) having a partner (1) no partner.

Education was defined as highest grade or year of school completed and comprised of 14 responses which were grouped accordingly and categorised into 4 variables (1) Less than high school (2) High school or GED (3) some college (4) completed degree or higher. This was recoded into (0) high educational attainment (1) low educational attainment

Employment was recoded into a dichotomous lifetime employment variable was created. (1) If respondents endorsed never worked (0) if respondents endorsed employed in lifetime.

Cannabis use was defined as (0) no cannabis use (1) cannabis use in lifetime.

Noteworthy: To ensure the integrity of the analysis missing data were coded as -99.

### **2.2.3 Childhood Trauma**

NESARC, wave 2 items on childhood trauma were taken from the AUDADIS-IV and modelled from the Adverse Childhood Events study (Dong et al., 2003; Dube

et al., 2003). These items first appeared in the Childhood Trauma Questionnaire (CTQ) (Bernstein et al., 1994; Wyatt, 1985) and in the Conflict Tactics Scale (CTS) (Straus, 1979; Straus & Gelles, 1990). The questions on emotional and physical abuse were modelled using questions from the CTS; two questions on emotional abuse were asked; and three questions on physical abuse were asked. Emotional and physical neglect were modelled from the CTQ, and sexual abuse in childhood were modelled using questions adapted from Wyatt (1985). Moreover, childhood trauma questions were selected from Section 13, part 3, on background information, and consisted of questions related to neglect, emotional, physical, and sexual abuse.

Neglect. Five items were selected from the above section of the survey and were combined and treated as an overall total childhood neglect item in the analyses. The introductory statement to each question asked, 'Before age 18, how often did parent/caregiver.'

1. Make you do chores that were too difficult or dangerous for someone your age.
2. Leave you alone unsupervised before 10 years old
3. Did you go without things you needed because a parent/caregiver spent the money on themselves?
4. Make you go hungry or not prepare regular meals
5. Ignore/Fail to get you treatment when you were sick

Physical neglect was defined as any response other than 'never' or 'almost never' on the series of five relevant questions. These two responses were recoded into (0) indicative of no neglect. The three other responses 'sometimes', 'fairly often' and

'very often' were recoded into (1) indicating physical neglect took place. Unknown responses were recoded into -99 as missing data.

Emotional abuse was defined as a response of 'fairly often' and 'very often' to the following questions.

1. Swear, insult, or say hurtful things to you
2. Threaten to hit you or throw something at you
3. Make you fear that you would be physically hurt or injured.

These definitions are consistent with those in the Adverse Childhood Experience Study (Dube et al., 2003; Dong et al., 2003)

Physical abuse was defined as any response other than 'never' or 'almost never' on two relevant questions indicative of physical abuse.

1. Push, grab, shove, slap or hit you
2. Hit you so hard that you had marks or bruises or were injured

Sexual abuse was defined as any response other than 'never' on a series of four questions (Wyatt, 1985) and modified for use in the AUDADIS-IV.

1. Fondle/touch you in a sexual way when you didn't want this/ were too young to know what was happening
2. Have you touch them in a sexual way when you didn't want this/were too young to know what was happening
3. Attempt sexual intercourse with you when you didn't want this/were too young to know what was happening

4. Have sexual intercourse with you when you didn't want this/were too young to know what was happening. These questions were rated on a 5-point scale. For the present thesis, responses were recoded into (0) for all questions endorsing 'never' and (1) for all other responses.

#### **2.2.4 Social Defeating Experiences**

Discrimination was measured in the NESARC by modelling questions taken from the Experiences of Discrimination scales (EOD). Krieger et al developed these scales to assess discrimination due to sexual orientation, race/ethnicity, and gender. The NESARC expanded on the original to include weight, religion, and physical disability discrimination (Krieger & Sidney, 1997; Ruan et al., 2008; Krieger, 1990; Krieger & Sidney, 1996; Krieger, Smith, Naishadham, Hartman, Barbeau, 2005) and showed good internal reliability ( $\alpha = 0.76$ ). Previous studies for this scale showed good test-retest reliability (0.79) (Janssen, Craig, Boyce, & Pickett, 2004). Moreover, questions taken from NESARC, wave 2, putative risk factors, under the section on discrimination scales, addressing perceived experiences of discrimination for each of the following attributes: physical disability, sexual orientation, religion, weight, race/ethnicity, and gender. Moreover, questions asked on perceived discrimination were followed by questions assessing reactions to unfair treatment or discrimination. One of these questions was used as a measure of social defeating experiences.

If the respondent perceived the experience of discrimination based on any of the attributes, and answered 'yes; to the following questions:

*“When treated unfairly because of physical disability, sex orientation, religion, gender, race, do you usually do something about it or do you try to accept it?”*



1. Accept it
2. Try to do something about it
9. Did not experience discrimination (due to the above)

1<sup>st</sup> Step. A variable was created to reflect discrimination. 1= did not experience discrimination, recoded to 0, and 2=experienced discrimination, recoded to 1.

2<sup>nd</sup> Step. If the respondent experienced discrimination, they were included in the next variable. If they choose to accept it, this was coded as 1 (social defeating experiences) but if they ‘try to do something about it, this was coded as 0 (No social defeat). Refer to figure 1 for a graphical representation of the coding process.

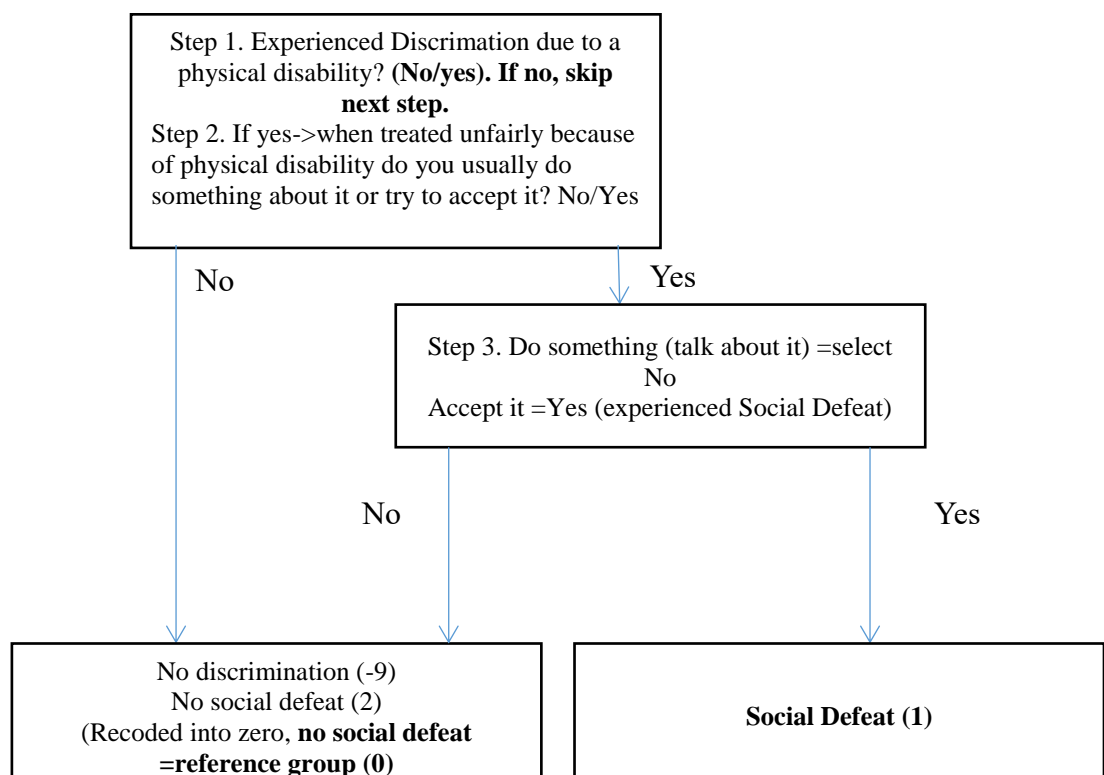


Fig 2.1. Graphical illustration of recoding process for discriminations and subsequently whether respondents experienced social defeat variables.

### **2.3 Secondary Data Analysis**

Secondary data analysis refers to analysis of primary data collected by another researcher or researchers and allowing the material to be made available for reuse for other research purposes (Boslaugh, 2007). Therefore, applying theoretical knowledge and skills to existing data to research an area of interest, or find answers to a research question is fundamental to analysing secondary data (Boslaugh, 2007). Data sets are regularly archived for the main purpose of permitting secondary data to be used by the general research community, therefore providing an opportunity to other researchers with limited time, funding, or resources. Also, primary survey research in rare circumstances would utilise all the data collected, therefore, data not used is often beneficial to other research questions (Smith, 2008).

There are various advantages and disadvantages associated with secondary data analysis. Considering the data has already been collected, the researchers have more time to concentrate on data already collected, thus freed of the time-consuming tasks that are associated with gathering primary data, such as research design, data collection, cost of transportation and ones one time (Vartanian, 2010). Secondly, secondary data analysis holds the advantage of the amount of the data that is offered. For example, many data sets comprise of large scale studies often with thousands of participants, therefore, making the samples highly representative of the general population (Boslaugh, 2007). Additionally, the design phase and sampling techniques used very often use complex sampling design and weight systems that permit population estimates to be calculated, which would be otherwise questioned on smaller convenience samples (Boslaugh, 2007). Alternative methodologies such as primary data are collected specifically for a research problem at hand. Such methods could be used for the research questions in the present thesis, however the population

sample would be small, the process would be lengthy and expensive, and time consuming (Vartanian, 2010).

The financial effectiveness, time efficiency and ease of access are some of the main advantages of secondary analysis (Smith, 2008). For example, measurements and collecting data have already been carried out (Doolan & Froelicher, 2009). Furthermore, the ultimate objective of secondary data analysis is no different to other methods in contributing to scientific research other than using data and material already available. Also, larger data sets are a better representation of the general population, therefore providing better validity and generalizability (Smith, 2008; Smith et al., 2011). On the other hand, secondary data analysis is not free of flaws. For example, the data was not collected with the researchers' prime research question considered, therefore, the researcher may run into problems regarding measurement issues, or whether there is enough covered regarding demographics. A related problem is that the available data may influence the direction of the research (Boslaugh, 2007; Vartanian, 2010). Additionally, the researcher was not part of the data collection, therefore may have limited knowledge on precisely how it was carried out. Therefore, the knowledge acquired is through theoretical knowledge rather than practical, requiring researching any available information reported (Boslaugh, 2007).

#### **2.4 Statistical Techniques Applied in the Current Thesis**

A series of statistical techniques will be used throughout the present thesis to uncover the factor structure of the dimensional psychosis phenotype used, the cumulative significance of adversities from childhood trauma through to social defeating circumstances later in life and various demographic risk variables that evidently contribute to psychosis, sub-clinical psychotic-like experiences. Moreover,

whether clusters of individuals who have endured similar patterns of adversities exist in the present data set. Furthermore, based on earlier research, the present thesis will assess whether experiencing loneliness mediates via the pathways from childhood trauma, and social defeat and contribute to the experience of PLE's in a large healthy population data set. The rationale for the current research on the use of statistical techniques will be covered.

Prior to carrying out technical statistical analysis, a series of bivariate analysis will be carried out to analyses the relationship between variables to test simple hypothesis of association between independent and dependent variables. Next, using Confirmatory Factor Analysis in chapter 3 expects to uncover the dimensional structure of psychotic-like experiences (PLE's) using two separate models (1) 'frequency-only' of experiences at an item level and (2) a level incorporating distress associated with frequency of experiences. Moreover, Confirmatory Factor Analysis (CFA), an extension of factor analysis will assess the association between observed measures (16 PLE items) and latent variables. This statistical technique differs from factor analysis because it is theory driven, thus quantifies how well the data set fits the theoretical constructs (Mason, 2015; Therman & Ziermans, 2016). This statistical method was chosen for the present thesis based on empirical findings that 3-distinct factors tend to cluster together, therefore share an underlying structure. Using a healthy population sample, this provides evidence for dimensionality; these experiences/symptoms are an extension of 'normal' mental functioning. Moreover, according to Mason (2015) this type of factor analysis is often chosen for positive type experiences due to their multidimensionality. Therefore, quantification can be sought for each item relative to their latent dimension. The present thesis aims to test the existing model of psychotic-like experiences analogous per the AUDADIS-IV used

as a measure of schizotypal personality in the NESARC wave 2 to identify which model best fits the data from the present general population sample. Moreover, a second series of models will be tested with 'distress' included in the model to test if the model fit mirrors or differs from items excluding distress.

Following the CFA in Chapter 3, a series of multivariate regression models will be assessed to uncover the predictive relation of each childhood trauma, social defeating experience and risk factor variables separately to the three PLE dimensional outcomes, followed by a second cumulative multivariate regression modelling all variables. Multivariate regression models allow the statistical assessment of the relationship between more than one dependent variable and several independent variables. Moreover, multivariate regression analysis will be used to predict the value of one or more responses from the set of chosen predictors to assess the association between predictors and responses. The variance explained will be indicative of the proportion of variability in the observed responses shown to be attributed to changes in the predictor variables. To date, regression-based analyses have been used to statistically model the association between childhood trauma and psychosis, however a simultaneous model including social defeating experiences using a dimensional representation of PLE's in a large general population sample has not been modelled. Moreover, the multivariate model permits investigating a range of demographic variables along with childhood trauma and defeat, however, it does not assume causality. Others (Hox, Moerbeek, & van de Schoot, 2010) suggest multivariate regression indirectly permits the examination of the relationship between childhood trauma and several symptoms by indirectly comparing associations

Therefore, the aim of using a multivariate model in the present thesis by regressing all in one model will allow observations to be made on the cumulative

explained variance that adversities and risk factors may have on PLE's. Therefore, identifying the cumulative value of traumatic events in childhood combined with social defeating adversities and demographic risk factors in terms of their link to psychotic-like experiences. Furthermore, to further test this, a simultaneous combined model has the potential to inform how these variables interrelate and increase how accurate they predict over and above what single childhood traumas, social defeat, and risk factor variables do uniquely (Shan et al., 2013).

Using latent class analysis (LCA), Chapter 5 aims to assess if the probability of experiencing childhood traumas and social defeat are distributed evenly in a large healthy population sample, and whether several homogenous subgroups may explain the heterogeneity of adverse social experiences. LCA was first introduced nearly half a century ago by Lazarsfeld and Henry (1968) to capture unobserved heterogeneity by distributing individuals into categories based on a series of survey item responses. Over the last decade, LCA has become a popular method to zoom in on the intricate nature of individual experiences of trauma (Berzenski & Yates, 2011). LCA is a person-centred method, with the assumption that the association among indicator variables are considered by a class/group variable, thus contrasting with variable centred statistical techniques (Muthen, 2006; 2008; Muthen & Muthen, 2000; 2002). LCA is probabilistic, therefore the model can be replicated with an independent sample (Muthen & Muthen, 2000). Furthermore, LCA allows the possibility of including multiple traumatic events a person has been exposed to in comparison to single traumatic events, therefore focusing on a person centred rather than a variable centred approach (Collin & Lanza, 2010). It is important to unveil cumulative trauma histories to explore if they have a differential or cumulative effect on psychopathology in comparison to single traumas (Cutajar et al., 2010). Also, the present thesis aims to

assess the relationship between such latent classes and background variables (sex, marital status, ethnicity, migration, cannabis usage, employment, educational attainment). The rationale for using a methodology such as LCA in the present thesis permits accurate examination of the co-occurrence of childhood traumas in conjunction with social defeating experiences and an array of demographic risk factors. This statistical technique expects to generate person centered profiles for specific clusters/latent classes of individuals who have encountered similar patterns of childhood trauma and possible social defeating adversities and demographic risk factors. The addition of demographic risk variables will further substantiate and validate the experience of trauma and defeat within this healthy population data set. Following the identification of the classes, a multinomial logistic regression model will be specified. Thus, the dependent variables signifies class membership (the CT, SD, and risk factors).

Using mediation analysis, chapter 6 aims to establish if loneliness mediates the pathways from multiple adversities to PLE's, and if the addition of this variable will increase or reduce the estimate effects. Moreover, the statistical method of multivariate modelling using mediation analysis uncovers mechanisms that lie beneath the core of the relationship between predictor and outcome variables (Fairchild, Mackinnon, Taborga, & Taylor, 2009). Thus, rather than postulating a direct linear association, mediation models propose a causal link whereby the predictors influence the mediator which in turn influences the outcome variable. Therefore, methodologies using mediation are rapidly expanding in epidemiological research (Richiardi, Beilocco, Zugna, 2013). Prior studies that assessed the mediating relationship between traumas endured in childhood and later psychopathology have produced mixed findings. For example, Shevlin and colleagues (2015) using a large

population sample (AMPS, 2007) found the relationship between childhood abuse and an array of psychopathologies; depression, generalised anxiety disorder, comorbid anxiety, phobias, PTSD and psychosis, to be mediated by loneliness.

Chapter 6 aims to predict the parameters of the proposed mediation model will be statistically significant while controlling for a range of covariates and potential risk factors associated with psychotic-like experiences. Moreover, childhood trauma and social defeat will significantly predict all dimensions of psychotic-like experiences and loneliness will act as a mediator linking relationship between childhood trauma, social defeating experiences, demographic risk factors and psychotic-like experiences in a general population sample.



**CHAPTER 3**  
**CONFIRMATORY FACTOR ANALYSIS**  
**PSYCHOTIC-LIKE EXPERIENCES**  
**FREQUENCY AND DISTRESS**

**Abstract**

**Gap in the Literature.** Researchers have endeavoured to find the best factor structure underlying the nature of PLE's to assess the psychosis phenotype in healthy or at-risk populations, thus allowing detection of early vulnerable signs, and therefore early intervention for potential transitions across the continuum. Instruments measuring the psychosis phenotype have relied on specifically rating experiences and symptoms based on how often they occur, thus failing to acknowledge whether the experiences or symptoms, or both, are distressing, therefore, not providing succinct information on whether these experiences regardless of frequency, are liable to cause concern.

**Aim.** The present study aims to examine the dimensional structure of 16 PLE's using two separate groups modelling the underlying structure of PLE's (1) a level of 'frequency-only' (2) a level incorporating distress associated with frequency.

**Method:** The data used (N=34, 653) in the present chapter was drawn from Wave 2 of the National Epidemiologic Survey on Alcohol and Related condition (NESARC). Analogous for measuring psychotic experiences in a general population sample, 16 items taken from Section 10 of the NESARC- which made use of the Alcohol Use Disorder and Associated Disabilities Interview Schedule (AUDADIS-

IV) to determine psychiatric disorders, based on Diagnostic and Statistical Manual of Mental Disorders-Fourth Edition (DSM-IV).

**Results & Conclusion.** It was found that the 3-factor model of Raine et al. (1994) best fitted the data for both ‘frequency-only’ and ‘frequency and distress’ data. The dimensional representation of the two models tested remained stable when examined at a frequency item level only, and, in the second model when incorporating associated distress with frequency of symptoms. The findings support a continuum perspective that psychotic-like experiences are prevalent in the general population, from healthy along a hypothetical dimensional spectrum of increased severity.

**Contribution to the Field.** Incorporating this novel method in further general population samples could potentially be used as an anchor in preventing transition across the dimensional spectrum from healthy to appraisals that are distressing warranting the need for care by pin-pointing symptoms that tend to be more distressing, therefore increasing the validity of measurement models. The method used in the current chapter adds to research supporting a broader dimensional psychosis phenotype that PLE’s are a multidimensional construct on a spectrum.

### **3.1 Introduction to the Present Chapter**

The main objective of the present chapter will be to assess the viability of a system that will uncover the underlying structure of a measurement of PLE's in a general population with and without associated distress. As such, both measurement models should be equivalent insofar as distress in dimensional models of the psychosis phenotype should mimic models without distress if these experiences are said to lie on a continuum of normality within the general population. Distress should be an anchor in measurements across the psychosis phenotype, if it this feature that is associated with an experience that highlights clinical outcome. Moreover, it will be assessed whether the data holds gender equally.

#### **3.1.1 PLE's and the dimensional psychosis phenotype**

The dimensional psychosis phenotype has undoubtedly gained popularity in recent years. Research has repeatedly revealed that pre-manifestation of psychosis may be expressed in healthy non-clinical individuals; with symptoms such as hallucinations, thought disorders, and delusions displayed at levels on a continuum. As such, mentally healthy individuals at the lower end and moving along a continuity spectrum towards those with phenomenological to sub-clinical experiences, to at risk moving along a severity dimension towards those with a clinical diagnosis of the disorder steering towards the other end (Linscott & van Os, 2013; van Os et al., 2009; Keshavan, Delisi, & Seidman, 2011; Shevlin et al., 2007). For example, at one end of a hypothetical spectrum, clinical individuals display characteristics of psychosis; while at the lower end of the spectrum lie healthy individuals devoid or with low levels of these characteristics. In between this bell curved like spectrum, sub-clinical psychotic experiences are displayed by certain individuals (Ahmed et al., 2012).

Moreover, it is important to note that without a clinical diagnosis, these symptoms are most often referred to as sub-clinical or psychotic-like experiences (PLE's) (Kelleher & Cannon, 2011). Furthermore, psychosis research uses a variety of terminology when referring to similar experiences that occur in healthy populations below levels of clinical manifestation, namely; sub-clinical experiences, psychotic-like experiences, schizotypy, schizotypal personality disorder, at-risk to psychosis, and proneness to psychosis (Claridge, 1997; Linscott & van Os, 2013, Kwapil & Barrantes-Vidal, 2014; Lee et al., 2016). Throughout the current thesis, psychotic-like experiences will be used to describe these experiences in a large general population sample.

### **3.1.2 Epidemiological evidence for the continuum psychosis phenotype perspective**

Despite epidemiological evidence, categorical and dimensional perspective debate classifying a system incorporating fleeting psychotic-experiences, sub-clinical psychotic experiences, and clinically defined psychosis as a dimensional spectrum (Lee et al., 2016; Tarbox & Pogue-Geile, 2011). In recent times, a vast amount of research is striving towards a continuous expression of a psychosis phenotype with widespread support evident in a vast number of epidemiological studies. For example, in a meta-analysis, van Os et al. (2009) found a median prevalence of 5% for the occurrence of these experiences in healthy populations. Furthermore, researchers (Linscott & van Os, 2013) carried out an updated systematic review and meta-analytic review on research evidence supporting the psychosis phenotype continuum. In 61 studies of epidemiological research evidence, the authors found the reported incidence to be 2.5%, with 20% of the population going on to develop persistent psychotic experiences, with prevalence rates of just over 7%.

Furthermore, using a general population sample (N=25,644) of 51 countries, Neuvo et al. (2012) revealed almost 6% prevalence of any psychotic experience, nearly 3%, reported two experiences, 1.7% reported 3 experiences and just over 1% reported 4 experiences. Findings suggest a dose-response relationship between increasing psychotic-like experiences and adverse health outcome. Overall, the prevalence of individuals presenting with one psychotic-like experience cross-nationally ranged from almost 10% to just over 30%. Also, overall variations in the psychosis phenotype are expressed in approximately 15% of the population from normality along varying levels of severity to psychosis (van Os et al., 2017). However, in spite of the abundance of epidemiological findings, researchers, Linscott and van Os (2013) suggest flaws in epidemiological research, reiterating that shortcomings are related to differences in design and methodology stages, and whether or not the research is longitudinal; therefore, proposing that assessing follow up is vital in ensuring evaluating whether the symptoms experienced transit to clinically defined psychosis and/or whether interventions will stop further progression of the phenomena needs to be addressed.

It has been proposed incorporating categorical and continuous approaches could benefit psychosis research (Linscott & van Os, 2013; van Os & Kapur, 2009). In line with this, much like modern medicine, certain medical disorders and diseases are often measured on a continuum. For example, an individual's cholesterol may be described on increasing scales from low to high. Conversely, the DSM-5 incorporates a comparable system into its classification system for diagnosing psychotic disorders (Reigier, Kuhl & Kupfer, 2013). Presently, The Diagnostic and Statistical Manual for Mental Disorders (DSM-5) (American Psychiatric Association, 2013) has no specific classification for psychosis. Moreover, although the DSM-5 assess disorders

categorically, it has highlighted the dimensional approach (Heckers, 2013). However, its addition of a dimensional section albeit not in the main text of the DSM-5 is favoured as a positive movement for future psychosis research to understand the underpinning of the development and treatment of such disorders (Barch et al., 2013). The DSM-5 has added eight dimensional assessments, including five domains of psychosis; hallucinations, delusions, disorganised speech, abnormal psychomotor behaviour, and negative symptoms. Conversely, other proponents of a dimensional psychosis phenotype argue the categorical approach impedes psychosis research advancements by not acknowledging differences in the severity of experiences, thus, preventing proper interventions and necessary treatment (Heckers, 2008). It has been argued, the nature of disorders is comorbid, therefore, signalling inadequacy in emphasising genetics (Owens et al., 2007). Therefore, it has been suggested it is vital to move away from categorical diagnostics and zoom in on dimensional approaches (Barch et al., 2013). In line with this, to completely disregard the categorical approach, the U.S. National Institute of Mental Health (NIMH) research centre will not provide funding unless the research focuses solely on dimensional models of psychosis (Cuthbert & Kozak, 2013).

### **3.1.3 Factor structure of Psychotic-like Experiences**

The multidimensionality of the underlying structure of psychotic experiences is best represented by its factor structure (Fonseca-Pedrero et al., 2014; Fonseca-Pedrero et al., 2017). Moreover, self-report questionnaires are most commonly used to assess PLE's with factor structures showing positive, negative, and disorganised dimensions of items which reflect symptoms indicative of a supposed liability for disorders on a psychotic spectrum (Kwapil & Barrantes-Vidal, 2014; Fonseca-Pedrero et al., 2017). Moreover, for the last several decades, researchers have endeavoured to

find the best factor structure of the psychosis phenotype to find the underlying nature of psychotic-experiences in healthy, phenomenological, or sub-clinical populations. Thus, better classification to measure early signs, and therefore, early intervention before severity of experience warrants care, or transit to psychosis (Barrantes-Vidal., 2010; Fonseca-Pedrero et al., 2008).

Over 25 years ago, Bentall, Claridge and Slade (1989) introduced a 3-factor model in comprehensive analyses. A few years later, Raine and colleagues (1994) proposed a three-factor model; reporting cognitive-perceptual (magical thinking, unusual perceptual experiences, odd ideas), interpersonal (no/lack of close friends) and disorganized (odd/eccentric behaviour) traits. Raine and colleagues (1994) model has received a great deal of attention over the last two decades with many researchers supporting a 3-factor model (Claridge et al., 1996; Lin et al., 2013) while others support a 4-factor model over a 3-factor model fit. For example, recently, Barron, et al. (2015) examined the factor structure of the SPQ using two samples from the general population. They found a 4-factor structure best fit the data, with adequate fit for a 3-factor structure. Predictive and criterion validity for a 3-factor structure has been established through research (Raine et al., 1994; Compton et al., 2009; Cohen et al., 2010; Fonseca-Pedrero et al., 2011; Davidson et al., 2016).

It has been established cross culturally and across gender the factor structure of measurement models retains stability. For example, using the largest sample set to date on the SPQ, Fonseca-Pedrero et al. 2017 collated data (N=27,000) from 12 countries, across 21 locations to assess the underlying nature of psychotic experiences cross culturally. Using CFA, they found three and four factor models best fitted the data at a sub-scale level, supporting Raine and colleagues (1994), and Stefanis and colleagues 4-factor model, respectively. Utilising multilevel analysis, a 3-factor

structure best represented the data, ranging from over  $0.70\alpha$  to almost  $0.95\alpha$  individually, and from nearly  $0.85\alpha$  to just over  $0.90\alpha$  when collated. When the data was evaluated at an item level, 9-factor and second order factors provided the best fit. Overall, Fonseca-Pedrero and colleagues (2017) empirical study suggests further evidence supporting a dimensional psychosis phenotype. Additionally, the 3-factor model has been empirically publicised as showing invariance across gender (Reynolds, Raine, Mellinger, Venables, & Mednick, 2000). Using exploratory analysis, Fossati, Raine, Carretta, Leonardi and Maffei (2003) supported this and found PLE's to be invariant across gender, therefore, suggesting gender influences responses to PLE's.

#### **3.1.4 PLE's, Psychosis and Associated Distress**

Cognitive models postulate that continuous appraisal of experiences play a role in the development and persistence of certain symptoms of psychosis. Moreover, it has been suggested the mechanisms underlying PLE's may be due to cognitive processes playing an important role in their maintenance (Freeman, 2007). This concept has been researched extensively in the past, for example, over four decades ago, Maher (1974) first postulated the theory that delusional thought might be understood as a type of abnormal perceptual process. Correspondingly, it is not necessarily the symptom or experience that leads to severity that warrants clinical intervention but how the individual interprets it and whether it causes them distress (Peters et al., 2017; Brett et al., 2014; Garety et al., 2007). Thus, psychotic-like symptoms experienced by an individual may be due to the way they process information. It has been suggested the main difference between individuals in clinical populations experiencing symptoms, such as hallucinations compared to individuals in healthy populations is dependent on the level of distress associated with the



symptom (Stip & Letourneau, 2009). For example, distress caused by frequency of psychotic-like experiences increases the shift towards psychosis (Krabbendam & van Os, 2005). Furthermore, authors (Peters et al., 1999; 2004; 2016) emphasise that it is the distress caused by delusions that distinguishes healthy and clinical outcomes of those individuals experiencing such symptoms. Thus, the authors suggest that not only does the actual delusion appear on this continuity of normality, but the level of distress it causes, preoccupation with the experience and conviction that it is held.

A certain trauma experienced may influence the type of symptom or psychotic-like experience and thus how they interpret meaning from the symptom (Bentall & Fernyhough, 2008). For example, Kline et al. (2012) suggest the way in which a person interprets these experiences potentially influences the relationship between the experience and distress, if any. According to cognitive approaches, it is not the experience, but the emotional distress associated with trying to process the experience, the stress, belief and how often it plays on the individuals' mind associated with the experience in question that defines the outcome (Brett et al, 2014; Jung et al., 2008). Various studies have shown distress to be associated with both PLE's in non-clinical individuals and those at high risk of psychotic disorder (Armando et al., 2010; Kline et al., 2012; Ronald et al., 2013).

Furthermore, as suggested by Shevlin et al. (2015), instruments measuring psychosis have relied on specifically rating experiences and symptoms, based on how often they occur. Thus, these measurements are failing to acknowledge whether the experiences or symptoms, or both are distressing, therefore, not providing succinct information on whether these experiences regardless of frequency are liable to cause concern. For example, one may answer 'yes' to having experienced the following symptom, for example, 'Have you often thought that objects or shadows are really

people or animals, or that noises are people's voices?', but if they can cope with this and it doesn't cause them distress, it may not be worthy a cause for concern. However, on the other hand, if the above causes the individual distress, and in conjunction with an array of other experiences, it may be an issue. Therefore, the authors suggest that combining frequency and distress as a composite score would be a more reliable measurement of these experiences. In combining both levels, the structure of the measurements used in healthy populations will mimic clinical measurements.

Furthermore, as suggested by Kaymaz and van Os (2010) the clinical outcome is not just established by the level and frequency of experiences/symptoms but how the individual copes with the experiences, and if negatively, whether this persists and interferes with their lives. The authors postulate a model with two possibilities; one showing the more an individual endorses psychotic experiences on a frequency scale, the more likely it will lead to clinical manifestation. Moreover, the second possibility involves incorporating the same model as the first but with two levels depicting low coping and high coping, therefore, assessing the level to which coping applies in healthy populations as opposed to those with clinically defined psychosis. For example, in a recent study, Ronald et al. (2013) undertook a study comprising of an adolescent sample (N= 5000) individuals. They found that an increase in the frequency of psychotic like experiences combined with lower levels of distress were associated with a decrease in high risk psychosis. Also, health status in this group of individuals remained well without need for support. In addition, the study showed that cognitive disorganisation was related to the highest levels of distress. Moreover, it has been suggested PLE's with low frequency combined with very little level of distress should not be considered as clinically important and are not related to increased risk of further psychotic symptoms (Armando et al., 2010; Schultze-Lutter et al., 2011; van Os et al.,

2009; Yung et al., 2006). Also, Wigman et al. (2017) used a sample (N=2870) from the Community Assessment of Psychic Experiences (CAPE) in a Dutch population sample to assess dimensionality of PLE's. Their findings suggest that frequency and patterns of co-occurring experiences distinguish transition from psychotic-like experiences to severe need for care psychotic experiences.

Recently, using the longitudinal youth at risk study (LYRIKS), A sample of individuals (N=173) with ultra-high risk of psychotic disorder, authors (Rekhi, Rapisardi & Lee, 2017) found that almost 90% of individuals had associated distress with one or more attenuated psychotic symptom. Furthermore, a 12 month follow up assessment revealed that over 6% of the sample transitioned to psychosis. The authors acknowledge that persistent and severe symptoms were related to increase distress of experiences.

Noteworthy, psychotic-like experiences are not always distressing, and may be a positive experience for some individuals (Brett et al., 2014; Unterrassner et al., 2017). For example, using three groups; clinically psychotic, at risk to psychosis and non-clinical individuals (N=35, 20, and 36, respectively), authors (Brett et al., 2014) found increased distress linked with lower cognitive function and awareness, and decrease perceptions of social support. In addition, low distress was linked to spiritual appraisals, increased perception of social support, increased control over the experiences and benign response to the experience. Therefore, in support of cognitive theories and dimensionality models, the findings suggest it is how the individual responds and interprets the psychotic-like experiences that differentiates distress or positive appraisal of the experience. Also, on assessing PLE's and their relationship to distress, Unterrassner et al. (2017) using a sample of healthy individuals (N=206) found paranoid appraisals differentiates need for care in individuals with persistent

PLE's. Also, their findings suggest PLE's and associated distress are displayed across the general population and experiencing odd beliefs and belief in paranormal are important for psychological functioning in some individuals. Furthermore, authors Kaymaz and van Os (2010) suggest the clinical outcome is evaluated by the level and frequency of experiences/symptoms and how the individual copes with the experience, and if negatively, whether this persists and interfere with their lives. The authors postulate a model with two possibilities; one suggests the more PLE items an individual endorses on a frequency scale, the more likely it will lead to clinical manifestation. Secondly, the possibility of incorporating the same model as the first but with two levels depicting low coping and high coping, therefore, assessing the level to which coping applies in healthy populations as opposed to those with clinically defined psychosis. Other researchers argue that all PLE's and increased frequency of PLE's and associated distress should be included. For example, Kline and colleagues (2012) using a sample of 355 students found that increased levels of distress, due to symptoms experienced which were related to an increased number of PLE's in students' low in schizotypy, who subsequently found their symptoms more traumatic in comparison to students with higher levels of schizotypy. Moreover, the authors question prior research assumptions that have suggested that symptoms that do not cause the individual distress should not be included as clinically irrelevant.

### **3.1.5 Rationale for the Present Chapter**

Using a broader model of the dimensional psychosis phenotype by building on a novel approach using CFA, devised by Shevlin et al. (2015), the present chapter aims to replicate a similar system to assess the underlying structure of PLE's, without and with distress associated with experiences. Furthermore, adapting postulations by Murphy et al. (2016) the main objectives of the present chapter is to assess the

feasibility of a system incorporating distress. In combining both levels, the underlying structure of measurements used across general populations should accurately mimic clinical measurements. The authors found a model with distress associated with frequency produced an equivalent model fit to one without distress. A gap in the literature was noted that this novel system had not been replicated using CFA across a large population sample.

The present study aims to examine the dimensional structure of PLE's using two separate groups both modelling the structure of the 16 psychotic-like experiences (1) a level of 'frequency-only' of experiences/symptoms at an item level and, (2) a level incorporating distress associated with frequency of experiences. The present study predicts that a 3-factor model for both models will provide an excellent fit and the model incorporating distress associated with frequency will remain stable, testing the hypothesis that measurements going forward should incorporate distress into their models to ensure distress in healthy populations are equivalent those found in clinical populations. Additionally, it is hypothesised that gender will be invariant across the data, therefore, no difference between male and females regarding the underlying nature of PLE's in a large general population sample.

The objectives of the present chapter are novel because to date assessing if the underlying structure of measuring distress accompanying experiencing psychotic experience as opposed to frequency of experiences alone has not been explored in a large population data set using confirmatory factor analysis. Theoretical models such as cognitive theories of psychosis suggest it is an individual's cognitive appraisal of a situation or experience that is important in how the experience affects the person particularly if it causes the person distress. For example, people with clinically

defined psychosis differ from those in healthy populations because experiencing symptoms distresses the person to the point of need for care. Therefore, if dimensional approaches to psychosis assume a curve like distribution from healthy to clinical manifestation of psychosis then the underlying nature of these experiences and associated distress underlying the structure of experiences in measurement models should mirror clinical experiences both phenomenologically, and in agreement with broader models of the dimensional psychosis phenotype.

## **3.2. Method**

### **3.2.1 Sample**

Covered in detail in chapter 2 Methodology

### **3.2.2 Measures**

The NESARC utilised the Alcohol Use Disorder and Associated Disabilities Interview Schedule (AUDADIS-IV) to determine psychiatric disorders. The AUDADIS-IV is a fully-structured, self-report, diagnostic instrument that yields diagnoses based on Diagnostic and Statistical Manual of Mental Disorders-Fourth Edition (DSM-IV), designed to be administered by clinicians or trained laypersons (Grant et al, 2001; Grant et al, 2004). The AUDADIS-IV assesses both past year and lifetime occurrence of a variety of psychiatric disorders. Studies have shown that the AUDADIS-IV measures of substance use and other psychiatric disorders have high reliability in general population samples (Grant et al., 2001; Grant et al., 2004). The validity of Section 10 has been reported to be 0.67 (Ruan et al., 2008). The internal consistency section of the PLE section is 0.83, therefore supporting the reliability of the measure used in the survey (Ahmed et al., 2012).

Comorbidity was examined initially controlling for clinically defined psychopathologies and following this addressing it in a multivariable manner. Further, the many findings on differences between population groups were taken from analyses of unfluctuating information sources on the different groups which were sampled in sufficient numbers (Hasin and Grant, 2015). The series of questions in Section 10 of the NESARC consisted of respondents being asked questions about how they felt or acted most of the time throughout their lives. It did not include symptoms when respondents were manic, suffering from anxiety, depressed, using drugs, taking medication, physically ill or withdrawal from substances. The prevalence of PLE's in Wave 2 of the NESARC sample was 3.9%. Males reported significantly higher rates than females, with rates of 4.2% and 3.7%, respectively. Younger respondents showed significantly higher rates of PLE's than their older counterparts. Refer to Chapter 2 on the methodology for further information.

### **3.2.3 Procedure**

Sixteen items were taken primarily from Section 10 of the NESARC that made use of the section, 'Usual Feelings and Actions', of the AUDADIS-IV. Table 3.1 shows the items that were selected for the present analysis. Items were recoded into binary variables in which subjects either endorsed the screener question and the specific symptom (1) or did not endorse screener question or specific symptom (0). Section 10 ('Usual Feelings and Actions') does not include screener questions, however, each specific symptom item 'a' has a follow-up question if respondents answer 'yes' then they proceed to answer the 'b' part of the question, which indicates associated distress or compromised functionality with a particular symptom. To ensure a more stringent selection criterion, data were recoded into binary variables in which respondents endorsed the symptom and associated distress/impaired

functionality with said item (1) or did not endorse the symptom or distress/impaired functionality (0). For each of the 16 items the frequency and distress scores were combined to produce a new variable with two levels. These were ordered levels representing (0) did not endorse the item (1) presence of endorsing the item with no associated distress, and (2) presence of endorsing the item with associated distress. This produced 16 item-level only (frequency only) and a second composite scores (frequency of each with incorporated associated distress). The resultant scoring method provided a combined measure of 'frequency' and 'frequency and distress'.



**Table 3.1**

*Item map showing pattern matrix of Negative, Positive and Disorganised Questions and Factors*

		<b>Factor 1</b>	<b>Factor 2</b>	<b>Factor 3</b>
		<b>Negative</b>	<b>Positive</b>	<b>Disorganised</b>
1	Have you often had a feeling that things that have no special meaning to most people are really meant to give you a message?		*	
2	When you're around other people have you often had a feeling of being watched or stared at?	*		
3	Have you ever felt you can make things happen just by making a wish or thinking about them?		*	
4	Have you had personal experiences with the supernatural?		*	
5	Have you believed you have a Sixth Sense that allows you to know and predict what other people think?		*	
6	Have you had a sense that some force around you even though you can't see anyone?		*	
7	Have you often seen auras or energy fields around other people?		*	
8	Have people thought you are odd or eccentric?			*
9	Have there been very few people you are close to outside of your immediate family?	*		
10	Often felt nervous when you are with people even if you know them	*		
11	Have you rarely shown emotion?	*		
12	Have you had trouble expressing your emotion	*		
13	Have you felt suspicious of people even if you know them for a while?	*		
14	Have people thought you have strange ideas?			*
15	Have people thought you act strange?			*
16	Have you often thought that objects or shadows are really people or animals or that noises are actually people's voices?	*		

### 3.2.4 Statistical Analysis

Confirmatory factor analysis (CFA) was used to test 18 separate factor analytic models. Models were specified and estimated using Mplus version 7.0 (Muthén and Muthén, 2010) using the robust weighted least squares estimator (WLSMV). To incorporate the items into a specified model of PLE's, three alternative CFA models were estimated. The first model specified included all 16 items, taken from section 10 of the scale, as a one factor phenomenon. The second model reflected three dimensions of PLE's (negative, positive and disorganised PLE's). Refer to table 3.1 for a detailed map of each of the items allocated to its specific factor. Chi-square difference tests ( $\chi^2$ ) were used to determine the best fitting model. The  $\chi^2$  test measures overall fit, with a good fitting model returning an insignificant result (i.e.  $p < 0.05$ ). However, the  $\chi^2$  is sensitive to sample size, with large samples almost always returning an insignificant result (Tanaka, 1987). Moreover, the adequacy of each model was further assessed by examining four fit statistics: Comparative Fit Index (CFI; Bentler, 1990), the Tucker Lewis Index (TLI; Tucker & Lewis, 1973), the root mean-square error of approximation (RMSEA; (Steiger, 1990) and the weighted root mean residuals (WRMR; (Brown, 2006)). The CFI and TLI measure how much better the model fits the data compared to a baseline model where all the variables are uncorrelated. A value of  $> 0.90$  was originally considered to represent a well-fitting model (Bentler, 1990), however a revised cut-off value of or close to 0.95 is advised (Hu & Bentler, 1999). Another absolute index, the RMSEA statistically informs how well the model, with unknown but optimally chosen parameter estimates fits the population's covariance matrix (RMSEA; (Steiger, 1990). Values of this index below 0.6 are considered to reflect good model fit, however, values less than 0.08 suggest adequate fit (Bentler, 1990; Hu & Bentler, 1999; Joreskog & Sorborn, 1993).

### 3.3 Results

#### 3.3.1 Models of levels 'frequency-only' and 'frequency and distress'

To assess the CFA, 18 separate factor models were tested. The fit statistics of the 18 CFA's are reported in table 3.2. The 1-factor model fit was rejected as the data poorly for both the 'frequency-only' and 'frequency distress' groups. The 2-factor model fit was acceptable as the data well for both the 'frequency-only' and 'frequency and distress' groups, with the frequency distress group showing slightly better fit. For these models, both the CFI and TLI values were outside of the acceptable range (i.e.  $0.90 <$ ). The 3-factor model showed excellent approximation of the data for 'frequency-only' ( $\chi^2=2792.500$ ,  $df=160$ ,  $p < 0.00$ ), CFI=0.95, TFI=0.95, RMSEA=0.028, and for 'frequency and distress' ( $\chi^2=3671.539$ ,  $df=101$ ,  $p < 0.00$ ), CFI=0.95, TFI=0.94, RMSEA=0.032).

**Table 3.2***Fit Statistics of the 16 PLE items using the NESARC Wave 2*

PLE factors	Frequency					Frequency and Distress				
	$\chi^2$	df	CFI	TFI	RMSEA	$\chi^2$	df	CFI	TFI	RMSEA
1 Factor	14979.161	105	0.748	0.712	0.064	17543.117	105	0.751	0.715	0.069
2 Factor	4296.029	101	0.929	0.916	0.035	5374.978	101	0.925	0.910	0.039
3 Factor	2792.500	101	0.954	0.946	0.028	3671.539	101	0.949	0.939	0.032
<b>Males</b>										
1 Factor	6905.496	105	0.738	0.700	0.067	7997.337	105	0.753	0.717	0.072
2 Factor	1778.205	101	0.935	0.923	0.034	2266.135	101	0.932	0.919	0.038
3 Factor	1144.326	101	0.960	0.923	0.034	2266.135	101	0.955	0.948	0.031
<b>Females</b>										
1 Factor	8515.456	105	0.754	0.719	0.063	10104.351	105	0.733	0.695	0.069
2 Factor	2773.462	101	0.922	0.907	0.036	3385.383	101	0.912	0.896	0.040
3 Factor	1784.451	101	0.951	0.942	0.029	2255.410	101	0.942	0.932	0.033

### 3.3.2 Gender invariance

To examine whether the best fitting model held across gender, the model was fit to various sub-samples of the data based on gender. Prior to this, a crosstabulation analysis that tested the relationship between gender and all levels of PLE's at a frequency only and frequency and distress collation was performed (see Table 3.3). As shown in Table 3.3 more females reported more positive PLE's experiences and a lower number of females reported negative and disorganised experiences than expected. The opposite result was found for male counterparts.

Standard residuals of chi-square cross tabulation analyses were conducted between gender and PLE's level in which negative residuals in a cell represented smaller number of cases than expected by chance, and positive residuals corresponded to overrepresented cases. The chi-square statistics were statistically different for males and females for the three dimensions of frequency of PLE's experiences, and the additive distress conjugates in all counts, with females showing overall higher percentages in comparison to male respondents

The fit statistics for the model by gender are presented in Table 3.2. The 1-factor model for both genders were rejected. The 2-factor model was acceptable, however, both the CFI and TLI values were outside of the acceptable range (i.e. <0.90). The 3-factor model for male gender showed excellent approximation of the data for frequency ( $\chi^2= 2792.500$ ,  $df=160$ ,  $p = < 0.01$ ), CFI =0.95, TFI=0.95, RMSEA= 0.028, and for 'frequency and distress' ( $\chi^2= 3671.539$ ,  $df=101$ ,  $p = < 0.01$ ), CFI =0.95, TFI=0.94, RMSEA= 0.032. The 3-factor model for female gender showed excellent approximation of the data for frequency ( $\chi^2= 2792.500$ ,  $df=160$ ,  $p = < 0.01$ ), CFI =0.95, TFI=0.95. RMSEA= 0.028, and for 'frequency and distress' ( $\chi^2= 3671.539$ ,  $df=101$ ,  $p = < 0.01$ ), CFI =0.95, TFI=0.94, RMSEA= 0.032).

**Table 3.3**

*Crosstabulated counts, percentages and standardised residuals of each PLE factor 'frequency' and 'frequency and distress' by gender*

<b>PLE factor</b>	<b>Male</b>	<b>Female</b>	<b><math>\chi^2(df)p</math></b>
<b>Negative</b>	6383(45%)	7803(55%)	
Std. Residual	5.5	-4.6	
<b>Negative_distress</b>	1079(45.5)	1295(54.4%)	
Std. Residual	2.6	-2.2	120.04(3) *
<b>Positive</b>	3956(40%)	5930(60.6%)	
Std. Residual	-3.1	2.6	
<b>Positive_Distress</b>	244(39.4%)	376(60.6%)	30.53(3) *
Std. Residual	-1.0	0.9	
<b>Disorganised</b>	2685(51.1%)	2565(48.9%)	
Std. Residual	10.2	-8.7	
<b>Disorganised_distress</b>	331(44.7%)	410(55.3%)	
Std. Residual	1.1	-0.9	218.75(3) *

*Note: \* $p < 0.05$*

Overall, the model provided a good approximation of the data regardless of gender. The CFI and TLI were higher for males than females, although this difference was minimal, respectively. Similarly, the RMSEA value was marginally lower for males, however, both values were well below the recommended value of 0.6. The chi-square statistics were all found to be statistically significant. However, the models were not rejected as the chi-square statistic is strongly related to sample size which increased the power of the analyses as suggested by Tanaka (1987).

Cronbach's alpha was calculated for the total 16 PLE's item and for each of the 3 factors:  $\alpha = .82$ ,  $\alpha = .53$ ,  $\alpha = .62$ ,  $\alpha = .53$  (total, negative, positive and disorganised, respectively). Table 3.1.1 displays the mean (SD) and inter-correlations of the three

PLE dimensions. Correlations shown in this table demonstrate the bivariate relationship between the three PLE's factors showing a moderate to large relationship between negative and positive PLE's ( $r=0.406$ ,  $p<0.01$ ), negative and disorganised PLE's ( $r=0.453$ ,  $p<0.01$ ), and positive and disorganised PLE's ( $r=0.447$ ,  $p<0.01$ ), in agreement with Cohen (1988) correlations of 0.1, 0.3, and 0.5, are representative as small, moderate and large, respectively.

**Table 3.4**

*Bivariate Correlations between Negative, Postive and Disorganised Dimensions*

<b>PLE factor</b>	<b>Mean(SD)</b>	<b>Skew(SE)</b>	<b>Positive</b>	<b>Disorganised</b>
<b>Negative</b>	1.07(1.60)	2.40(0.013)	0.41**	0.44**
<b>Positive</b>	0.62(1.23)	2.99(0.013)		0.45*
<b>Disorganised</b>	0.36(0.09)	3.13(0.013)	0.45**	

\*( $p<0.05$ )

Table 3.5 displays percentages of the frequency of endorsing each PLE item and the associated distress. The most prevalent item endorsed for the negative dimension was 'few people close to you outside your family' ( $N=30.7\%$ ), with 1.4% experiencing associated distress. The item with the highest percent of associated distress was for the item 'trouble expressing emotion'. 8.5% endorsed this item, and 5.1% experienced both frequency and distress. For the positive dimension the most prevalent item was 'sense there is a force around you' ( $N=17.9$ ), However, only 0.8% endorsed frquency and distress for this item. For the disorganised dimension, 11% endorsed 'strange idea' and 1.5% endorsed strange idea and associated distress

Tables 3.6 and 3.6.1 display the standardised factor loadings for frequency and distress for each dimension for the entire sample of the NESARC population that endorsed each PLE dimension and grouped according to gender.

**Table 3.5**

*Frequency and Percentages of PLE's (F) and Frequency & associated Distress (F&D) of positive, negative and disorganised items endorsed*

<b>PLE factor</b>	<b>Item</b>	<b>F(N)</b>	<b>F&amp;D(N)</b>
<b>Negative</b>	Feeling of being watched	2648(7.6%)	682(2%)
	Few people you're close to outside family	10638(30.7%)	492(1.4%)
	Felt nervous with people you know	1762(5.1%)	491(1.4%)
	Rarely show emotion	4971(14.3%)	749(2.2%)
	Trouble expressing emotion	2932(8.5%)	1762(5.1%)
	Felt suspicious of people you know	3379(9.8%)	1033(3%)
<b>Positive</b>	Special meaning message	2951(8.5%)	397(1.1%)
	Felt you could make things happen	2296(6.6%)	166(0.5%)
	Experience Supernatural	2888(8.3%)	210(0.6%)
	See aura's or energy fields	895(2.6%)	68(0.2%)
	Sense force is around you	6186(17.9%)	268(0.8%)
	Sixth Sense	2970(8.6%)	222(0.6%)
	Objects, Shadows, Voices	484(1.4%)	124(0.4%)
<b>Disorganised</b>	Act strangely	2355(6.8%)	455(1.3%)
	Strange ideas	3819(11%)	524(1.5%)
	Odd, eccentric, strange	3220(9.3%)	438(1.3%)



**Table 3.6**

*Standardised factor loadings for the 3-Factor PLE NESARC structure for 'frequency-only' and 'frequency & distress'*

<i>Item</i>	<b>Frequency</b>			<b>Frequency and Distress</b>		
	<i>Neg</i>	<i>Pos</i>	<i>Disorg</i>	<i>Neg</i>	<i>Pos</i>	<i>Disorg</i>
Emotion	0.47**			0.52**		
Expression	0.59**			0.63**		
Nervous	0.74**			0.76**		
Suspiciousness	0.80**			0.80**		
Watched	0.81**			0.80**		
Close to	0.51**			0.54**		
Supernatural		0.75**			0.74**	
Force		0.77**			0.77**	
Sixth sense		0.73**			0.72**	
Aura		0.77**			0.75**	
Happen		0.68**			0.68**	
Meaningful		0.73**			0.74**	
Shadows		0.77**			0.80**	
Act Strange			0.91**			0.92**
Ideas			0.89**			0.90**
Odd behaviour			0.86**			0.88**
<b>Factor Correlations</b>						
<i>Neg</i>		0.65**			0.67**	
<i>Pos</i>			0.67**			0.69**
<i>Disorg</i>	0.68**			0.71**		

Note \*\*= p<0.01

**Table 3.6.1**

Standardised factor loadings for the 3-Factor PLE NESARC structure for 'frequency-only' and 'frequency & distress' gender invariance (males)

<i>Item</i>	<b>Frequency</b>						<b>Frequency and Distress</b>					
	<i>Male</i>			<i>Female</i>			<i>Male</i>			<i>Females</i>		
	<i>Neg</i>	<i>Positive</i>	<i>Disorg</i>	<i>Neg</i>	<i>Pos</i>	<i>Disor</i>	<i>Neg</i>	<i>Pos</i>	<i>Disorg</i>	<i>Neg</i>	<i>Pos</i>	<i>Disor</i>
Emotion	0.46**			0.49**			0.51**			0.53**		
Expression	0.57**			0.61**			0.63**			0.65**		
Nervous	0.75**			0.74**			0.75**			0.77**		
Suspiciousness	0.79**			0.81**			0.79**			0.81**		
Watched	0.81**			0.81**			0.81**			0.81**		
Close to	0.50**			0.52**			0.53**			0.55**		
Supernatural		0.72**			0.77**			0.71**			0.76**	
Force		0.77**			0.76**			0.77**			0.75**	
Sixth sense		0.74**			0.73**			0.74**			0.71**	
Aura		0.78**			0.76**			0.76**			0.75**	
Happen		0.71**			0.65**			0.71**			0.66**	
Meaningful		0.74**			0.72**			0.74**			0.74**	
Shadows		0.76**			0.79**			0.79**			0.80**	
Supernatural		0.72**			0.77**			0.71**			0.76**	
Act Strange			0.91**			0.93**			0.90**			0.93**
Ideas			0.91**			0.90**			0.89**			0.89**
Odd behaviour			0.87**			0.89**			0.86**			0.86**
<b>Factor Correlations</b>												
Neg			0.68**			0.67**	0.70**					
Pos	0.68**			0.63**				0.70**		0.65**		0.71**
Disorga		0.68**			0.68**				0.70**		0.71**	

Note \*\*= p<0.01

## 3.4 Discussion

### 3.4.1 Main Findings

Distress is recognised as being a major factor related to transitioning across the psychosis phenotype spectrum in those with negative appraisals of such experiences. The current chapter assessed the underlying structure of psychotic-like experiences at a frequency of symptom-only item level and at an associated distress level using a large general population sample. As such, the present findings agreed with the hypothesis; the underlying factor structure on the dimensionality of the underlying factor structure between frequency and frequency with associated distress were found to be equivalent. Moreover, dimensional representations of PLE measurement models including distress associated with frequency of experiences in the general population are reflective of those in clinical populations.

The purpose of modelling the dimensionality of psychotic-like experiences with and without distress within a large healthy population is valuable in psychosis research. In applying and uncovering the same model fit initially established for measuring individuals with psychosis, into a large general population sample provides further justification in support of a broader dimensional psychosis phenotype. Including distress as a conjugate, the model fit remained stable therefore adding to evidence on combining categorical and dimensions features to increase the reliability and validity of measures using a broader dimensional psychosis phenotype. Furthermore, the model fit was invariant across gender suggesting no gender difference in psychotic-like experiences regarding the underlying nature of PLE's across variations in a large general population sample.

Moreover, a 3-factor model best fit the data and the dimensional representation of the two models tested remained stable when examined at a frequency item level only and incorporating associated distress with frequency of experiences. Subsequently, it was predicted gender would be invariant across the data. In line with the hypothesis findings suggest gender invariance.

The current chapter used CFA to compare two models using phenomenological dimensional criteria and categorical representations of distress. Psychotic-phenomena can be distressing, but not always depending on they are cognitively appraised. Therefore, occurrence of PLE's could be viewed as a skewed dimension of experience severity rather than a psychiatric medical based model. As such, providing the first large general population sample to use a technique combining categorical criteria using dimensional data to test the underlying structure of a broader model of the dimensional psychosis phenotype that can be comparable across clinical and general population samples.

### **3.4.2 Findings in the Context of Previous Research CFA 'Frequency-only' and 'Frequency and Distress'**

The results from the CFA for the 'frequency-only' model indicated that a 1-factor model showed poor fit, therefore supporting the dimensional model, and rejecting the categorical approach. The 2-factor model showed a big improvement compared to the 1-factor model, showing a good fit across the data. The 3-factor model, as expected showed excellent approximation of the data improving on the 2-factor model. The current finding is consistent with previous research revealing a 3-factor model best fits the data (table 3.2). Thus, suggesting negative, positive, and disorganized dimensions are distinct constructs with differernt sequences of associations. This finding is

consistent with previous findings by several researchers, in both clinical and non-clinical populations (Raine et al., 1994; Compton et al., 2009; Fonseca-Pedrero et al., 2011; Davidson et al., 2016).

The results from the CFA model for ‘frequency and associated distress’ showed similar results when compared to frequency items alone. Again the 1-factor model showed poor fit, the 2-factor model showed a very good approximation of the data. The 3-factor model as expected showed excellent approximation of the data. The 3-factor model for ‘frequency and distress’ was equivalent to the ‘frequency only’ model. This finding partially supports research by Shevlin et al. (2015) who found similar results using healthy populations to identify whether a composite of distress associated with frequency of symptoms mirrored the data fit. Moreover, the frequency and distress model produced the same factor structure as the model using frequency items only; however, the fit statistics were not superior in the present findings (table 3.2). A possible reason for this could be the use of different measurement models, and a large population data set.

#### **3.4.2.1 CFA gender invariance ‘frequency-only’ and ‘frequency and distress’**

In addition to examining the entire data set for ‘frequency’ alone and for ‘frequency and distress’ combined, assessment of invariance across gender for both analysis was carried out. The results for the 1-factor model for frequency-only for both male and female respondents indicated the fit was poor across the data. For the ‘frequency and distress’ model the result was similar except in this instance the model fit for females showed an improvement when compared to males for ‘frequency and distress’. The 2-factor model for males showed a good fit across the data. For females,

it was slightly lower but still a good fit. The 3-factor model showed an improved fit for both genders, favourably in line with findings by Reynolds et al. (2000).

For the 'frequency and distress' the fit was very similar for males but a decrease in model fit for females for 'frequency and distress'. The 3-factor model for frequency-only showed an excellent fit for both males and females with males showing a slightly better approximation of the data. The 3-factor model for frequency and distress again showed an excellent approximation of the data for males. Again, the data was a slightly better fit for males. The 'frequency-only' data for a 3-factor was a slight better approximation in comparison to 'frequency and distress' across all the analysis.

### **3.4.3 Strengths & Weaknesses of the Approach**

The present findings should be interpreted in the context of several limitations. Firstly, the sample was a household survey excluding individuals from institutions, and with clinical diagnosis of psychosis. Hence, the data is based on individuals who self-report, therefore there is a possibility for bias recall, not reporting or under-reporting due to shame, denial, or stigma due to social perceptions of mental illness. It has been suggested that variation in findings may be reliant on the data set used (Kwapil & Barrantes-Vidal, 2014). Although measurements of psychotic-like experiences have many advantages such as being economical and permitting assessment of large samples of both healthy and clinical individuals (Kwapil, Barrantes-Vidal & Silvia 2008), the measurement instruments used creates issues due to differences various instruments on the underlying factor structure, therefore, creating issues uncovering the relationship across variations of the spectrum in symptoms from healthy to sub-clinical to psychotic (Fonseca-Pedrero et al., 2008). Thus, the reliability in identifying and measuring dimensions is detrimental in construing the dimensional psychosis phenotype (Kwapil

& Barrantes-Vidal, 2014). In addition, the authors suggest the terms used to interchangeably describe PLE's and similar experiences may decrease the effectiveness of research, as it leads to vagueness in collaborating results due to differences in the severity of the symptoms across dimensions. Additionally, the present study utilised data from the NESARC, wave 2 representing a large representative sample of healthy adults. However, the NESARC was performed in two waves, with the section measuring PLE's only available in wave 2. It would be preferable if a longitudinal data set was used to assess the experiences and progression over time.

Therefore, it should be a future requirement for measurement models to include internal appraisals such as threatening experiences, paranoia and fear to assess further underlying processes that separates distress related PLE's (Underwood, Kumari, Peters, 2016; Peters et al. 2017; Murphy et al., 2016), therefore differentiating those in need of care and those who can cope with the experiences, regardless of frequency. However, this would need to be tested at different points in time, to assess if persistence of experiences will influence non-distressed individuals over time.

#### **3.4.4 Implications for Research and Future Directions**

The present findings support accumulating evidence of a dimensional psychosis phenotype using a large sample of individuals from a healthy population. The dimensional representation of the two groups remained stable across the data, thus, indicating for this data set and items used in the measurement emulates that of measuring symptoms across a general population set using clinical criteria by means of incorporating distress into the model. There was relatively no change for model fit when comparing frequency-only of symptoms, and frequency of symptoms with associated distress. This finding was reproductive of that tested by other researchers (Shevlin et

al., 2015) who used 20 items taken from the CAPE. This method of incorporating distress along with frequency is of great importance for future psychosis research, for example, the way an individual cognitively interprets the symptoms they experience; whether they are distressed or not may determine the outcome of future psychosis (Garety et al., 2007). Therefore, it is benefit research for other measurements to identify whether distress associated with experiences/symptoms mirror in their factor structure, therefore providing a more succinct accurate representation of a dimensional psychosis phenotype. Thus, providing earliest possible identification and potential interventions depending on the severity of the symptoms across a spectrum (McGorry et al., 2007). Moreover, emphasising the importance of identifying when PLE's indicate increased risk of potential severity leading to psychotic disorder. Furthermore, due to the high occurrence of these symptoms in the general population researchers needs to look at methods of identifying individuals at risk of clinical disorder through recognizing which PLE's are more significant in terms of risk of developing psychosis and combining PLE's with other clinical and non-clinical features, such as distress (Peters et al., 2017; Hanssen, Krabbendam, Radstake, Verdoux, van Os., 2005). Incorporating such methods using general population samples could potentially be used as an anchor in preventing transition across the dimensional spectrum from healthy to appraisals that are distressing warranting the need for care. The method used in the current chapter adds to research supporting a broader dimensional psychosis phenotype that PLE's are a multidimensional construct on a spectrum (Shevlin et al., 2015). In line with postulations, distress was hypothesised to reflect the same underlying structure as a model without distress, because these experiences are thought to exist along a continuum of normality, therefore it should be a requirement this factor is included



across the spectrum to pinpoint variations in its intensity across the dimensional psychosis phenotype.

Research in the last 10 years has been paying more attention in acquiring interventions for individuals at high risk of psychosis (National Institute for Health & Clinical Excellence, 2012). Moreover, interventions to decrease the distress caused by the psychotic experiences, thus attending to any warning signs so the individual will know how to deal with them. Moreover, researchers have been reviewing the factor structure of PLE's to assess the continuity spectrum, thus detecting early signs for early interventions, moreover, when, why and where potential transit to phenomenological, to sub-clinical, to more severe levels on the spectrum occur (Barrantes-Vidal et al., 2010; Fonseca-Pedrero et al., 2008). Furthermore, the National Institute for Health and Clinical Excellence (2012) suggest more emphasis should be given to psychotic-like experiences that are distressing, as distress has been found to be related to long lasting difficulties associated with PLE's. As such, it has been suggested that distressing factors should be primarily determined based on the experience (National Institute for Health & Clinical Excellence, 2012).

Diagnostic and clinical classification of psychosis incorporates distress into its models. Therefore, as addressed by Shevlin et al. (2015) to assess if the continuous appraisal of clinical psychosis measurements reflects the factor structure of dimensional measurements, it is important research incorporates a detailed examination of the structure of these measurements using both frequency and associated distress into their models. Moreover, in combining both levels, the structure of the measurements used in healthy populations will more accurately mimic clinical measurements. Until recently, incorporating distress associated with frequency of symptoms/experiences into models

of PLE's has not been used across general population studies. Therefore, it has been suggested distress associated with experiences should be a requirement in measurement models, as measuring frequency alone does not consider how the individual perceives the experience, whether distressing or a psychological functioning requirement (Peters et al., 2017; Unterrassner et al., 2017). The combination of symptoms or experiences if distressing may increase risk of psychotic disorder, depending on cognitive appraisal. Moreover, certain symptoms that co-occur may also result in putting certain individuals are at risk (Peters et al., 2017).

### **3.5 Conclusion**

To date, there has only been one other study that incorporated distress associated with symptoms when assessing the factor structure of PLE's or risk to psychosis in finding the best fit of a model of psychosis like experiences in a general population sample (Shevlin et al, 2015). Therefore, aligning findings with that of previous research is problematic. Considering the present findings, it is imperative future research should integrate distress into factor structure models in general populations to further advance psychosis research advocating the dimensionality of psychosis, therefore establishing concurring wavelengths in categorical and dimensional models. In using measurements designed to target audiences in the clinical population with those in the general population with psychotic-like experiences, it is important there is stability in such diagnostic or quantifying techniques. Moreover, model variations in distress along the continuum must be considered to further increase psychosis research to build on investigations that may not be a result of eccentricities but rather a multidimensional construct showing an increased risk to psychosis albeit on different platforms across the hypothetical continuity of experiences spectrum.

## **Chapter 4**

### **Pathways from Specific and Cumulative Adversities To Psychotic-like Experiences**

#### **Abstract**

**Gap in the Literature.** The past two decades has unfolded a myriad of evidence the social environment plays a role in the pathway to psychotic symptoms across a dimensional psychosis phenotype. In clinical and non-clinical populations, a diverse range of traumas and social adversities, cannabis use, lower educational attainment, single status, and ethnicity are related to such phenomena. However, a gap was noted in the literature on patterns of social defeating adversities later following early adversities and whether cumulatively they will have increased effect of PLE's in a general population sample above and beyond childhood trauma and social defeating experiences occurring on their own.

**Aim.** The present chapter evaluated a model construct relationship in two stages; firstly, all childhood trauma variables, social defeating experiences and demographic risk variables were modelled separately with negative, positive and disorganised PLE's. Next, simultaneously in a multivariate regression model to assess the cumulative effects of childhood traumas and social defeating experiences.

**Method.** The data used (N=34,653) was drawn from Wave 2 of the National Epidemiologic Survey on Alcohol and Related condition (NESARC). 16 items taken from Section 10 of the NESARC to measure PLE's. Childhood trauma questions were selected from Section 10, and consisted of questions related to neglect, emotional, physical, and sexual abuse prior to age 18. Items relating to social defeating

experiences were taken from the NESARC that made use of the Experiences of Discrimination scales (EOD) on items relative to perceived discriminatory experience because of physical disability, weight, religion, sexual orientation, and race.

**Results & Findings.** The second model (cumulative adversities) significantly improved over the first model when childhood trauma, social defeating adversities and demographics were combined. Moreover, the findings support research that social explanations, such as trauma in childhood, social defeat, and risk factors such as cannabis use, unemployment, ethnicity, and lower educational attainment are related to psychotic-like experiences in a large general population.

**Conclusion.** The current chapter revealed that childhood traumas; physical, emotional, neglect and sexual abuse and social defeating experiences and a range of demographic risk when combined increase the predictive relationship of experiencing PLE's.

**Contribution to Research.** The following chapter adds to existing literature extending on evidence that social explanations are putative in their role linking adversities and psychotic-like experiences across the psychosis phenotype dimensional spectrum. In addition, extending on evidence that social explanations are putative in their role linking adversities and psychotic-like experiences across the psychosis phenotype, this chapter adds to the extant literature by strengthening the reliability and validity of a multitude of specific adversities and their links that potentially merge to psychotic experiences. In addition, through establishing specific mechanisms involved whether through specific or cumulative adversities will aid future research in how best to apply the most appropriate intervention or preventions.

#### **4.1 Introduction to Chapter 4**

Research is continuing to make advancements into processes involved in the link established backed by 20 years of empirical research that the social environment plays a pivotal role in the emergence of psychotic experiences in both clinical and non-clinical populations (Varese et al., 2012; Bebbington, 2015; Linscott & van Os, 2013; Bentall et al., 2012; Shevlin et al., 2007, Catalan et al., 2017). Previously, there was predominately a misguided focus on biological and genetic vulnerabilities to explain psychotic experiences (Bentall, 2014). However, research is ongoing, with researchers seeking mechanisms, processes and a myriad of social explanations in an attempt to further understand the development of psychotic symptoms in both healthy and clinical populations (van Os, Kenis & Rutten., 2010; van Os, Reininghaus, Meyer & Lindenberg, 2017), such as traumatic childhood events, social adversities, stress, migration, cannabis use (McGrath et al., 2017; Varese et al, 2012; Bentall et al., 2012; Beards et al., 2013; Cantor-Graae & Selten, 2005). The course of action triggering the emergence of such psychopathologies in those who have been subjected to childhood trauma and/or later adversities requires further research (van Os et al., 2017; Rauschenberg et al., 2017; Bentall et al., 2014; Read & Mayne, 2017) with several theories backed by empirically tested evidence, albeit with outcomes nevertheless shared and conflicting. Researchers are continuously testing theories and recently incorporating categorical and dimensional perspectives (van Os et al., 2017) to link processes and pathways underlying adversities and the emergence of psychotic-like symptoms across the psychosis phenotype spectrum from healthy individuals along a dimension of severity to those with psychotic disorders. Recently, there has been a surge towards finding specific pathways and mechanism due to the high correlation between diagnosis and symptoms, triggering research to break down possible barriers

using stringent assessments, such as the effect of specific adversities and cumulative adversities on symptoms and modification of measurement models (Bentall et al., 2014). The current chapter will focus on theory and empirical evidence to date on the link between specific adversity types separately (childhood traumas; social defeating experiences), demographics and psychotic experiences across psychosis phenotype spectrum. Following this, a review of empirical evidence on the combined effects of traumas, reasons for combining adversities and obstacles in research that need to be addressed. Next, the methods and findings will be presented, followed by a discussion including future directions and limitations pertaining to the outcome of the findings.

#### **4.1.1 Childhood Trauma and Psychotic-like Experiences**

A dearth of empirical research has repeatedly established that childhood maltreatment such as physical, emotional, sexual abuse, and neglect are related to later clinical and non-clinical psychotic experiences (Varese et al., 2012; McGrath et al., 2017; Gibson et al. 2016; Longden & Read, 2016). Research into the processes involved in the relationship between childhood traumas and the emergence of psychopathologies across the general population is imperative for interventions, with findings to date emerging with mixed results.

More extensively, the link between childhood trauma and elevated risk of experiencing psychotic symptoms has been studied widely, as evident in a meta-analytic review with overall findings suggesting that adversities in childhood elevated the risk for psychosis symptoms or PLE's by almost 3 times and almost 4 times in clinical populations (Varese et al., 2012; Matheson et al., 2013)

More recent studies have revealed sexual abuse was found to increase the risk to PLE's by 4 times (OR=4, 95% CL 2.6-6.3), physical abuse by almost 3 times (OR=2.8%), those with a history of neglect over twice as likely, and victims of rape were 5 times more likely to experience PLE's (McGrath et al., 2017; McGrath., 2017b).

#### **4.1.2 Social Defeating Experiences & Psychotic-Like Experiences**

Social defeat, or perceived discrimination may be defined as the chronic experience of inferiority in the social environment (Selten & Cantor-Graae, 2005). Such social adversities such as discrimination are related to being in a minority group or experiencing subordinate feelings, therefore leading to a perception of being 'socially defeated' (Selten & Cantor-Graae, 2005; 2007). As such, according to the social defeat (SD) hypothesis, social adversities may indirectly be representative of social defeat, however, only if the individual perceives the situation as defeating by accepting discrimination, rather being assertive and doing something about it (Selten et al., 2013). Furthermore, the SD hypothesis suggests that chronic experiences of SD may trigger sensitization of the mesolimbic dopamine system leading to a heightened risk to psychosis due to repeated exposure (Selten & Cantor-Graae, 2005; 2007). As such, this functional alteration in the hypothalamic pituitary axis (HPA) axis elevates firing in dopamine receptors (Walker and Diforio, 1997).

Sensitization may be referred to as the effect of additional exposures to a received (evoked) stimulus. The stimulus may be stress, a drug, a stimulant or the experience of social defeat. The increased response is sensitization of the mesolimbic dopamine system (DA) system (Selten et al., 2013). The authors provide an update of the social defeat hypothesis put forward more than a decade ago and related systematic

research in the past decade after its initiation suggesting the hypothesis is credible. They suggest the SD hypothesis provides a good social explanation as a process involved in the emergence of psychotic-symptoms. Essentially, the authors (Selten & Cantor-Graae, 2005; Selten et al., 2013) suggest exposure of exclusion and subordination puts individuals at a higher risk for developing psychotic-like disorders.

For example, since its initiation, many researchers have endeavoured to test the SD hypothesis. Initially recognised in laboratory rodents; it has been postulated that social defeating experiences may affect humans in a similar fashion. Such animal studies, for example, the resident-intruder paradigm suggest that social defeat may lead to catastrophic mental or physical symptoms. For example, during the resident-intruder interaction, both rodents experience elevated corticosterone because of social stress (DeMiguel et al. 2011; Bjorkqvist, 2001). Studies to date on social defeat have primarily focused on animal models of social defeat showing exposure to chronic long-term stress increases levels of dopamine in the mesolimbic system; thus, by paralleling this model with social defeating experiences in humans, it has been suggested increases the probability of psychosis possibly due to sensitization overtime (Selten & Cantor-Graae, 2005). For example, discrimination of minority groups in society such as ethnicity, sexual orientation, gender, and religion have been found to be associated with poor mental health (Selten et al., 2013). However, it is important to acknowledge this hypothetical comparison of environmental stress induced on rodents with social defeating experiences in humans is a biological and behavioural response and confined to animal studies.

Furthermore, research of social defeating experiences is under researched for minority groups in society (Skosireva et al., 2014). However, minority status due to



race, sex orientation, gender and religion are related to increased psychopathology (Veling, 2013; Veling et al., 2007). For example, perceived discrimination has been found to be a risk factor in psychotic disorder (Saleem et al., 2014). Over a decade ago, Janssen et al. (2003) examined ethnicity, disability, sexual orientation, gender, and age minorities, and whether they were related to psychotic experiences. The authors assessed data from The Netherlands Mental Health Survey and Incidence Study (NEMESIS); a prospective longitudinal sample (N= 7076) in the general Dutch population, which was designed to assess the incidence of psychiatric disorders. They found a dose-response relationship between perceived discrimination and delusional ideation but not hallucinations, providing evidence that specific psychotic symptoms may be associated with perceived discrimination. More recently, in a cross-sectional case-control study carried out in a clinical service in South London, using ultra high-risk psychotic individuals (N=64), and healthy controls (N=43), authors (Valmaggia et al., 2015) found that the individuals at high risk to psychosis and experiences of social defeat had high levels of paranoid thought when interacting with people socially in comparison to the control group.

To date, research is poor, predominately focusing on discrimination because of gender and ethnicity in comparison to other forms of discrimination, with a focus on poor working conditions (Pascoe & Richman, 2009; Sahver, Klein & Fagan, 2012; Bayard, Hellerstein, Neumark & Troske, 2003). Therefore, it is imperative research seeks to assess the co-occurrence of different types of discrimination (Cole, 2009).

#### **4.1.3 Demographic Risk Factors and Psychotic-like Experiences**

Other environmental or demographic risk factors linked to risk to psychosis have been researched frequently, such as single status, unemployed, cannabis use, education, gender and age (Varese et al., 2012; van Os et al., 2009; Kuepper et al., 2011; Wigman et al. 2017). Such findings are held cross-culturally, and in both clinical and non-clinical populations. The demographic variables have been assessed for PLE's in general, for specific experiences, and for dimensional symptoms, however the latter is understudied. However, findings are often mixed, producing differential results. The present thesis will use several demographic risk factors throughout. A brief overview will be provided below on the relationship between each demographic variable and evidence of their link to psychotic-symptoms in both clinical and non-clinical populations.

#### ***4.1.3.1 Age and PLE's***

Using a Dutch general population sample (N=2870), authors (Wigman et al. 2017) found psychotic experiences to be more common in younger people. Calkins et al. (2014) found younger age be associated with psychotic-symptoms.

#### ***4.1.3.2 Gender and PLE's***

Authors, Morgan, Castle and Jablensky (2008) identified lower prevalence rates of negative experiences in females, whereas Galderisi et al. (2011) identified higher prevalence rates of disorganised and negative psychotic symptoms in males.

Also, authors, Bora and Baysan Arabaci (2009) using a sample (N=1024) from the general population found males scored higher on both negative and disorganised PLE dimensions. Unterrassner et al. (2017) found female reported more positive symptoms and males reported more negative symptoms. However, Rossler et al. (2012) using a longitudinal community cohort study found no sex differences.

#### ***4.1.3.3 Single Status and PLE'S***

Single status has been shown to be related to a lifetime prevalence of PLE's in meta-analysis (Linscott & van Os, 2013). Furthermore, in assessing the associations between environmental factors and psychosis, a UK AESOP (Aetiology and Ethnicity in Schizophrenia and Other Psychoses) study using 390 cases with first episode psychosis and 391 healthy controls, it was found unemployment and single status were related to elevated odd of psychosis (Morgan et al., 2008).

#### ***4.1.3.4 Educational attainment and PLE's***

Using a Dutch general population sample (N=2870), authors (Wigman et al. 2017) found a relationship between lower education and psychotic experiences. Others have found higher IQ and a higher level of education attainment are related to decrease in development of psychotic symptoms (Jhon, Kelleher & Cannon, 2011). Also, more recently, Unterrassner et al. (2017) found lower educational achievement related to increased PLE's.

#### ***4.1.3.5 Employment and PLE's***

Furthermore, in assessing the associations between environmental factors and psychosis, a UK AESOP (Aetiology and Ethnicity in Schizophrenia and Other Psychoses) study using 390 cases with first episode psychosis and 391 healthy controls, it was found unemployment were related to higher likelihood of psychosis (Morgan et al., 2008). However, McGrath et al. (2017) assessed psychotic experiences using data (N=31,261) from the WHO World Mental Health (WMH) a general population epidemiological survey. Findings revealed lifetime prevalence rates to be nearly 6%, with individuals from countries with moderate to high income reporting increased psychotic experiences.

#### ***4.1.3.6 Migration and PLE's***

In relation to migration, research studies have uncovered findings of higher incidences and prevalence rates of psychosis and psychotic-like experiences in migrants (Cantor-Graae & Selten, 2005; Morgan et al, 2009; Cantor-Graae & Pedersen, 2013). For example, Cantor-Graae & Selten (2005) carried out a meta-analysis on migration and psychosis on the studies carried out over a 23-year period up until the year 2005, to assess the history of migration and its relationship in the development of psychosis. They found elevated risk of psychosis incidence rates of 2.7 for all groups of migrants. They found elevated risk of psychosis incidence rates of 2.7 for all groups of migrants. In addition, this incidence rate was found to be nearly 5 times higher in densely populated black countries. Noteworthy, a meta-analysis of 21 studies published between 1977 and 2008, authors (Bourque et al., 2011) found elevated risk of schizophrenia among migrants persevering into 2<sup>nd</sup> generation migrants. Across the studies, the authors found a persisting increase in the effect sizes for social defeat in second generation migrants, therefore suggesting a minority position plays a vital role rather than the actual migration process. This elevated risk seems to be attributed to minority disadvantage being passed down to children born into a country of parent who had previously migrated there.

#### ***4.1.3.7 Ethnicity and PLE's***

Ethnic minority has been found to be a risk factor in the development of psychotic experiences. For example, in their meta-analysis, Varese et al. (2012) found ethnic minority status to be related to PLE's. Also, Morgan et al. (2017) using a sample (N=320) of first episode AESOP patients following a 10-year longitudinal assessment (baseline N=532) found ethnicity to be related to increased psychosis. In comparison to whites, black Caribbean patients had elevated negative symptoms and greater severity of psychosis symptoms in comparison to whites. However, using a

sample (N=5427) of adolescents from a Chinese general population data set, Sun et al. (2015) found no relationship between PLE's and ethnicity.

#### ***4.1.3.8 Cannabis use and PLE's***

Research suggests that changes in the mesolimbic dopamine system leading to an increased expression of psychotic experience have been shown in individuals who have experienced social defeat, childhood adversities, and consumed cannabis during adolescence (van Os, Kenis & Rutten, 2010). For example, other researchers have proposed that childhood trauma and cannabis use are a cause and effect phenomenon. As such, individuals who experiences childhood trauma may consume cannabis but unlike those who haven't experienced childhood trauma may experience psychotic symptoms because of prior psychological disturbances (Houston, Murphy, Shevlin, & Adamson, 2011). For example, Morgan et al. (2014) assessed the cumulative odds of elevated psychosis in those who consume cannabis with a history of abuse. They found increased likelihood of over 5 and a half times (OR=5.54) increased psychosis in those who consumed cannabis with histories of abuse. The likelihood was more than 50% less for those with history of abuse only (OR=2.04) and who consumed cannabis but did not experience abuse (OR=2.04).

#### **4.1.4 Cumulative Adversities (Childhood Trauma and Social Defeating Adversities) & PLE's**

The processes involved in pathway from adversities to psychotic experiences across the psychosis phenotype are complex, relative to the numerous types of adversities, the interplay between them, and the involvement of other risk factors. Research suggests there is a dose-response relationship for the number of adversities experienced and the likelihood of psychotic-experiences in both clinical and non-clinical populations (Varese et al., 2012; Wickham & Bentall, 2013). For example,

cumulative traumas in childhood increase the likelihood of psychopathology in comparison to one in isolation (Evans et al., 2013; Reeder et al., 2017). Therefore, it is necessary to elucidate further risk factors that may play an additional role in the emergence of psychotic-experience following a history of childhood trauma, such as later adversities (Beards & Fisher, 2014). Empirical studies have provided evidence suggesting cumulative adversities elevated the risk of experiencing psychotic experiences across the psychosis phenotype in both healthy individuals and those along the spectrum to the severe end displaying psychotic disorder (Morgan et al., 2014a; 2014b; Bentall, 2012; Kelleher, 2013; Read & Mayne, 2017). Previously, research predominately focused on higher risk traumas such as childhood neglect, sex, physical and emotional abuse. However, recent advancements in studies have sought to focus on a broader range of adversities (Longden, Sampson & Read, 2016).

There is vast epidemiological evidence to suggest the cumulative effects of adversities increase the development of PLE's. For example, exploring stressful life events in adulthood and the emergence of psychotic-like experiences, Beards et al. (2013) conducted a meta-analysis using 16 publications over the past 44 years. They found 14 of the studies provided evidence of a link between adversities in adulthood and inception of psychotic like experience, with findings that over a dozen studies included in this meta-analysis revealed an odd ratio of 3.2 increased likelihood of re-experiencing adversity later and the development of psychosis. (OR=3.19: 95% CL 2.15-4.75). Despite ongoing accumulation of epidemiological evidence on childhood trauma and subsequent experiences of psychosis (Varese et al., 2012), there is a void in research assessing patterns of traumatic life adversities later in life following early adversities (Beards et al., 2013).

In an empirical study, Morgan et al. (2014a) captured the link between the synergistic effects of childhood trauma combined with later adversities and the relationship to psychotic-experiences. Using a general population community health study (SELCoH) carried out in south-east London (N=1680), the authors found cumulative trauma increased the likelihood of experiencing psychotic-experiences. Firstly, experiencing both physical abuse and sexual abuse increased the likelihood of experiencing psychotic-experiences. The adjusted OR for physical abuse and sexual abuse were found to be (adjusted OR 2.17-2.13) increasing in likelihood (adjusted OR= 3.24) when combined. Additionally, when childhood traumas were preceded by further adversities, the likelihood of experiencing psychotic symptoms increased for each adversity by 30 percent. As such, the additive effects of traumatic experiences outweigh in terms of how it leads to problems later in life. Also, extending on their previous work, authors (Morgan et al., 2014b), used a case control sample of patients with first episode psychosis (N=390) and controls (N=391) to assess the synergistic effect of childhood disadvantage and later adult adversities. Their findings suggest an increase in the risk of psychotic disorder due to cumulative social disadvantage.

Quite recently, to unfold links that are involved in transitioning across the psychosis phenotype spectrum and a history of exposure to childhood trauma in those who have experienced discrimination, Stowkowy et al. (2016) found individuals with high risk to psychosis displayed high risk to transitioning to disorder in those who reported perceived discrimination. Findings uncovered that over 50% of the group (N=764) had a higher chance of reaching clinical threshold of psychosis. Interestingly, results from the study found no significant link between childhood traumas and elevated risk to transitioning to psychotic disorder, highlighting the additive role of discrimination following childhood trauma.

Recently, combining childhood traumatic events with recent exposure to stress, Mansueto and Faravelli (2017) found a stronger relationship for psychosis risk. Using a sample of psychotic patients (N=78) and controls (N=156) the authors found an additive effect of trauma in childhood and stress that occurred in more recent times linked to increased risk of psychosis in comparison to childhood trauma alone. Those with multiple or more recent adverse events were found to have over 11 times increase likelihood of psychotic disorder (OR=11.60, 95% CI=2.83-47.41). Also, the cumulative effect of both recent adversities and early childhood trauma increased the variance explained ( $R^2$ ) from 32% to 37%. The authors suggest being exposed to social adversities increases the risk of developing psychosis, with an additive effect for those with histories of childhood traumas. There was a dose response relationship between numbers of trauma exposure and elevated risk to psychosis. In addition, the authors uncovered findings of a direct link for both childhood trauma and psychosis, and a direct link between recent social adversities and psychosis irrespective of having been exposed to childhood trauma.

Also, Kraan, Velthorst, Smit, de Haan and van der Gaag (2015) performed a meta-analytic review (6 studies) on adversities and recent life stress on individuals at ultra-high risk to psychotic disorder. They found the average prevalence risk of childhood trauma to be almost 87% in ultra-high-risk samples. Also, there was a decrease in recent adversities in those with ultra-high risk than controls, and furthermore, recent adversities were not related to transition to psychotic disorder.

The complex nature due to the high comorbidity of disorders and symptoms and the processes involved in linking adversities to psychosis is an on-going challenge in research attempting to uncover the precise pathways from adversities to psychotic-



experiences across the spectrum of the psychosis phenotype (Bentall et al., 2014). For example, evidence of the cumulative effects of multiple adversities was revealed in a recent study (Read & Mayne, 2017). The authors used patient data files from a New Zealand child and mental health service (CAMHS). The findings suggest a diverse range of adversities (N=14) in childhood predict adverse mental health. Also, findings suggest if the study relied on diagnosis (N=20), 90% of the diagnosis would have been ruled out according to adversities. When the focus was on symptoms (N=38) alone, more than one-third of symptoms were related to one or more adversities. Also, if diverse range of adversities had been omitted, specific symptoms would have been missed. For example, negative symptoms were related to poverty, and disorganised symptoms were related to childhood neglect. The authors suggest further assessment not restricted to diagnosis and few specific adversities, but to an array of rigorous assessments of diverse adversities and symptoms, which is necessary for intervention and prevention of further mental health issues in those with histories and ongoing adversities.

There is widely reported evidence that cumulative adversities are common in other disorders, such as complex PTSD. For example, authors, Cloitre et al. (2009), found a similar pattern when assessing the cumulative nature of adversities and complex PTSD symptoms. The authors assessed the relationship between combined histories of traumas in clinical groups of both adults (N=582) and children (N=152). The cumulative effect of traumas in the adult sample was related to increased complex PTSD symptoms. However, only when cumulative childhood traumas were included. Also, cumulative childhood trauma was found to be related to symptom complexity in the child sample. Each trauma experienced increased likelihood of experiencing more symptoms increased (OR=1.17 95% CL 1.00-1.37). Noteworthy, almost 17% of

the children assessed were exposed to a staggering 6 or more types of trauma. Furthermore, Cloitre and colleagues demonstrate childhood traumas and cumulative adversities are related to other disorders, therefore evidence of the correlation of social adversities across different disorders.

#### **4.1.5 Specific Adversities and Specific PLE Dimensions**

Findings suggest that childhood trauma is more specifically related to certain types of disorders, symptoms/experiences, or certain PLE dimensions, with general population data showing links between trauma and increased PLE's. However, to date much of the studies have focused trauma and specific symptoms, such positive and negative symptoms, therefore research on the specific dimensions requires further research. Of the few studies, prior research has revealed a link between specific abuse types particularly related to positive symptoms (Velikonja et al., 2015; Wickham & Bentall., 2016; Van Dam et al., 2015; Ajnakina et al., 2016). For example, Velikonja, and colleagues (2015) found a relationship between exposure to childhood trauma and experiencing more positive symptoms. The authors carried out a systematic literature review dated from 1806 to 2013 uncovering over 17000 articles, however only 25 studies were eligible for the review. The findings suggest all forms of childhood trauma were linked to positive, negative and disorganised experiences. The strongest relationship was found between traumas and positive experiences. Also, assessing traumatic experiences and specific dimensions of symptoms in a sample of first occurrence patients (N=236), authors, Ajnakina et al. (2016) found a link between physical and sexual abuse and positive symptoms of psychosis.

Similarly, Wickham and Bentall (2016) found evidence of a dose-response relationship between the co-occurrence of childhood traumas and specific adversity types and symptoms of psychosis. Using a sample of patients with schizophrenia (N=72) and a control sample (N=72), the authors found individuals who experienced 3/4 traumas were almost 4 times more likely to have schizophrenia (OR=3.93), this increased for those who experienced 5/6 traumas to almost 8 times (OR 7.8), indicative of a dose-response association. Sex abuse was specific to hallucinations and emotional neglect specific to paranoia. Therefore, both symptoms correlating with positive symptoms.

Others, Van Dam et al. (2015) found significant associations between positive PLE's and both abuse and neglect. Using a longitudinal sample as part of the Genetic Risk and Outcome of Psychosis Project, they assessed psychotic patients (N=1119), their siblings (N=1057) and control sample (N=589) on histories of specific childhood traumas and psychotic symptoms. Their findings suggest a dose-response relationship between both negative and positive sub-clinical psychotic experiences and childhood traumas (abuse and neglect). More specifically, they found abuse to be related to more positive experiences than negative, and neglect to be equally related to positive and negative symptoms.

Assessing the relationship between childhood trauma and transition from ultra-risk psychosis to full blown psychotic-disorder, Kraan et al. (2015) used a sample of ultra-high risk (UHR) individuals (N= 125) assessed at baseline and follow-up two years later. Findings revealed just over 20% transitioned to psychosis, however, this was not related to a history of childhood trauma. However, positive attenuated symptoms were found to increase over time. Also, the authors carried out further analysis suggesting psychotic symptoms to be specifically related to emotional

abuse, emotional abuse was positively associated with increased severity of negative symptoms. Moreover, overtime the relationship between emotional neglect and general symptoms remained but no longer a relationship for negative symptoms.

In relation to specific traumas and disorganised dimension, authors (Powers, Thomas, Ressler & Bradley, 2011) used a sample (N=541) of individuals from a primary care clinic to assess child trauma (emotional, physical and sexual abuse) and PTSD across dimensions of schizotypal PD. The authors found an association between all abuse types and symptoms, however emotional abuse was the only unique predictor of disorganised symptoms. Also, further analysis revealed PTSD partially mediated the relationship between emotional abuse and symptoms.

#### **4.1.6 Rationale and Current Hypothesis**

The relationship between an array of specific types of cumulative adversities and PLE's have not been studied extensively. Moreover, adversities assessed to date vary in severity and nature, except for the four main child trauma types. However, there is empirical evidence of a link established in several studies using both clinical and non-clinical populations. There are many interlinked explanations, however no theory fits exclusively. Therefore, advancements using more stringent techniques into specific pathways are necessary in future research to explain the processes of social explanations and psychotic experiences across the general population. For example, in comprehensive review (Bentall et al., 2014), the authors challenge theoretical accounts of mechanisms involved in the pathways from adversities to psychosis, suggesting several avenues research needs to take to further uncover the mechanisms involved in the pathways to psychosis.

The authors suggest lack of specification leads to lack of reliable and valid research. The authors discuss several valid points suggesting reasons for a union

between categorical diagnostic approaches and dimensional perspectives. Firstly, Bentall and colleagues (2014) point out the high correlation between disorders and secondly, their links to social adversities is partially responsible for complications across empirical research and thus requires advanced research to pin-point the routes that lead from adversities and psychotic-experiences.

One such study provides evidence for the high comorbidity between childhood traumas across a range of disorder. For example, authors, (van Nierop, Lataster, Smeets, 2014) carried out a study using Netherlands Mental Health Survey and Incidence Study (NEMESIS-2), a Dutch general population with a sample size of 6646 participants. Of those participants (N= 1577, 1120, 825) had a lifetime diagnosis of mood, anxiety, and psychosis respectively. The authors assessed childhood trauma and firstly each disorder separately. Secondly, CT was assessed with all the disorders combined. The findings suggest the relationship between the combined effects of all disorders were significantly stronger than the unique association of the disorders. The schizophrenia sample revealed that those with a history of childhood trauma had a greater likelihood of several symptoms compared to those with no history of childhood trauma. Furthermore, cannabis was found to play a mediating role between childhood trauma and psychotic experiences.

#### **4.1.7 Gaps in the literature and how this will be addressed in Chapter 4**

Acknowledging the research gaps outlined above the present chapter will assess the combination of two different types of adversities, and whether cumulatively they will have increased effect of PLE's in a general population sample above and beyond childhood trauma and social defeating experiences on their own. Therefore, the effects will be assessed uniquely and subsequently cumulatively in one model. The present chapter will evaluate a model construct relationship in two stages; firstly,

all childhood trauma variables, social defeating and demographic variables will be modelled separately with the three PLE dimensions uncovered in the confirmatory factor analysis in chapter 3 (negative, positive and disorganised), and secondly, simultaneously in a second stage multivariate regression model. It is hypothesised combining adversities simultaneously will improve the model significantly in comparison to single groups, suggesting that a multitude of adversities will have a greater effect on experiencing psychotic-like experiences.

As previously outlined, subjection to trauma is often experienced in multiple rather than isolated events (Finkelhor et al., 2007). Also, trauma in childhood followed by further adversities increases the likelihood of experiencing psychotic symptoms in both clinical and non-clinical populations (McGrath et al., 2017; Morgan et al., 2014a; 2014b). Therefore, in accordance with empirical evidence to date, and suggestions to explore different avenues, the present chapter will explore findings using different adversity types to assess the combined effects of childhood trauma and emergence of trauma or adversities later in life. Thus, in the context of the research established to date, the present analysis aims to assess such links using an array of variables not previously assessed together in a large general population sample. As such, the current study predicts multiple traumatic events; childhood trauma and social defeating experiences will increase the likelihood of experiencing psychotic phenomena, firstly each on their own, and secondly, in combining all such adversities, it is hypothesised this will increase the amount of variance explained for each of three PLE dimensions. It is hypothesised that the cumulative effect of social adversities and/or traumas will increase the explained variance for the three PLE dimensions in the present general population sample.

In summary, the present chapter attempts to fill a noteworthy gap in the literature to uncover further mechanism involved in the pathways to psychotic experiences. Building on existing research through assessment of the relationship between an array of specific types of adversities (childhood traumas and social defeating experiences) both separately and cumulatively. The outcome will add to the extant literature by strengthening the reliability and validity of a multitude of specific adversities and their links that potentially merge to psychotic experiences. In addition, through establishing specific mechanisms involved whether through specific or cumulative adversities will aid future research in how best to apply the most appropriate intervention or preventions.

## **4.2 Method**

### **4.2.1 Measures**

#### ***4.2.1.1. Psychotic-like Experiences***

Sixteen items were taken primarily from Section 10, 'Usual Feelings and Actions', of the AUDADIS-IV which served as the outcome variable in the present chapter. Refer to table 2.1 (chapter 2) to view the items that were selected for the present analysis. All NESARC Wave 2 respondents were asked a series of questions to assess PLE's; they were asked about how they felt or acted most of the time throughout their lives. Items were recoded into binary variables in which subjects either endorsed the screener question and the specific symptom (1) endorsed or (0) did not endorse screener question or specific symptom (0).

#### ***4.2.1.2 Demographics***

Sex was recoded into male (1) and female (0). Ethnicity/Race included five categories; (1) white, non-Hispanic, (2) Black, non-Hispanic, (3) American,

Indian/Alaska Native, (4), Asian/Native Hawaiian/other pacific islander, non-Hispanic, (5) Hispanic, any race. In the present thesis, these responses were recoded into dichotomous variables: (0) for white (1) for all other responses. Also, migration was recoded into a binary variable (0) U.S citizen and (1) migrants.

Marital Status included 6 categories, (1) married, (2) living with someone as if married recoded into (0) representing having a partner and (3) widowed, (4) divorced, (5) separated (6) never married recoded into (1) representing single status.

Education was defined as highest grade or year of school completed and comprised of 14 responses which were grouped accordingly and categorised into 2 variables (0) higher educational attainment (1) low educational attainment

For the present analyses, a dichotomous lifetime employment variable was created; (1) If respondents endorsed never worked (0) if respondents endorsed employed in lifetime, and similarly, cannabis use was defined as (1) cannabis use disorder in lifetime (0) no cannabis use disorder (-99) cannabis dependence with or without abuse.

#### ***4.2.1.3 Childhood traumas***

Childhood trauma questions were selected from Section 13: Background information part 3 of the NESARC wave 2, and consisted of questions related to neglect, emotional, physical, and sexual. NESARC wave 2 items on childhood trauma were taken from the AUDADIS-IV and modelled from the Adverse Childhood Events study (Dong et al., 2003; Dube et al., 2003). These items first appeared in the Childhood Trauma Questionnaire (CTQ) (Bernstein et al., 1994; Wyatt, 1985) and in the Conflict Tactics Scale (CTS) (Straus, 1979; Straus & Gelles, 1990). Refer to Chapter 2, section 2.2.3 for a detailed description of the measures used for childhood trauma.



#### ***4.2.1.4 Social Defeating Experiences***

The NESARC made use of questions taken from the Experiences of Discrimination scales (EOD). These scales were developed by Krieger et al to assess discrimination because of sexual orientation, race/ethnicity, and gender. The NESARC expanded on the original to include weight, religion, and physical disability discrimination (Krieger & Sidney, 1997; Ruan et al., 2008; Krieger, 1990; Krieger & Sidney, 1996; Krieger, Smith, Naishadham, Hartman, Barbeau, 2005) and showed good internal reliability ( $\alpha = 0.76$ ). Previous studies for this scale showed good test-retest reliability (0.79). (Janssen et al., 2004). NESARC, Wave 2, Putative Risk Factors, under ‘discrimination scales’, addressing perceived experiences of discrimination for each of the following: physical disability, sexual orientation, religion, weight, race, and gender. Refer to Chapter 2, section 2.2.4 for a detail description of the variables used in the present study measuring social defeating experiences.

#### **4.2.2 Statistical Analysis**

The analysis was conducted in two stages. A multivariate regression model was specified and estimated using Mplus 7 (Muthen & Muthen, 2012). The predictor demographic variables were gender, age, ethnicity, whether the respondents were migration or not, cannabis use, employment, and education. The independent variables for childhood trauma were neglect, emotional, physical and sex abuse. In addition, the independent variables for social defeating experiences were disability, religion, weight, race, and gender and sex orientation. Furthermore, the dependent variables were scores on the negative, positive, disorganized PLE dimensions. This model was estimated separately for each trauma type and social defeating variables

and covariates separately, and secondly, in a second stage model incorporating all predictor variables. As such, a cumulative adversity model including all variables were compiled in one model to assess if there would be increased effects over each separate group of traumas.

#### 4.4 Results

Of the 34,653 NESARC respondents in Wave 2, 1534 respondents were classified as meeting the criteria for PLE's. Also, 85% of respondents were migrants. The sample consisted of 58% females, 42% males, 58% of the respondents were white, and 41.8% other. 51% of respondents were married, 13.3% were divorced and 19.2% of single status. In addition, 36.5% completed high school, 35.5% had obtained college degree, 21.5% had some college education and 6.7% had less than high school educational attainment. Also, 15.8% of the sample had lifetime unemployment, and 7.3% of respondents were lifetime cannabis users. The PLE items, childhood traumas and social defeating experiences and demographic response frequencies are shown in Tables 4.1-4.4.

Refer to chapter 3 for the frequency of endorsement of each question related to positive, negative, and disorganised PLE's. As shown, the negative PLE item 'Have there been very few people that you're really close to outside of your immediate family?' was the most prevalent PLE (32.1%), followed by the item in the positive dimension 'Have you had the sense that some force is around you, even though you cannot see anyone?' with 18.6% of respondents endorsing this item.

#### **Table 4.1**

*Frequency and rate of Individual Childhood Traumatic Experiences before age 18 (NESARC N=34653)*

---

<b>Childhood Traumatic Event</b>	<b>Frequency (N)</b>	<b>%</b>
<b>Neglect</b>		
Chores too difficult/danger	3626	10.5
Alone unsupervised before 10	1170	3.4
Go without things needed	548	1.6
Go hungry	305	0.9
Ignore treatment when ill	264	0.8
<b>Emotional abuse</b>		
Swear, insults, say hurtful	1351	3.9
Threaten to hit you or throw something at you	814	2.3
Make you fear you would be physically hurt	732	2.1
<b>Physical Abuse</b>		
Push, grab, shove, slap or hit	3828	11
Hit you so hard that you had marks or bruises	2451	7.1
<b>Sexual Abuse</b>		
Fondle/touch in a sexual way when you didn't want this	1321	3.8
Have you touch them in a sexual way	919	2.7
Attempt sexual intercourse with you	653	1.9
Have sexual intercourse when you didn't want this/too young to know	893	2.6

**Table 4.2**

*Frequency and rate of Individual Social Defeating Experiences variables in the NESARC (34,653)*

<b>Social defeat type</b>	<b>Frequency N</b>	<b>%</b>
<b>Physical Disability</b>	728	2.1
<b>Sexual Orientation</b>	165	0.5
<b>Religion</b>	1057	3.1
<b>Gender</b>	2929	8.5
<b>Race</b>	3530	10.2
<b>Weight</b>	1264	3.6

Table 4.1 shows that 0.8-10.5 % of respondents in the NESARC, Wave 2 experienced at least one form of childhood trauma at or before the age of 18. The highest rates of individual childhood traumatic experience involved neglect due to ‘being endangered by tasks or subjected to chores that were too difficult’ (10.5%), followed by physical abuse ‘being hit so hard it left bruises or marks’ (7.1%). Also, 2.6% were raped, and 1.9% reported having experienced attempted rape before the age of 18.

Table 4.2 shows the prevalence of respondents in the NESARC Wave 2 reporting social defeat due to perceived discrimination ranged from 0.5% for sexual orientation, 2.1% for disability, 3.1% for religion, 3.6% weight, gender 8.5% and the highest rate for race at 10.2%.

**Table 4.3**

*Crosstabulated frequencies, expected counts and percentages and chi-square statistics of Negative, Positive & Disorganised PLE's by Childhood Trauma (N=34,653) s*

<b>Child Trauma variables</b>		<b>Negative</b>	<b>Positive</b>	<b>Disorganised</b>
<b>Neglect-yes</b>	Count (%)	3623(21.9%)	2504(23.8%)	1647(27.5%)
	Std.Residual	15	16.8	19.5
	$\chi^2$ (df)	8698.36(4) *	7205.17(4) *	6163.68(4)
<b>Emotional-yes</b>	Count (%)	1868(11.3%)	1428(13.6%)	1033(17.2%)
	Std.Residual	13	18.5	23.8
	$\chi^2$ (df)	9937.62(4)	7984.97(4) *	7342.46(4) *
<b>Physical-yes</b>	Count (%)	3817(23%)	2715(25.8%)	1778(29.7%)
	Std.Residual	14.9	18.6	21
	$\chi^2$ (df)	11054(4) *	8076(4) *	7377.29(4)
<b>CSA-yes</b>	Count (%)	2283(13.8%)	1841(17.5%)	1130(18.9%)
	Std.Residual	11.1	20.5	18.6
	$\chi^2$ (df)	7826(4) *	6346.86(4)	5382.65(4)

\*(p<0.05)

**Table 4.3.1**

*Standardized regression coefficients for childhood trauma predictors on Negative, Positive and Disorganised PLE's(N=34,653)*

	<b>Negative</b>	<b>Positive</b>	<b>Disorganised</b>
<b>Neglect</b>	0.13 *	0.08 *	0.09 *
<b>Emotional</b>	0.06*	0.09*	0.06*
<b>Physical</b>	0.10*	0.08*	0.08 *
<b>Sex Abuse</b>	0.10*	0.10*	0.15*
<b>R<sup>2</sup></b>	0.07*	0.06*	0.07*

\*(p<0.05)

Results from the multivariate regression analysis of childhood trauma, showed the total variance explained by the predictor variables did not vary in relation to the cumulative R<sup>2</sup> (0.06% 0.05% 0.06%) for negative, positive and disorganized PLE's, respectively. All variables made a significant contribution to the total variance

explained for all three sub-scales of the PLE's ( $p < 0.00$ , respectively). In addition, results from the multivariate regression analysis of social defeating experiences, showed that the total variance explained by the predictor variables did not vary in relation to the cumulative  $R^2$  (0.04%, 0.04%, 0.03%) for negative, positive, and disorganized PLE's, respectively. All variables made a significant contribution to the total variance explained for all three sub-scales of the PLE's ( $p < 0.00$ , respectively).

**Table 4.4**

*Crosstabulated, expected counts and percentages and chi-square statistics of experiences of Negative, Positive & Disorganised PLE's by social defeat variables (N=34,653)*

<b>Social Defeat</b>		<b>Negative</b>	<b>Positive</b>	<b>Disorganised</b>
<b>Disability-yes</b>	Count (%)	455(2.7%)	300(2.9%)	230(3.8%)
	Std.Residual	5.7	5.3	9.3
	$\chi^2$ (df)	93.09(4) *	74.57(4) *	111.99(4) *
<b>Religion-yes</b>	Count (%)	605(3.7%)	460(4.4%)	293(4.9%)
	Std.Residual	4.4	7.8	8.2
	$\chi^2$ (df)	44.205(4) *	102(4) *	107.135(4)
<b>Weight-yes</b>	Count (%)	734(4.4%)	460(4.4%)	331(5.5%)
	Std.Residual	5.3	7.5	7.6
	$\chi^2$ (df)	68.74(4)		73.18(4)
<b>Race-yes</b>	Count (%)	2029(12.3%)	1474 (14.2%)	1005(16.8%)
	Std.Residual	8.3	12.3	16
	$\chi^2$ (df)	193.24(4)	285.40(4) *	386.39(4) *
<b>Gender-yes</b>	Count (%)	1721(10.4%)	1227(11.7%)	846(14.15%)
	Std.Residual	8.6	11.4	15.1
	$\chi^2$ (df)	238.19(4)	293.59(4) *	377.51(4)
<b>Sex Orient-yes</b>	Count (%)	102(0.6%)	87(0.8%)	70(1.2%)
	Std.Residual	2.6	5.2	7.8
	$\chi^2$ (df)	21.04(4)	40.75(4) *	84.78(4) *

\*( $p < 0.05$ )

**Table 4.4.1**

*Standardized regression coefficients for Social Defeat predictors on Negative, Positive and Disorganised PLE's (N=34,653)*

	<b>Negative</b>	<b>Positive</b>	<b>Disorganised</b>
<b>Disability</b>	0.06*	0.05*	0.05*
<b>Religion</b>	0.03*	0.04*	0.05*
<b>Weight</b>	0.07*	0.04*	0.05*
<b>Race</b>	0.10*	0.10*	0.07*
<b>Gender</b>	0.09 *	0.11 *	0.09*
<b>Sex Orientation</b>	0.04*	0.04*	0.04 *
<b>R<sup>2</sup></b>	0.04*	0.04*	0.03*

\*(p<0.05)

Tables 4.1, 4.2, and 4.3 show the frequencies, percentages, and chi-square statistics by respondents for PLE's (negative, positive and disorganised) by childhood trauma type, social defeat, and demographic risk variables, respectively. The unstandardized regression coefficients and model statistics are reported in tables 4.3.1, 4.4.1, and 4.5.1 for childhood trauma, social defeating experiences and demographic risk factors, respectively. Additionally, findings for the negative dimension of PLE's suggest being female, of ethnic minority, migration, single status, cannabis use, and unemployment were all significantly positively related. For the positive dimension of PLE's, it was found being female, and lower educational attainment, were all significantly positively related (see table 4.5.1).

Results from the multivariate regression analysis for the 1<sup>st</sup> Model for demographic variables, showed that the total variance explained by the predictor variables did not vary in relation to the cumulative R<sup>2</sup> (0.07%, 0.08%, 0.04% for negative, positive, disorganized dimensions of PLE's, respectively). It was found that age and ethnicity made a significant contribution to the total variance explained for negative and positive PLE dimensions. Also, gender made a significant contribution to the total variance explained for all three dimensions. It was found migration and marital status both contributed significantly to the model. There was an inverse relationship between negative and positive PLE's for educational attainment, however, the disorganized PLE dimension showed a positive significant association. Employment was the only significant variable for positive PLE's, and cannabis use was significantly positively associated with all three PLE dimensions.

**Table 4.5**

*Crosstabulated frequencies, percentages, standard residuals and chi-square statistics of Negative, Positive & Disorganised PLE's by demographics*

Demographics		Negative	Positive	Disorganised
<b>Male</b>	Count (%)	7462 (45%)	4200(40%)	3016(50.3%)
	Std.Residual	6.0	-3.2	9.9
<b>Ethnicity-other</b>	Count (%)	7578 (45.8%)	4950(47.1%)	2557(42.7%)
	Std.Residual	7.8	8.4	1.0
	$\chi^2$ (df)	208.4 (2) *	186.60 (2) *	<b>3.69(2)</b>
<b>Migration-no</b>	Count (%)	2433 (14.7%)	1531(14.6%)	557(9.3%)
	Std.Residual	-2.6	-2.4	-12.2
	$\chi^2$ (df)	285.52 (4) *	189.55(2) *	387.80(4) *
<b>No Partner</b>	Count (%)	8118 (49%)	5179(49.3%)	3295(55%)
	Std.Residual	6.6	5.7	10.8
	$\chi^2$ (df)	207.91(2) *	141.42(2) *	317.51 (2) *
<b>Low Educ</b>	Count (%)	1095(6.6%)	553(5.3%)	291(4.9%)
	Std.Residual	110	704	401
	$\chi^2$ (df)	50.78 (2) *	108.76(2) *	78.83 (2) *
<b>Unemployed</b>	Count (%)	2607(15.7%)	1405(13.4%)	780(13%)
	Std.Residual	-0.1	-6.2	-5.4
	$\chi^2$ (df)	78.40 (2) *	137.28(2) *	157.37(2) *
<b>Cannabis</b>	Count (%)	1423 (8.6%)	993(9.5%)	776(13%)
	Std.Residual	6.0	8.1	16
	$\chi^2$ (df)	76.96(2) *	101.88(2) *	339.86(2) *

\*( $p < 0.05$ )



**Table 4.5.1**

*Standardized regression coefficients for demographic predictors on Negative, Positive and Disorganised PLE's(N=34,653)*

	<b>Negative</b>	<b>Positive</b>	<b>Disorganised</b>
<b>Age</b>	-0.06*	-0.02*	-0.12*
<b>Gender</b>	0.08*	-0.05 *	0.12*
<b>Ethnicity</b>	0.14*	0.13*	0.04 *
<b>Migration</b>	-0.08*	-0.03*	-0.12*
<b>Martial St</b>	0.12*	0.09*	0.12*
<b>Education</b>	0.03*	-0.04*	<b>0.00</b>
<b>Employment</b>	0.04*	-0.04*	<b>0.01</b>
<b>Cannabis</b>	0.07*	0.09*	0.10*
<b>R<sup>2</sup></b>	0.05*	0.08 *	0.04 *

\*( $p < 0.05$ )

### **Stage 2 Multivariate analysis (Cumulative Adversity Model).**

Table 4.6 shows standardised estimates, standard errors, and significance for all three groups of predictor variables simultaneously included in the model. The total variance explained by the predictor variables varied from the first model revealing 15%, 15%, 12%, for negative, positive, and disorganised PLE's, respectively. All demographic variables were associated with PLE's excluding ethnicity, educational attainment and employment and their relationship to the disorganised PLE's. Also, age and migration and their link to positive PLE's made a significant contribution to the total variance explained for all three dimensions of PLE's ( $p < 0.00$ , respectively). For the negative PLE dimension, all variables excluding social defeating experiences because of religion and sex orientation preference made a significant contribution to the total variance explained for all three PLE dimensions ( $p < 0.00$ , respectively).

As shown in table 4.6, physical abuse revealed the strongest estimates and significantly associated with the three PLE dimensions. Also, similar findings were found for sexual abuse. Next, neglect and emotional abuse both showed very weak but significant effect sizes. Also, the social defeat variables contributed significantly to the model showing the largest effect sizes when compared to all other variables in the model. Additionally, in the second model cannabis had a significant effect on the three PLE dimensions, and no significant effect for social defeating experiences because of religion and negative and disorganised PLE dimensions. In addition, no significant effect for educational attainment and the positive dimension of PLE's and no significant effect was shown for employment and the disorganised dimension of PLE's.

**Table 4.6**

*Standardised regression coefficients (SE) for CT, SD, and demographics on Negative, Positive & Disorganized PLE's*

	<b>Negative</b>	<b>Positive</b>	<b>Disorganised</b>
<b>Age</b>	-0.05 *	<b><i>0.00</i></b>	-0.11*
<b>Sex</b>	0.12*	-0.02 *	0.15*
<b>Ethnicity</b>	0.13 *	0.12*	0.02
<b>Migration</b>	-0.13 *	<b><i>-0.01</i></b>	-0.11*
<b>Marital Status</b>	0.12*	0.08*	0.12*
<b>Education</b>	0.03*	-0.04*	<b><i>-0.01</i></b>
<b>Employment</b>	0.04*	-0.03 *	<b><i>0.01</i></b>
<b>Cannabis</b>	0.04*	0.06*	0.07*
<b>Disability</b>	0.04*	0.03 *	0.03*
<b>Religion</b>	<b><i>0.01</i></b>	0.03*	0.03 *
<b>Weight</b>	0.06*	0.03 *	0.03*
<b>Race</b>	0.06*	0.05*	0.07 *
<b>Gender</b>	0.06*	0.07*	0.07*
<b>Sex Orientation</b>	0.01 *	0.03*	0.02*
<b>Neglect</b>	0.11 *	0.08 *	0.08*
<b>Emotional abuse</b>	0.05*	0.05 *	0.07*
<b>Physical Abuse</b>	0.09 *	0.07*	0.07*
<b>Sex Abuse</b>	0.10*	0.13 *	0.10 *
<b>R<sup>2</sup></b>	0.15*	0.15*	0.12*

\*( $p < 0.05$ )/ ***bold italics (non-significant)***

## **4.5 Discussion**

### **4.5.1 Main Findings**

The present chapter investigated the relationship between childhood trauma, social defeating experiences and PLE's using a large healthy population of adults from wave 2 of the National Epidemiological Survey on Alcohol and Related Conditions (NESARC). Two multivariate regression models were specified, firstly, one assessing specific trauma and adversity types (childhood trauma, social defeating experiences) and risk factors and their relationship to PLE's. Next, a model that combined all the trauma, adversities and risk factors cumulatively into one model and their relationship to PLE's.

Both separate and combined effects of childhood trauma and social defeating experiences and their links to PLE's in a large general population sample were assessed. As such, the current chapter found cumulative adversities; childhood trauma, and social defeating experiences increased the likelihood of experiencing psychotic phenomena when combined in a model. The present findings suggest when adversities and risk factors were combined in the second model, the amount of variance explained increased for all PLE dimensions (table 4.6).

### **4.5.2 Findings in the Context of Previous Research**

The present findings agree with prior empirical research cumulative traumas outweigh singular traumas in their relationship to increasing psychotic symptoms (Shevlin et al., 2008; Morgan et al., 2014a; Morgan et al., 2014b).

Therefore, acknowledging suggestions proposed by Bentall et al. (2014) on further elucidating mechanisms involved in the pathways to psychosis, the present

chapter assessed the combination of two different types of adversities, varying in severity and found the cumulative effects on three separate dimensions of the PLE's increased above and beyond the effects of the adversities alone. Therefore, firstly, the findings pertaining to the effects of singular groups will be discussed, followed by findings according to their cumulative advantage in one model.

#### **4.5.2.1 Specific Childhood Traumas and PLE's**

Firstly, the current findings linking childhood trauma and psychotic-like experiences are in line with previous research, e.g. (Varese et al., 2012; van Winkel et al., 2013; Shevlin et al., 2008). All four childhood trauma types; emotional abuse, neglect, physical abuse, and sexual abuse were significantly related to PLE's (Table 4.3.1). Therefore, the present finding was expected and in agreement with the hypothesis and theoretical assumptions that social explanations, such as trauma in childhood play a role in the aetiology of psychotic phenomenon (Bentall et al., 2012; Shevlin et al., 2007; Catalan et al., 2017). Specifically, sexual abuse was related to the highest estimates over the other trauma types for all PLE dimensions, with the disorganised dimension showing the highest estimates. Also, neglect and increased estimates of the negative dimension were specific. Furthermore, emotional abuse and physical abuse was relatively stable across all dimensions.

The findings in the present chapter partially agree with the social defeat (SD) hypothesis; supporting the assumption that experiences of subordination are linked to psychotic-like experiences (Selten & Cantor-Graae, 2005, 2007; Selten, van der van, Rutten, & Cantor-Graae, 2013; Saleem et al., 2014). Therefore, the present findings partially agree with models of environmental stress that suggest sensitization to social defeating experiences increases the likelihood of psychotic experiences in certain individuals (Selten & Cantor-Graae, 2005; van Winkel et al., 2008).

As expected, the regression coefficients of the effects of the six different types of social defeating variables, namely; subordination because of disability, gender, religion, weight, sexual orientation were significantly related to the PLE dimensions. All types of social defeating experiences combined made a significant contribution to the total variance explained for negative, positive, and disorganised PLE's; and thus, in line with the expected hypothesis (table 4.4.1). Furthermore, all the social defeating predictors followed a positive significant direction. Therefore, the experience of social defeat increased the likelihood of experiencing symptoms of positive, negative, and disorganised PLE's in a large population of healthy individuals. Interestingly, the effect size was greatest for social defeating experiences because of sexual orientation and physical disability. This finding partially agrees with a study by Janssen et al. (2003) suggesting perceived discrimination because of ethnicity, disability, sexual orientation, gender, and age, and their relationship to psychotic experiences. They found a dose-response relationship between perceived discrimination and delusional ideation but not hallucinations, providing evidence that specific psychotic symptoms may be associated with perceived discrimination.

Also, the present findings somewhat agree with findings by authors, Valmaggia et al. (2015) that individuals with high risk to psychosis and experiences of social defeat had high levels of positive symptoms such as paranoid thought when interacting with people. However, it must be noted there have been very few empirical studies on social defeating experiences. Previous studies have focused on perceived discrimination, not social defeat because of discrimination, thus there are very few studies to make a comparison with. Also, the present study assessed dimensions and not specific, therefore it is not known if the estimates of the positive dimension were specific to delusions or hallucinations. Also, the findings are partially in agreement

with authors (Selten & Cantor-Graae, 2005, 2007; Selten, van der van, Rutten, & Cantor-Graae, 2013; Saleem et al., 2014).

#### **4.5.2.2 Demographic Risk Variables and PLE's**

The present findings regarding the relationship of demographic variables and psychotic-like experiences coincide with ongoing research that certain risk factors play a pivotal role in the link to such experiences (table 4.5.1). Females experienced increased positive PLE's whereas males experienced more negative and disorganised PLE's, therefore consistent with prior findings. For example, Morgan et al. (2008) identified a lower prevalence of negative experiences, whereas others (Galderisi et al., 2011) identified a higher prevalence of disorganised and negative symptoms in males. Additionally, younger age had a significant effect on the three PLE dimensions. Consistent with prior research, PLE's are generally associated with younger age. Also, being single resulted in higher estimates for three PLE dimensions, therefore, in line with a vast array of empirical studies; being unmarried is related to lifetime prevalence of PLE's (Linscott & van Os, 2013). Relative to the ethnicity the present findings suggest higher estimates of all three PLE negative and positive dimensions, as expected. Also, U.S citizens rather than migrants had higher levels of PLE's, which was unexpected. Higher educational attainment was uniquely related to the negative PLE dimension. This reiterates previous research suggesting higher IQ and higher education attainment are related to decreased psychotic symptoms (Jhon, Kelleher & Cannon, 2011). Also, higher educational attainment resulted in effects for the positive PLE dimension. However, there was no relationship between education attainment and disorganized PLE's, with findings showing no significance or effect size, which was unexpected. Also, being employed was significantly related to positive symptoms which was unexpected, however unemployment had increased estimates for the

positive PLE dimension, and no significant effect for disorganised PLE's (table 4.5.1). As expected, those who consumed cannabis had increased PLE's for all three PLE dimensions. This reiterates findings in psychosis research on the association between cannabis use and psychotic like experiences (Konings et al., 2011; Morgan et al., 2014b). Furthermore, research has consistently shown that risk factors which have remained consistent as risk factors include being single, alcohol or substance use and being an ethnic minority (Linscott & van Os, 2013). Also, the findings are line with the social defeat theory. Subjection to defeat requires risk factors such as ethnicity, cannabis use, single status in combination with childhood traumas and social defeating experiences relating to disadvantage of being in a minority in society (Selten et al., 2016).

#### **4.5.2.3 Cumulative Adversities and PLE's**

The second stage of the analysis revealed that combining childhood traumas, social defeating adversities and demographic variables simultaneously increased the variance explained, as expected (table 4.6). Thus, as expected the findings are partially in accordance with prior findings (Morgan et al., 2008; 2014a; 2014b) who found that multiple social adversities in early life followed by stressful life events in adulthood elevated the risk for psychotic experiences. However, one such study (Morgan, 2014b) assessed 'disadvantage in childhood' rather than interpersonal traumas such as abuse. Thus, studies that used different types of adversities cannot be directly compared to the present findings. However, the present findings agree with suggestions that using broader models of cumulative adversity increase the likelihood of experiencing psychotic experiences (Longden et al., 2016).



All demographic risk variables remained constant except for ethnicity on the disorganised PLE dimension when combined with childhood traumas and social defeating experiences. For example, the link between predominately black ethnic groups and disorganised PLE's were no longer significant when combined with multiple adversities.

#### **4.5.4 Implications for Research and Future research**

Finding the precise mechanism from cumulative effects of multiple adversities and PLE's presents with difficulties for several reasons due to the complex nature of adversities, the different types of adversities, their intensity and duration of trauma. This challenge and evidence for the cumulative effects of multiple adversities was revealed in a recent study (Read & Mayne, 2017). Such challenges involved in linking adversities to psychosis is an on-going challenge in research attempting to uncover the precise pathways from adversities to psychotic-experiences across the spectrum of the psychosis phenotype, therefore it is important proponents of both perspective work together to achieve the best outcome, that is, essentially the future of those in treatment or in need of intervention prior to transitioning across the spectrum from healthy to warranting clinical intervention (Bentall et al., 2014). As such, high quality longitudinal studies are necessary involving a mixture of adversity types, genetic underpinnings and biological aspects.

Research into the processes involved in the relationship between childhood traumas and the emergence of psychopathologies is imperative with findings to date emerging with mixed results. As such, future research need to further examine a broader range of cumulative adversities, firstly to design protocols for elaborate interventions for victims of child abuse prior to potentially experiencing further adversities, and secondly interventions for adults exposed to an array of adversities

(Bentall, 2014; Read & Mayne, 2017; Bendall, Alvarez-Jimenez, Nelson, McGorry, 2013).

The present findings agree with meta-analytic findings (Varese et al., 2012; Beards et al., 2013; Matheson et al., 2013). Although there are genetic, biological links, the present results point largely towards social explanations, in agreement with suggestions by Bentall et al. (2014). Thus, in agreement with suggestions for a requirement for more specificity of adversity type across disorders. Therefore, a more complex diverse range of adversity types requires further assessment into specific adversities and the psychosis phenotype.

#### **4.5.5 Study Limitations**

There are several methodological limitations associated with the present study. Firstly, the data used was cross-sectional because PLE measures were only added in the second wave of the NESARC. It would be interesting to see whether childhood trauma and experiencing defeat due to minority status increases the frequency and level of PLE's overtime. In addition, under-reporting childhood trauma due to shame, unclear memory, and/or over reporting feelings of perceived discrimination as defeating due to feeling of threat or mistrust because of earlier traumas, or in response to feeling particularly stressful at the time of filling out the survey. However, research assessing social defeating experiences and links to PLE's is under researched. Most studies to date have focused on discrimination, or perceived discrimination, however this needs to be extended to the individual accepting discrimination, thus being social defeated in society. Comparing environmental stress induced on rodents with social defeating experiences in humans can only be hypothetically suggested as a biological

and behavioural response confined to animal studies. However, despite limitations, the following chapter provides a framework for future research. For example, as proposed by Selten and Cantor-Graae (2005; 2013) exposing subjects to experimental studies to measure association between social defeating scenarios and subsequent PLE's by measuring reactivity and stress might provide additional support to existing social defeat research in humans.

#### **4.5.6 Conclusion**

In conclusion, the current chapter has revealed that childhood trauma; physical, emotional, neglect and sexual abuse and social defeating experiences and a range of demographic risk when combined increase the predictive relationship of experiencing PLE's. The following chapter adds to existing literature extending on evidence that social explanations are putative in their role linking adversities and psychotic-like experiences across the psychosis phenotype dimensional spectrum.

The present chapter partially supports the SD hypothesis; being socially defeated has a direct effect on psychotic-like experiences. In addition, the present thesis is in alignment with the dimensional psychosis phenotype using general population sample to assess variations of experiences across the spectrum of normality to severity. Furthermore, this was the first study to simultaneously investigate an array of demographic risk factors, childhood trauma, and social defeat in a large population sample. However, the findings do not infer establishment of causal relationships, only association. The current chapter extends existing literature on social explanations as risk factors for psychotic-like experiences. Furthermore, consistent with psychosis research over the last few decades, the current study further extends upon current literature that the psychosis phenotype is dimensional and psychotic experiences are

evident in general population samples. The next chapter will use an alternative statistical approach (LCA) to identify groups of individuals in the present large general population data set with histories of exposure to varying clusters of adversities (childhood traumas, social defeating experiences, and demographic risk variables). Additionally, specific abuse types and their relationship to specific PLE dimensions will be assessed. This will unearth more specific findings, as suggested in Bentall and colleagues (2014) comprehensive review.

## Chapter 5

# Specific Traumatic Histories and Specific Dimensions of Psychotic-like Experiences: A Person Centered Approach

### Abstract

**Gap in the Literature.** Multiple traumas in childhood and recurrences of adversity later in life, such as social defeating experiences are prevalent, and both have been found to be related to PLE's. Several studies have explored multiple adversity profiles; however, a gap was noted in the literature that no study to date specifically explored profiling histories of childhood traumas and social defeating experiences using a person centered approach

**Aim.** The current chapter purports to assess if the probability of experiencing traumatic events in childhood and later social defeating experiences are evenly distributed in a large healthy population; identifying specific groups of individuals characterised by histories of exposure to varying clusters of traumas and social adversities.

**Method.** A latent class analysis method (LCA) was utilised to uncover the hidden co-occurrence of individual profile histories of childhood trauma and social defeating experiences. Data was derived from Wave II (2004-2005) of the National Epidemiological Survey on Alcohol and Related Conditions; a national representative sample of US adults. Following class assignment, the model was further validated by using multinomial regression on a range of covariates.

**Results and Findings.** A LCA suggested a 5-class solution. These classes displayed evidence of both quantitative and qualitative differences across classes in item endorsement patterns. Results indicate underlying patterns of childhood traumas,

social defeating experiences and demographic risk factors. Three dimensions of PLE's were identified across the 5 groups, with the magnitude of the high-risk traumas associated with increased effect size of experiences. The present findings underpin the clustering of multiple adversities from childhood and later social defeating circumstances. Individuals in the high-risk subgroup endorsed greater exposure to childhood traumas. Additionally, there was a dose-response relationship between severity of adversities and psychotic-like experiences.

**Conclusion:** existing childhood trauma social adversity classes that exist, aids to better protocols for interventions. The present chapter has added to existing research by introducing further insight into mechanisms surrounding traumas and social defeating experiences.

**Contribution to Research.** The findings in the present chapter are a good indication of the importance and practicality for assessing the multiple nature of different types of traumatic experiences, and further social adversities later in life and their association with PLE's in a large population. Furthermore, present findings point towards high levels of childhood trauma that are not linked to social defeating experiences in an ordered fashion, however both childhood trauma and social defeat were significantly associated with symptoms of PLE's at all three sub-levels; negative, positive, and disorganised. This finding contributes to research by pinpointing sub-types of groups as found by latent class analysis detecting cohorts of individuals with specific characteristics that could be used to zoom in specific target populations, and therefore developing interventions or preventative programs.

## 5.1 Introduction to Chapter 5

As explored in the preceding chapter, exposure to single and multiple traumas in childhood and their link to psychotic-like experiences has been established in a myriad of empirical research in both clinical and non-clinical populations (Read & Bentall, 2013; Shevlin, Houston, Dorahy, & Adamson, 2008; Holtzman et al., 2013; Matheson et al., 2013; Varese et al., 2012; Wigman et al., 2012; Read, 2013). However, research examining isolated abuse types fails to consider the adverse effects of additional trauma, therefore underestimating the additive impact it may have on mental health (Cutajar et al., 2010). As such, research has established that specific trauma types in childhood often co-occur, and consequently experiencing multiply traumas increases psychopathologies (Finkelhor et al., 2009; Longdon, Sampson & Read, 2016; Curran et al., 2016).

Also, individuals who have histories of childhood trauma also suffer from re-victimization or later adversities in adolescence or later in life. For example, recently, Schouwenaars, Murphy and Elklit (2016) utilised a Danish sample who took part in a structured interview (N=2980) taken from an original sample (N=4718:2008-2009) of young adults to explore the relationship between childhood trauma and re-occurrence of trauma in late adolescence/young adulthood. The participants were asked 20 questions related to child abuse (sex, physical, emotional, emotional and physical neglect) and 13 questions related to later traumatic events (for example, car accident, fire, interpersonal assault and threat). The findings revealed nearly 9% of individuals were emotionally abused, 2% were sexually abused, and just over 2% endured multiple abuse types (physical, emotional and neglect). Overall, the findings suggest child abuse was directly and indirectly related to increase exposure to later traumatic

events. Furthermore, later adversities increase the psychological impact in those who have a history of trauma intensifying psychotic-like experiences in individuals across the dimensional psychosis phenotype (Morgan et al., 2014a; 2014b).

### **5.1.1 Person Centered Approach-Profiles of Individuals with Histories of Co-Occurring Adversities**

Chapter 4 explored the relationship between traumas in childhood and social defeating adversities and psychotic-like experiences using an array of adversity types, individually and combined. The statistical approach used in the previous chapter focused on variables, rather than individuals (person-centered approach). Using adversity/trauma variables as the unit of analysis, the effect on other variables can be estimated. However, this exploration lacks credential insofar as it does not explore the effect of co-occurring traumas clusters of individuals have experienced collectively and in turn their relationship to psychotic-like experiences. There have been relatively few studies using LCA to explore traumas outside the typical childhood abuse types, and other studies have explored an array of different trauma types, varying in severity. As such, the search to establish routes to possible reasons why traumatic experiences tend to co-occur in certain individuals, and consequent links to their potential to increase psychopathology is surging in psychosis research (Shevlin & Elklit., 2007; Kessler et al., 2010; Armour, Elklit & Christoffersen, 2014; Evans et al., 2013; Morgan et al., 2014a; Morgan et al., 2014b). Therefore, the present chapter hopes to add to existing literature using a person-centered approach to explore histories of traumas in specific groups of individuals with different profiles. The importance of this is invaluable in terms of the correct evaluation from a person centered perspective, essentially because the more defined the processes uncovered to be involved in the



route to psychotic experiences will determine the diagnosis and the best treatments and outcomes necessary for specific individuals seeking treatment or interventions.

### **5.1.2 Specific Adversities and Specific Symptoms**

Research has established that different combinations of traumas or the unique contribution of specific traumas may be linked to specific symptoms or disorders (Bentall et al., 2014; Briggs-Gowan et al., 2013; Hardy et al., 2016). As such, it is often one or more of those traumatic experiences that outweighs in terms of how it leads to problems later in life. However, there is conflicting research regarding multiple traumatic events in childhood and the relationship between psychopathology in adulthood. Shevlin, McElroy and Murphy (2015) found physical and sexual abuse to be related to psychotic disorders. However, they found opposing findings for other psychopathologies, such as PTSD and depression. The authors suggest the importance of measuring frequency and severity of childhood abuse. This finding coincides with suggestions by Bentall et al. (2014) for advancements in research regarding specific adversities and specific pathways to psychosis.

Furthermore, research suggests the severity of the adversity is indicative of how severe the resultant psychopathology will be. The more severe the psychological experience has been found to be linked to psychotic-like experiences in a dose-response relationship. Also, different exposures to traumas or co-occurring traumas or the unique contribution of specific traumas may be indicative or lead to specific symptoms or disorders (Varese et al., 2012; Briggs-Gowan et al., 2013; Houston et al., 2011; Longden et al., 2016).

Authors (Myin-Germeijer et al., 2011; Isvoranu et al., 2017) found associations between PLE's/schizotypy and trauma in childhood. Symptoms were found to be

related to abuse defined in their study as (physical, emotional and sexual abuse) and secondly, neglect. The authors found a dose-response relationship between severity of traumas and severity of psychotic-like symptoms, with an increased relationship between abuse and psychotic experiences when compared to neglect and positive psychotic experiences, with reported odds ratio of 5.53 (OR 5.53, 95% CL 2.04-11.39). Also, their findings revealed abuse types (physical, emotional and sex) were related to the positive dimension, only. However, neglect was found to be related to negative and positive dimensions, with 4 times increased likelihood of experiencing negative symptoms of psychosis because of a history of neglect, and a likelihood of 3.7 times (OR 3.67, 95%, CL1.60-8.41) of experiencing positive symptoms.

### **5.1.3 Latent Class Analysis- Clustering of Specific Trauma Histories**

First introduced nearly half a century ago by Lazarsfeld and Henry (1968) to capture unobserved heterogeneity by allocating individuals into categories based on a series of survey item responses, latent class analysis (LCA) has recently become a popular method to zoom in on the intricate nature of individual experiences of trauma (Berzenski & Yates, 2011). LCA is a person-centred method, therefore clusters groups of individuals into latent classes with the assumption that the association among indicator variables are considered by a class/group variable, thus contrasting with variable centred statistical techniques (Muthen, 2006; 2008; Muthen & Muthen, 2000; 2002). LCA is probabilistic therefore the model can be replicated with an independent sample (Muthen & Muthen, 2000). Furthermore, LCA allows the possibility of including multiple traumatic events a person has been exposed in comparison to single traumatic events, therefore focusing on a person centred rather than a variable centred approach (Collin & Lanza, 2010). It is important to unveil latent classes of co-occurring trauma histories to explore if they have a differential effect on

psychopathology (Cutajar et al., 2010). In the present chapter, to explore if distinct profiles of individuals who have been subjected to similar traumas and adversities exist and their link to PLE's.

LCA is increasingly being utilised to explore heterogeneity in trauma research. With an increasing demand to assess the complex processes that link individual profiles to (for example) symptoms across the dimensional psychosis phenotype, this method is useful primarily for diagnosis and treatments, and interventions prior to transitions across the continuum relative to those with histories of abuse. As such, the last two decades has seen a surge in the application of LCA in psychopathology research. For example, in the period between 2002 and 2013 as indicated by a PsychInfo search there was approximately a 70% increase in LCA mentioned in publications (Wurpts & Geiser, 2014). There has been an increased use of LCA to uncover traumatic life events, or histories of cumulative abuse, such as sexual abuse at an individual level. Most studies have used different sampling characteristics; trauma types, sample sizes, clinical and non-clinical populations, and adult, adolescent and child samples (Berzenski & Yates, 2011; Shevlin et al., 2017; Houston et al., 2011; Shevlin et al, 2012; Shevlin & Elklit, 2008; Curran et al., 2016).

To explore studies to date that used LCA to uncover classes of individuals with similar histories of trauma, and the link between such classes and diagnosis of disorders, authors (O'Donnell et al., 2017) performed a systematic literature review. Using EMBASE, MEDLINE and PsycInfo, (N=17) studies fell within the criteria for the review. 10 of the studies were adult samples, the remainder childhood and adolescent sample. Overall, the findings from the review revealed clusters of

individuals with trauma histories, with several studies providing evidence that disorders were quantitatively different across classes. Across the studies, sex abuse and no sex abuse classes were the most prevalent class types. In four of the 17 studies, 3 classes were revealed, in two studies two classes were found, one study identified five classes and two studies identified six. Also, females were found to be most likely characterised by sex abuse and multiple traumas, whereas males dominated classes characterised by physical abuse.

In one of the two studies of adult lifetime adversity exposure, using a sample from the National Comorbidity Survey (N=5877), authors, Houston et al. (2011) used LCA to explore the heterogeneity of individuals experiences co-occurring traumas. The study explored 10 trauma items including childhood abuse, interpersonal and non-interpersonal traumas in adulthood. They found a 4-class solution best fit the data. 3% were grouped into a high-risk trauma group, 21% into high-risk non-interpersonal traumas, 14% into a 'high childhood neglect, non-interpersonal, rape and molestation' group and the remainder fell into a baseline group. The findings suggest exposure to co-occurring adversities elevates the risk for psychotic experiences and thus determines specific symptoms and their relationship to specific traumas.

Using the same data set as the present thesis, the NESARC, wave 2 (N=34,653), Curran et al. (2016) performed an LCA on a wide range of adversities. The findings uncovered a 3-class model (low adversities, global adversities and a domestic class). 60% of individuals clustered in the low adversity group, 14% in the global group characterised by emotional, physical, and neglect abuse, child domestic abuse and sex abuse, and the third group of individuals (26%) were characterised by domestic, physical abuse and low neglect.

Also, several studies have used LCA to explore co-occurring trauma histories in adolescent samples. For example, in one such study, McChesney, Adamson and Shevlin (2015) used a U.S adolescent sample (N=10,123), with overall findings suggesting that multiple traumas are common. The authors found 4 classes of individuals with varying histories of trauma types. The first class comprised of a high-risk group; just over 1% experienced 18 trauma types. Just over 4.5% of the sample were in the second class characterised by witnessing traumatic events. The third class consisted of 15.6% of the sample, characterised by non-sexual traumas. And the fourth class (N=78.5%) was characterised by low-risk traumas. And 'death of someone close' was evident across all groups.

Also, using a person centered approach, Nooner et al. (2010) explored sex and physical abuse in a sample (N=795) of youths from LONGSCAN, a longitudinal study on interview records of child abuse and neglect. The study comprised of questions on 18 physical abuse, and 12 sexual abuse items. The LCA found 4 distinct classes of individuals with similar profiles of abuse histories. In the first class, nearly 3% of individuals suffered high-risk physical and sex abuse. The second class (3.3%) had a history of moderate sex abuse only. The third class (6.2%) was characterised by high physical abuse and low sex-abuse. The remainder (85.1%) of individuals fell into a fourth class characterised by no abuse.

Similarly, Shevlin and Elklit (2008) used LCA to explore a general population sample (N=390) equal across gender of Danish adolescents on a range of traumas. They identified four groups of individuals with similar profile of experiences. The first class comprise of just over 2% of the sample, characterised by severe abuse types,

such a rape, psychological abuse, and neglect. The second class (3.8%) was characterised by moderately experiencing a diverse range of traumas. The third class (35.9%) was characterised by individuals with histories of low serious interpersonal traumas, and the remainder of the sample fell into the baseline group. When differentiating the three classes (1-3) from the baseline group, it was found they had a significantly higher likelihood to have a diagnosis of PTSD and live with one parent.

The above studies advocate the use of LCA in profiling the histories of trauma and adversities in both clinical and non-clinical populations, using adult, adolescent and child studies. On observing the plethora of the studies to date, it is clear many studies have focused on the four main abuse types, and different adversities vary in severity, across age groups, and sample size in clinical and non-clinical data. Also, certain prevalent adversities or stressful life events in adulthood have been omitted or unacknowledged.

For example, Nylund, Bellmore, Nishina and Graham (2007) point out that classifying individual histories may be a problem due to the high correlation between traumas. However, LCA findings are exploratory; therefore, no assumptions are made prior to the analysis. Ordered or non-ordered classes are the basic types of class patterns that can emerge from an unconstrained LCA. If the item probabilities don't cross each other this is considered ordered; therefore, all the items are higher for one class in comparison to the other classes. On the other hand, non-ordered classes occur when the probability profiles cross each other; evident when classes are identified by one or a combination of items rather than high or low probabilities of endorsing all items (Nylund et al., 2007). For example, if a childhood trauma class emerges,

characterised by having a high likelihood of endorsing childhood trauma, and another class emerges with but a low to zero likelihood of childhood trauma and high probability of endorsing social defeat items, it may be indicative of an ordered class. However, arguments have been made suggesting the use of binary models lack in sufficiently capturing sub-types that may exist (Leggio, Kenna, Fenton, Bonenfant & Swift, 2009).

Furthermore, LCA incorporating covariates allows the probabilities to be predicted via a logistic link (Bandein-Roche, Miglioretti, Zeger & Rathouz, 1997) and therefore, may help in precisely determining the number of classes (Muthen, 2004). Statistical analysis quality improves individual disparities by having more indicators (Oertzen, Hertzog, Lindenberger & Ghisletta, 2010). However, arguments have been made regarding the usage of demographics. According to Wurpts and Geiser (2014) covariates decrease incorrigibility and add to information to be used in the approximation process. The authors explored whether including covariates into LCA models improves the quality of parameter estimation. Using a Monte Carlo simulation assessment comparing 2 and 3 latent classes, with sample sizes ranging from 70-2000, indicators ranging from 4-12, and the effect of a covariate on class assignment ranging from no effect to small, medium or large. Findings suggest using more items benefits the model, and in a dose-response increasing items decreases classes suggesting adding covariates increases proper class assignment.

An alternative method involves adding covariates to classes once classes are assigned. This is preformed using latent class regression (LCR), an extended version of LCA. This method explores class prevalence as a function of the covariates

assuming indicators are uncorrelated after class membership is accounted for and covariates are not correlated with indicators after accounting for class membership (Bandeem-Roche et al., 1997).

Other alternatives to LCA, such as cluster analysis have explored pattern of abuse in individuals. For example, Schilling et al. (2016) conducted a cluster analysis to assess patterns of childhood abuse and whether they are linked to increased severity of psychopathology using a general sample (N= 2504) from a German population. They found abuse types co-occur, specific abuse types clustered together with varying levels of psychological distress. For example, one cluster identified minor childhood abuse and neglect, the second cluster identified emotional and physical neglect, but not abuse, and the third cluster identified neglect and emotional, physical and sexual abuse. Severity of distress increased according to the severity of abuse, with cluster three displaying the highest effects. However, Nylund et al. (2007) argue that LCA is more reliable in comparison to cluster analysis. LCA outweighs cluster analysis in terms of allowing covariates and dependent variables to be assessed simultaneously. In addition, cluster analysis is not model based or probabilistic, and does not provide fit statistic. However, LCA does not benefit in analysis using pre-determined groups.

#### **5.1.4 Rationale, gaps in the literature and how these questions will be addressed.**

Several studies have explored multiple adversity profiles; however, a gap was noted in the literature with no study to date specifically having explored childhood traumas and social defeating experiences using a person centered approach. Histories of co-occurring traumas have been found be related to symptom complexity.



However, there are few studies and inconsistencies on individual profiling of co-occurring adversity histories. The present chapter will explore if the probability of experiencing childhood traumas and subsequent social defeating experiences are distributed evenly in a large healthy population sample. Whether the heterogeneity of adverse experiences may be explained by homogenous subgroups of individuals; if clusters of individuals who have experienced similar adversities exist. Furthermore, latent class analysis (LCA) will be used to identify latent groups of individuals with histories of childhood traumas and social defeating experiences. And whether such sub-groups are linked to psychotic-like experiences. Additionally, the relationship between the latent classes and background variables will be assessed (sex, age, single status, low education attainment, unemployment, ethnicity, migration, and cannabis use). In investigating the co-occurrence of specific trauma and later social defeating adversities in individuals with PLE's, the present chapter will establish if existing latent classes will provide significant different profiles for each PLE dimension, therefore enhancing classification.

Also, in combining risk factors, childhood traumas and defeating experiences, the present chapter will highlight if certain groups of individuals with a history of similar traumatic events cluster together, testing assumptions postulated in agreement with social explanations for PLE's, such as cognitive models, and the SD hypothesis (Selten & Cantor-Graae, 2005; 2013). As such, providing additional support for co-occurring histories of adversities as mechanisms linking psychosis-like symptoms. Specific high-risk groups, with more severe traumas should essentially be more strongly associated with increased PLE's. For example, illustrative of cognitive models of psychotic experiences, the focus is on the mechanisms that potentially lead

an individual who has previously been threatened to inaccurately have a distorted view of their environment. Chronic exposure or repeated threats and personal intrusion may lead the individual to mistrust, suspect and over analyse situations by zooming in on the adverse experience and applying this to future social interactions (Peters et al., 2017; Garety et al., 2001). It has been established that intrinsic perception of traumatic experiences is indicative of the risk for psychosis (Bak et al. 2005; Bentall et al., 2007) possibly through elevated reactions to future stress indicative of sensitization (Lardinois et al., 2011). For example, being put in a position of subordination may lead to sensitization of mesolimbic dopamine systems, potentially elevating risk for the development of symptoms of psychosis (Howes & Kapur, 2009). Drawing on such cognitive theories, and combining biological process to the model, the SD hypothesis suggests chronic exposure to experiences of social defeat may activate and disrupt the mesolimbic dopamine system leading to increase risk to psychosis (Selten & Cantor-Graae, 2005; 2013). Thus, following childhood trauma and potential acquired sensitization, any resultant stress will have an additive effect in those previously exposed to a trauma, or multiple traumas. The present chapter, aims to establish if clusters of individuals with similar co-occurring histories of trauma and exposure to socially defeating circumstances exist in a large general population sample. Furthermore, if such sub-groups exist, whether they are related to specific PLE dimensions in a dose-response manner; the more severe the risk-group, the stronger the association between class group assignment and PLE dimensions.

The hypothesis will consist of two parts; rather than assessing traumas at a variable level, the current chapter will examine the data at a population level using a person centered statistical technique to uncover classes of individuals who may have

been subjected to similar traumatic events in both childhood and subsequent social defeating adversities. It is hypothesised the probability of experiencing traumatic or multiple adversities will not be uniformly distributed in a large general population. Second, it is hypothesised the more severe the trauma risk profile, or the greater number of adversities, the more likely the increase in symptom severity for PLE dimensions.

## 5.2 Method

Refer to chapter 2 for a more extensive overview of the methodology pertaining to the present chapter. Responses for individual questions on each childhood trauma type were recoded as binary variables (1 = Yes (trauma), 0 = No (no trauma)). Background variables were coded as follows; sex was coded as (0) for females and (1) for males. A variable assessing educational achievement in the survey captured qualifications ranging from less than school to degree level and above. This variable was re-coded into a dichotomous variable, which identified respondents as either having attained higher educational qualification (0) or lower educational attainment (1). Respondents for migrants were coded as (0) whereas those not migration were coded as (1). The variable for having a partner came as result of recoding married, co-habiting, in a long-term relationship into (0) or single, divorced, not in a relationship was recoded as no partner with a value of (1). Ethnicity was re-coded into a dichotomous variable, which identified respondents as being of white ethnic origin (0) or of non-white ethnic origin (1). For the employment variable, participants were asked if they were employed over their lifetime and coded as unemployed (1) or employed (0). Cannabis use was coded as yes (1) or no (0) for no

cannabis use. Therefore, all the minority groups had values of 1 for simplification purposes.

### **5.2.1 Statistical Analysis-Latent Class Analysis**

Latent class analysis (LCA) is a statistical method utilised in the identification of homogenous groups, which are referred to as classes from categorical multivariate data. The optimal numbers of latent classes are dependent on several fit indices. In the following chapter, latent class analysis (LCA) was utilised to determine the number and nature of classes based on the responses to nine trauma/social adversity questions; namely five social defeat variables; and 4 childhood trauma variables; physical, emotional, neglect and sexual abuse. A combined LCA model was utilised exploring social defeating experiences and childhood trauma simultaneously and inclusive of demographic variables. The fit of five models (a two-class model through to a six-class model) was assessed. The models were estimated using robust maximum likelihood (Yuan & Bentler, 2000) and sample weight were included to adjust for non-response and sample selection probabilities. To avoid solutions based on local maxima, 500 random sets of starting values were used initially and 100 final stage optimizations. The optimal number of latent classes is dependent on a number of fit statistics, whereby the relative fit of the models was compared by using several information theory based fit statistics; likelihood ratio chi-square (LR<sub>x</sub>), the Akaike Information Criterion (AIC; Akaike), the Bayesian Information Criterion (BIC; Schwartz, 1978) and sample size adjusted Bayesian Information Criterion (ssaBIC; Sclove, 1987), the Lo-Mendell-Rubin adjusted likelihood ratio test (LRT; Lo, Mendell, & Rubin, 2001), and entropy (Ramaswamy, DeSarbo, Reibstein, & Robinson, 1993). The LRT was used to compare models with increasing numbers of

latent classes; a non-significant value ( $p > .05$ ) occurs this suggests that the model with one less class denotes acceptable fit. Entropy is a standardised measure of how accurately respondents are classified with values ranging from 0 to 1; higher values indicate better classification. The LCA was conducted using Mplus 6.12 with the appropriate weighting variable. Multinomial logistic regression was also employed to allow for latent classes to be regressed simultaneously with the measurement models.

LCA was conducted to estimate the number and nature of classes based on individual childhood trauma and social defeat scores, to firstly determine if there were meaningful sub-groups of individual that experienced childhood trauma and social defeat. Next, to determine if the classes differed qualitatively and/or quantitatively. A range of variables was included in the model as covariates (age, sex, ethnicity, migration, partner status, educational attainment, employment and cannabis use). The model is shown in Figure 5.1 illustrated with profile plots indicative of the 9 individual traumatic experiences along the X-axis and the probability of endorsing the item along the y-axis. The different peaks illustrate two trauma types- childhood trauma (CT) and social defeat (SD). The second part of the analysis consisted of logistic multinomial regression, which investigates the relationship between the latent class childhood trauma and social defeat classes and PLE's. The latent classes were dummy coded using the low risk class (class-5) as the baseline/ reference category and re-entered into a logistic regression model as independent variable with the PLE's as dependent variables.

## Results

The present chapter revealed five homogenous groups of individuals with similar histories of childhood trauma and social defeating experiences exist in a large general population sample. The fit statistics for the current LCA are presented in Table 5.1. The BIC is lowest for the 6-class model and the LRT and BSLRT indicated that there were no significant improvements in fit in comparison to the 5-class model. The AIC and ssaBIC continued to decrease from 2 through to 6 classes, but the relative magnitude of the decrease was smaller after the 5-class solution. Based on this the 5-class series provided the most meaningful solution.

**Table 5.1**

*Fit indices of the latent class analysis of indicators of childhood traumatic experiences and social defeat*

Classes	Loglikelihood	AIC	BIC	SsBIC	Entropy	BSLRT (p)
2	-80510.70	161079.41	161324.55	161232.38	0.83	13332.14*
3	-79310.38	158716.76	159122.50	158969.96	0.68	2388.62*
4	-78934.63	158003.27	158569.62	158356.69	0.64	747.73*
5	<b>-78547.36</b>	<b>157266.72</b>	<b>157993.68</b>	<b>157720.38</b>	<b>0.57</b>	<b>754.65*</b>
6	-78447.24	157104.49	157992.06	157658.37	0.61	35.18

Note. \*=  $p > 0.05$ , AIC = Akaike Information Criterion; BIC= Bayesian Information criterion, ssBIC=sample-size adjusted BIC, BSLRT=Bootstrap likelihood ratio test.

Figure 5.1 shows a profile plot inclusive of the nine individual social adversity items; five social defeating experiences and four childhood trauma adversities along the y-axis and the probability of endorsing the items along the x-axis. As illustrated

in Figure 5.1, Class 5 was the largest class (N=21818: 63%), characterized by a low to zero probability of endorsement for all items. This class was labelled 'low social defeat-low childhood trauma'. This class was the baseline or normative group. Class 4 (N= 4906: 14%) was characterised by 'low-intermediate probabilities of neglect and physical abuse, on the cusp of intermediate, with low to zero probabilities of emotional and sexual abuse, and an almost low to zero social defeat probabilities'. Class 3 was the smallest class (N=1965: 6%). This class was characterised by an intermediate probability of 'sexual abuse, low-medium probabilities of neglect and physical abuse, low-medium probabilities of gender social defeat, low to zero probability of emotional abuse, and a low to zero probability of all other social defeat variables. This was labelled 'intermediate sexual abuse-low to medium neglect, physical CT, and gender SD - low social defeat other'. Class 2 (3003:9%) was characterised by 'intermediate levels of race and gender social defeat, low to intermediate probabilities of neglect and physical childhood abuse, steering towards lower probabilities, and low levels of all other social defeat adversities, with an almost zero probability of sexual orientation SD', and consequently labelled 'intermediate race, gender, low to intermediate neglect & physical CT, low other. Class 1 and 2 had similar class size, Class 1 (2957: 9%) was characterised by high childhood trauma; extremely high probabilities of physical childhood abuse, high probabilities of emotional abuse and neglect, intermediate probabilities of sex abuse, low to intermediate race and gender social defeat (at the lower spectrum) and low probabilities of all social defeat. This was labelled 'high childhood traumas, low-medium gender and race SD, low social defeat other'.

Figure 5.1. LCA profile plot displaying class response probabilities to adversity indicators

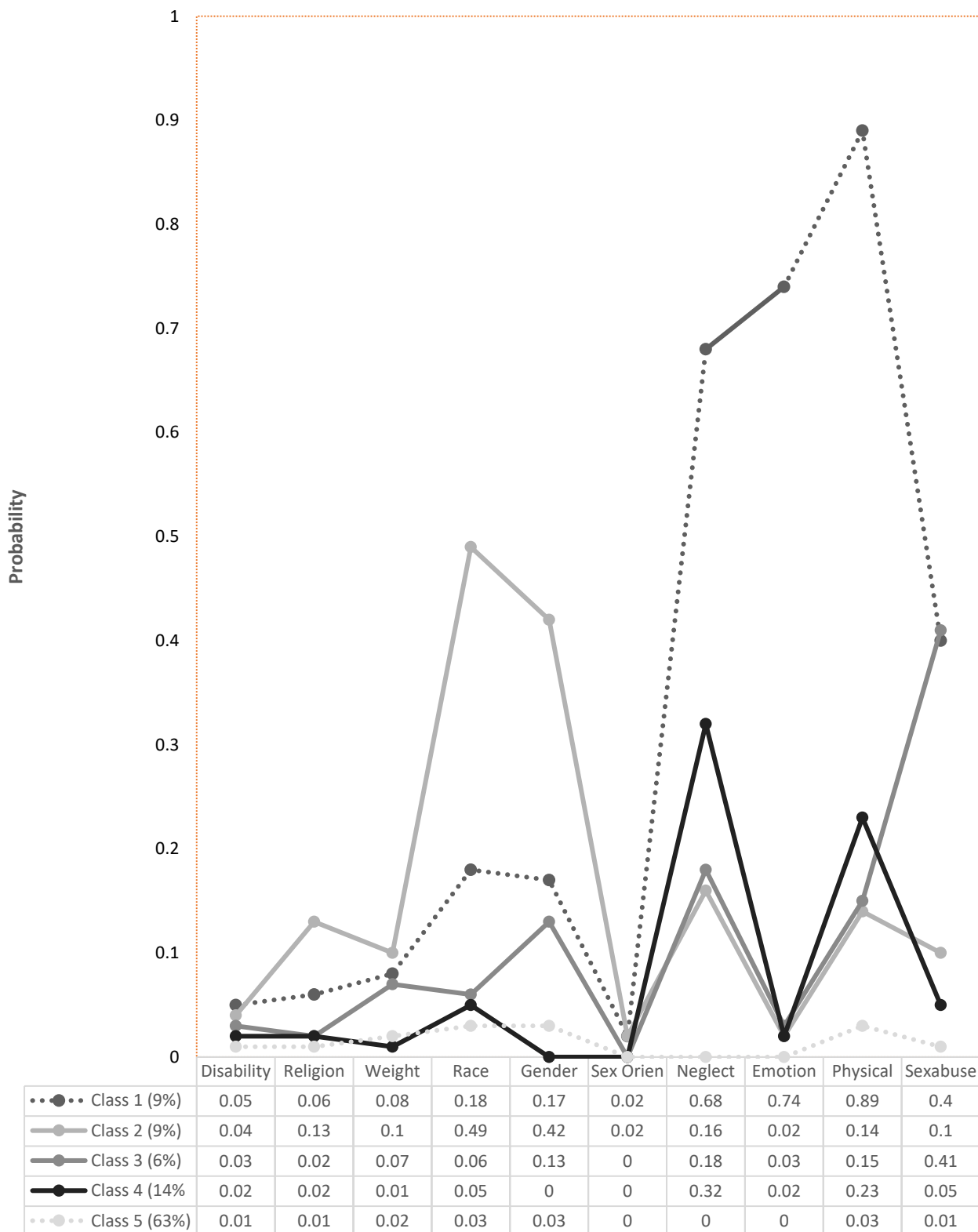




Table 5.2.1 shows relevant percentages of the presence of demographic risk factors assigned within each class. As expected, more females were present within the high-risk class (Class 1: high childhood trauma) in comparison to the other classes. Also, there were no males in class 3, which has intermediate probabilities of sex abuse.

**Table 5.2.1**

*Percentage of risk demographic variables across classes*

	<b>Class 1</b>	<b>Class 2</b>	<b>Class 3</b>	<b>Class 4</b>
<b>Males</b>	34.8%	50.7%	0%	65.6%
<b>Ethnic minority</b>	43.4%	50.5%	35.6%	57.6%
<b>Migrants</b>	11.4%	7.8%	7.3%	30.1%
<b>No Partner</b>	49.8%	59.4%	50%	39.3%
<b>Low Education</b>	5.6%	1.4%	1.8%	17.7%
<b>Unemployed</b>	12.5%	6.1%	12.7%	22.1%
<b>Cannabis use</b>	14.9%	12.4%	13.1%	7.3%

Table 5.2.2 displays odd ratios associated with each demographic variable for each latent class compared to Class 5, the baseline/reference category. Table 5.2.2 shows that compared with the low risk group/baseline group (class 5) respondents in the high-risk childhood trauma class (Class 1) were four times more likely to smoke cannabis (OR 3.73,  $p < 0.05$ ), and twice as likely to be of non-white ethnic origin (OR 1.54,  $p < 0.05$ ). Individuals in Class 2 were twice as likely to consume cannabis (OR 2.01,  $p < 0.05$ ) and to be of ethnic origin (OR 1.58,  $p < 0.05$ ). Also, compared to the baseline group, participants in Class 3 (high neglect, emotional, physical CT-low/medium sex abuse and low social defeat) were three times more likely to smoke cannabis. Compared to the baseline group respondents in Class 4 were 2.5 times more likely to be female (OR 2.50,  $p < 0.05$ ), almost twice as likely to be of ethnic origin (OR 1.92,  $p < 0.05$ ), almost twice as likely to be migrants (OR 1.81,  $P < 0.05$ ), over

one and a half times as likely to have a low educational attainment (OR 1.69,  $p < 0.05$ ), and twice as likely to smoke cannabis (OR 2.03,  $p < 0.05$ ).

**Table 5.2.2**

*Standardised Estimates of Demographic variables predicting class membership*

	<b>Class 1</b> OR (95% CL)	<b>Class 2</b> OR (95% CL)	<b>Class 3</b> OR (95% CL)	<b>Class 4</b> OR (95% CL)
<b>Age</b>	1.00* (0.99-1.00)	1.00* (0.98-1.00)	1.00* (1.00-1.00)	1.00* (0.96-0.99)
<b>Sex</b>	0.68* (0.56-0.83)	1.29 (1.00-1.59)	0.00 (0.00-0.00)	2.50* (1.07-2.55)
<b>Ethnicity</b>	1.54* (1.31-1.81)	1.58 (1.25-1.93)	0.96 (0.72-0.96)	1.92 (1.54-1.92)
<b>Migration status</b>	0.62* (0.47-0.81)	0.63 (0.44-0.85)	0.41* (0.26-0.41)	1.81 (1.26-1.81)
<b>Marital Status</b>	1.07* (0.95-1.19)	1.38 (1.25-1.54)	1.08 (0.89-1.08)	0.83* (1.05-2.00)
<b>Education</b>	1.21 (0.89-1.65)	0.41 (0.24-0.64)	0.50 (0.25-0.50)	1.69 (1.17-1.69)
<b>Employment</b>	0.77 (0.64-0.91)	0.65 (0.48-0.84)	0.79 (0.58-0.79)	1.14 (0.89-1.14)
<b>Cannabis</b>	3.73* (3.03-4.58)	2.01* (1.58-2.46)	3.00* (2.09-3.00)	2.02* (1.51-2.03)

*Note. Each trauma risk class is compared to the baseline (Class 5 group)/\*= $p < 0.05$*

Table 5.3.1 displays relevant percentages in relation to the presence of symptoms for the three dimensions of PLE's within each class. As expected, elevated rates of PLE's for each of the three dimensions occurred within the high-risk class (Class 1; high childhood trauma) in comparison to the other classes. As such, there is evidence of a dose-response pattern of estimates decreasing in magnitude from high risk class to the baseline class for the three PLE dimensions.

**Table 5.3.1***Percentage of PLE's dimensions across classes*

	<b>Class 1</b>	<b>Class 2</b>	<b>Class 3</b>	<b>Class 4</b>
<b>Negative</b>	68.5%	60%	56.7%	57.6%
<b>Positive</b>	52.3%	41.4%	43.9%	33.9%
<b>Disorganised</b>	37.7%	28%	23.1%	20.1%

Table 5.3.2 shows bivariate correlations for PLE dimensions as predicted by class membership. All classes (1-4) were significantly correlated with each of the three PLE dimensions. All associations were low, with the highest correlations associated with individuals assigned to class 1.

**Table 5.3.2***Bivariate correlations for PLE dimensions as predicted by class membership*

	<b>Class 1</b>	<b>Class 2</b>	<b>Class 3</b>	<b>Class 4</b>
<b>Negative</b>	0.12 *	0.07*	0.04*	0.07*
<b>Positive</b>	0.15 *	0.07*	0.07*	0.02*
<b>Disorganised</b>	0.16 *	0.08 *	0.03*	0.02*

*Note \*=p <0.05*

Table 5.3.2 shows results of the multinomial logistic regression analysis for the association between each PLE dimension by class membership. As shown, all 4-classes significantly predicted all PLE dimensions. The multinomial regression including class 5 accounted for 24% of the total variance explained in PLE's. The negative PLE dimension accounted for 9% variance explained, the positive dimension

accounted for 8% and the disorganised dimension accounted for 8% in the variation explained, for all classes combined respectively. The high-risk class (class 1) showed the highest effects compared to the other 3 groups which decreased in magnitude according to the severity of the traumas characteristic of each class.

**Table 5.3.2.1**

*Estimates and Standard errors for PLE's sub-levels as predicted by class membership*

	<b>Class 1</b>	<b>Class 2</b>	<b>Class 3</b>	<b>Class 4</b>	<b>R<sup>2</sup></b>
<b>Negative</b>	0.73 (0.03) *	0.53 (0.03) *	0.38 (0.04) *	0.37 (0.02) *	0.09*
<b>Positive</b>	0.62 (0.03) *	0.42 (0.02) *	0.46 (0.03) *	0.23(0.02) *	0.08*
<b>Disorganised</b>	0.75 (0.03) *	0.57 (0.03) *	0.35 (0.04) *	0.26 (0.03) *	0.08*

*Note* \*= $p < 0.05$

## 5.4 Discussion

### 5.4.1 Summary of main findings

The primary aim of the current chapter was to identify the appropriate number of latent classes assigned to individuals with similar histories of a range of childhood trauma and adversities in a large general population sample (NESARC-Wave 2). Histories of physical abuse, emotional abuse, neglect and sexual abuse and several social defeat experiences because of being a minority group in society; physical disability, religion, gender, sexual orientation, weight, ethnicity. Following this, a multivariate regression predicting class membership across several covariates following assignment of specific clusters of individual profiles was assessed. As such, class membership was used as a categorical dependent variable in a series of bivariate

multinomial logistic regression path models with the unaffected baseline class serving as a reference category.

Furthermore, the present chapter shows person-centred analytic methods such as latent class analysis is useful for exploring individual histories of childhood traumas and social adversities and whether these latent classes are linked to psychotic-like experiences. In utilising latent class analysis to identify individual profiles of people within a large general population sample, according to their histories of childhood trauma and social defeat experienced, it was predicted that the resulting profiles would provide a more comprehensive overview of multiple adversity profiles. It was unclear whether distinct classes could be identified among respondents based on trauma and social defeating experiences in adulthood as the two different types of adversities have never been assessed together in prior studies using a person centered approach method. However, results indicated that five distinct childhood trauma-social defeat profiles emerged from the latent class analysis that were both quantitatively and qualitatively distinct. It was found that classes 1, 3, and 4 differed quantitatively (Figure 5.1), whereas class 2 and class 3 were qualitatively different. As such, the probabilities of endorsement did not fluctuate in a uniform fashion across classes. Also, three of the groups had relatively high probabilities of endorsing multiple childhood traumas. These 4 classes independently emerged in each PLE dimension when covariates were included.

The high-risk class profile (class-1) (figure 5.1) showed a group of individuals characterised by extremely high probabilities of having endorsed physical trauma, high probabilities of experiencing emotional trauma and neglect, and intermediate probabilities this group experienced sexual abuse in childhood. This is consistent with

prior research that reiterates it is common for multiple childhood traumas to co-exist (Curran et al., 2016; Green et al., 2010; Kessler et al., 2010). This cohort of individuals also experienced low to intermediate levels of social defeating experiences because of their gender and race. Also, this cohort showed higher estimates in comparison to the other classes, which were significantly related to all three levels of PLE's in comparison to the other classes. Such findings are partially in line with Curran and colleagues (2016), that distinct profiles of individuals with histories of similar adversities cluster together. Also, in line with Houston et al. (2011) profiles of individuals with similar histories of trauma and adversities clustered together. The higher the trauma risk of the profile group, the more severe the psychological outcome in a dose-response fashion. As such, the present findings indicate the more severe the trauma profile, the increase in estimates of psychotic-like experiences for all three PLE dimensions.

#### **5.4.2 Findings in the context of Previous Research**

This finding also coincides with existing research (Cloitre et al., 2009) that exposure to trauma in childhood is related to co-occurrence of other traumas. Also, that intentional abuse is linked to further social defeating experiences (van Nierop et al., 2014). This finding partially supports the SD hypothesis (Selten & Cantor-Graae, 2005), that chronic exposure, and specifically co-occurring defeating experiences, in combination with demographic risk factors, as evident in the trauma/adversity history patterns of this cohort of individuals is a risk factor for psychotic-like experiences. This pattern cannot be explained by genetics, suggesting social subordination as a risk for psychotic like disorders, as acknowledged by the of the social defeat hypothesis

more than a decade after it was first publicised in psychosis literature (Selten et al., 2016).

Class 2 captured intermediate probabilities of social defeating experiences because race and gender and low to medium probabilities of neglect and physical abuse steering towards the lower end of the probability scale, with a low to zero probability of all other variables. This finding is interesting showing individuals in this class experiences higher probabilities of social defeating experiences because of gender and race. This finding is partially in alignment and supportive with the SD hypothesis (Selten & Cantor-Graae, 2005; Selten et al, 2013); subjective experiences of subordination are likely risk factors for psychosis like experiences. Also, regarding perceived discrimination, as empirical studies on social defeating experiences are scarce, the present finding is consistent with that of Skosireva et al. (2014) who found perceiving discrimination was related to perceiving other forms of discrimination. More specifically, the findings are in line with a study by Bayard and colleagues (2003) and with Berdahl and Moore (2006) who showed similar findings of a cumulative effect of gender minority and ethnicity discrimination perception.

Class 3 captured an intermediate probability of a sexual abuse cohort. This class was also characterised by a low to medium probability of neglect and physical childhood trauma, and a low to medium probability of gender social defeat. A reason for this finding may be due to increased sensitivity of being in a gender minority and treated unfairly, therefore possibly triggering old feelings of defeat from experiencing sexual abuse in childhood. Also, a possible reason for experiencing social defeating experiences because of gender could overlap with evidence that females suffer sexual

trauma more than males, therefore this group with medium probabilities of histories of sexual abuse could tie in with experiencing later adversities after being a victim of sex abuse, therefore any discrimination in relation to feeling inferior in the presence of anyone dominant discriminating, might lead to submissiveness and feeling defeated because of sensitization or triggering memories of abuse.

Class 4 was characterised by low to intermediate probabilities of neglect and physical childhood trauma, low to zero probabilities of emotional and sexual abuse and almost a zero probability of all other variables. Also, this class is quantitatively different to class-1. In relation to the demographic variables the findings were in line with suggestions by certain authors (Zammit et al., 2010) who postulated that any characteristic that separates an individual from society elevates their risk to psychosis. Moreover, as previously suggested by Selten & Cantor-Graae (2005), experiencing social defeat, unemployed, and consuming cannabis is related to heightened rates of psychosis in ethnic minority groups of individuals that were consistent with findings in the present study. Researchers, Veling et al. (2007) found the incidence rates and severity for psychosis to be higher among ethnic groups. Research studies have shown a strong relationship between childhood trauma and later drug use (Simpson & Miller, 2002). However, in this study cannabis did not reflect the likely differences in frequency, type, and amount of use. Consistent with previous research (Houston, Shevlin, Adamson & Murphy, 2011) females experienced more sexual traumas compared to non-sex traumas.

In the context of the current study it was hypothesised that individuals who experienced multiple traumas, particularly in childhood or when combined with



recurring traumas later in life would be at greatest risk for experiencing psychotic phenomena. The multinomial regression analysis confirmed this expectation, showing higher estimates for Class-1 in comparison to the other classes for all three PLE dimensions. The findings are in line with previous research suggesting a relationship between high-risk traumas in childhood and later psychopathology. The high-risk profile group with multiple abuse traumas, is alignment with prior LCA profiling of childhood trauma and PLE's. Furthermore, there was a pattern decreasing in size from the classes that were quantitatively distinct from each other from high severity to less severe social adversities. This is consistent with previous research suggested by Hagan, Sulki, and Lieberman (2015) that cumulative traumas are a strong predictor of psychopathology. Furthermore, exposure to stressful life events following childhood trauma increases the relationship between childhood trauma and later PLE's (Holtzman et al., 2013; Rössler et al., 2016). The 5-classes differed significantly in relation to the number of traumatic events and types of social adversities they were exposed to. This finding is consistent with previous research (Houston et al., 2011; Shevlin and Elklit, 2008; Curran et al., 2016), insofar as the classes differed regarding trauma types using data from the general population. The current analytical observation is of importance for potential treatment plans and interventions, extending on the suggestion that combining both dimensional and categorical dimensions might be the way forward in psychosis research.

The findings that emerged regarding the social defeat variables produced interesting findings. For example, social defeating experiences because of sex orientation had probability endorsement rates of almost zero for all classes; therefore, individuals who experienced social defeating experiences because of their sexual

orientation were qualitatively different and did not match the profile of any of the classes. A possible reason for this finding may be due to under-reporting or not reporting due to the stigma still associated with sexual orientation minority groups. However, it could also be argued they might feel discrimination but ‘do something about it’, therefore they do not consider themselves defeated. This could be a result of the increase in LGBT parades, therefore making a public standpoint and doing something about discrimination.

Due to the exploratory nature of LCA, the method provides latent variables that give the best description of the data without specifying a model to endorse patterns of results. The findings point towards a mixed ordered and unordered class. Individuals in the high-risk childhood trauma class had a high probability of endorsing each of the childhood trauma items and a low probability of endorsing items in the ‘low trauma, high social defeat class’ (class-2). The emergence of non-ordered class profiles in which not all items distinguished between classes in the same manner, distinguished by type of social adversity versus severity (severity defined as endorsing all the items). The ordered classes may be capturing an underlying continuum of social adversity. The LCA captured distinct profiles into social adversity classes. This could somewhat indicate that traumatic experiences are both dimensional and categorical construct. A potential reason for the inverse relationship for the low levels of social defeat probabilities in the higher risk childhood trauma probability classes was unexpected and not in alignment with sensitization theories, however the finding could indicate increased tolerance for dealing with defeating circumstances, perhaps even though discrimination occurred, it didn’t lead to social defeat as the individuals were better able to cope. There may be a degree of resilience, or internal coping

mechanism because of a traumatic history, therefore allowing the individuals who experienced childhood trauma to be more equipped or better able to handle social defeating circumstances. Also, the social defeating experiences may lack threat or intrusiveness, therefore less likely to have the same impact.

### **5.4.3 Implications for Research and Future Research**

The present findings and empirical studies to date provide evidence using a person centered approach such as LCA to reveal cluster of individuals with similar histories of trauma and later adversities in both clinical and non-clinical populations, using both adult, adolescent and child studies. On observing the plethora of the studies to date, many studies have focused on the four main abuse types, and a diverse range different adversity types that vary in severity. Also, certain prevalent adversity or stressful life event types in adulthood have been omitted or unacknowledged.

It is important to recognise the impact cumulative traumatic adversities have on certain individuals and the nature of the adversities following a history of abuse in childhood. For example, newly diagnosed chronic illness that may not necessarily be perceived as discrimination, but the individual feels defeated. Also, from a biological aspect, such individuals may already be experiencing increased cortisol levels due to the illness and medication prescribed. This potentially could have a differential impact on individuals, however this would need to be explored by including specific types of trauma in a LCA model with childhood traumas and other life-events.

Other likely traumas such as life-threatening surgeries, such as heart surgeries, organ transplants and brain surgery might also fit a specific cluster, due to the intrusive

nature and fear component of ongoing such life events, and traumatic impact of not knowing their future, raising cortisol levels attempting to ‘fight’ the disease. However, on the other hand, such traumas could potentially change an individual’s attitude and make them more resilient. Again, LCA would need to be applied in a model with numerous indicators. In agreement with Bentall et al. (2014) current approaches need to consider collaborating with several disciplines, such as biological, psychiatry, and trauma-based therapies.

Also, a person who has had a stroke and is unable to use their limbs, or speak cannot express how they feel, but feel socially defeated. It is necessary research studies explore further social defeating experiences using person centered methods. For example, other experiences of defeat might be more severe such as, not being able to have children, being widowed at a young age, neighbour deprivation, and rejection from peers because of financial loss. Therefore, it is vital other subjective traumas that lead to emotional distress and increase cortisol levels, likely to cause interference with the HPA axis are included in assessments, measurements, and evaluation. Substance misuse is commonly evaluated but prescribed medication particularly neurological medications prescribed for migraines, epilepsy, chronic back pain and a myriad of common illnesses are not evaluated particularly in general population research. Moreover, specific medications along with feelings of social defeat are likely to have further impact on a person

The findings in the present chapter show that a large representative healthy population are commonly exposed to several childhood traumatic life events and social defeating experiences. The nature of adversities in the general population was

explored. In doing so, it was established that trauma groups are best understood because of severity rather than type in the present population of individuals. There is a consistent trend that childhood traumas were more likely to occur in multiples rather than in isolation. This finding coincides with previous studies on cumulative abuse; children subjected to one type of abuse also are more likely to be subjected to other forms of abuse. For example, as suggested by Jacobs, Agho, Stevens, and Raphael (2012) childhood traumas accumulate in a predictive fashion.

The present chapter contributes to the literature by filling a gap in research that had not previously been addressed. Prior to the present study childhood traumas and social defeating experiences in a large population sample using a person centered approach had not been explored. The findings in the present chapter are a good indication of the importance and practicality for assessing the multiple nature of different types of traumatic experiences, and further social adversities later in life and their association with PLE's in a large population. Furthermore, present findings point towards high levels of childhood trauma that are not linked to social defeating experiences in an ordered fashion, however both childhood trauma and social defeat were significantly associated with symptoms of PLE's at all three sub-levels; negative, positive, and disorganised. Coinciding with previous research the co-occurrence of childhood trauma is evident in class 1 and class 4. Individuals who experienced physical abuse, also suffered other childhood traumas albeit at a lower level.

The findings presented throughout the present chapter have potential clinical implications. For example, interventions in the form of possibly promoting some type of cognitive behavioural programme in healthy individuals experiencing such symptoms prior to reaching sub-clinical or psychosis would be beneficial (Cicchetti,

2013). For example, educating individuals on early interventions, such as awareness of cognitive bias and the possible formation of false beliefs. Such interventions are imperative as early detection of this phenomenon is important for proper care needed before the outcome reaches clinical manifestation of psychosis (Oh et al., 2014). Subtypes of groups as found by latent class analysis detecting cohorts of individuals with specific characteristics could be used to zoom in specific target populations, and therefore developing interventions or preventative programs.

The findings add to the dearth of evidence that traumatic childhood events and other adversities should be a compulsory part of assessment in patients and outpatients experiencing psychotic disorders (Read, 2014; Bentall et al., 2014). Extensive assessments of individual histories will aid in better classifying disorders, symptoms and effectively the treatment. This is important for several reasons. If individuals respond to trauma-focused therapies, sports therapy or compassion-based CBT this should decrease unnecessary prescribing of psychotropic medication with a multitude of side-effects. Some individual response to treatments produce deleterious effects because of the nature of their symptoms due to trauma. (Read, 2014).

#### **5.4.3 Strengths and Weakness of Approach**

The main limitation of the present chapter is that it is based on self-reported trauma histories. The reliability and validity of such reports cannot be established, although there is evidence that such accounts are reliable for both population and clinical samples. Second, the reports of sexual abuse may be limited as respondents were asked to report those experiences that occurred 'without your consent'; any sexual contact under the age of 16 years meets the definition of abuse. Third, the

social defeat variables may not reflect social defeating experiences with clinical relevance. Social defeating experiences following abuse in childhood sensitivity due to the stress of constant exposure to social stress. Therefore, there might be a potential degree of cognitive bias involved in measuring this variable. As suggested by authors (Shin et al., 2010) traumatic research is conducted on the premise that rates of these experiences are underestimated due to not reporting or underreporting abuse experienced. Also, comparing findings is difficult as no prior research has used a person centered approach (LCA) to explore hidden clusters of individuals with histories of childhood trauma and socially defeating experiences. There seems to be a gap in the literature that needs addressing because profiling of individuals is important regarding distinct groups of people who might require specific therapies such trauma-based therapies.

Furthermore, relying on self-report measurements there will always be some confounding, particularly for a measure of social defeat which is a personal perception and may be exaggerated or heightened depending on the circumstances. As suggested by Harrell, Hall and Taliaferro (2003) this over-reporting of discrimination has been found to be related to stress. Also, there is a degree of whether this perceived social defeat has a degree of cognitive bias due to the perceived perception of social defeat. For example, various researchers (Samplin, Ikuta, Malhotra, Szeszko & DeRosse, 2013) found the higher the number of childhood trauma experienced to be associated with anomalous perceptions. Also, individuals may have pre-conceived perceptions due to society or stigma. Furthermore, there may be a degree of paranoia due to generational experiences and expected discrimination. Whether self-reporting social defeat is accurately measurable or whether the perceived experience of social defeat

is questionable warrants further investigation. The accuracy of self-report measurements of social defeat could be improved using longitudinal analysis to track any changes across time, therefore improving the ecological validity. Unfortunately, this was not possible in the present thesis due to the present variables only being introduced in Wave 2 NESARC. the measure of social defeat could be improved. Also, the social defeat measure in the NESARC did not address the associated level of distress, frequency, or intensity due to experiencing the adversities addressed in the present study. Adding additional questions in measurements in the future would also improved the accuracy and ecological validity of self-report measurements on social defeating experiences. Others (Valmaggia et al., 2015) suggest combining virtual reality settings of social environment in conjunction with self report measures which would also improve the accuracy of measuring social defeat.

The co-occurrence of childhood trauma (physical, neglect, emotional, sexual abuse) and social defeating experiencing (weight, religion, race, sexual orientation, and physical disability) were modelled explicitly using latent class analysis. The utilisation of latent class analysis defines the hidden structure of co-occurring histories of traumas and adversities experienced by individuals in the NESARC wave 2 data sample. Latent class analysis examined the co-occurring experience of trauma both in childhood and as a social defeating experience later in adulthood. These experiences are not normally distributed within populations. Homogenous groups were identified showing that individuals exposed to either similar or different types of multiple traumatic experiences, therefore are both qualitative and quantitative distinct.



### 5.4.2 Conclusion

The present chapter examined the association between trauma profiles and the three PLE dimensions by assessing the presence of each dimension of PLE's across the latent classes. The present chapter set out to identify clusters of individuals who share similar patterns of traumatic experiences in childhood and subsequent social defeating experiences. The findings reiterate the necessity for differentiation between profiles of traumatic experiences using person-centered approaches LCA analysis to explore individual patterns of multiple traumas. It was established that those who had a history of high risk traumas were at greater risk of experiencing psychotic-like symptoms. Therefore, adding to the existing research that, firstly, traumas tend to co-occur, and secondly, that individuals with a history of multiple traumas are at higher risk of psychopathologies. Those previously exposed to specific childhood traumas are a greater risk of experiencing further traumas, and in the present thesis, in the form of social defeat. This finding is in alignment with the social defeat hypothesis per Selten and Cantor-Graae (2005; 2013). In establishing the existing childhood trauma social adversity classes that exist, aids to better protocols for interventions. The present chapter has added to existing research by introducing further insight into mechanisms surrounding traumas and social defeating experiences.

## CHAPTER 6

### LONELINESS AS A MEDIATOR

### LINKING THE PATHWAY FROM

### ADVERSITIES TO SPECIFIC PLE DIMENSIONS

#### Abstract

**Gap in the Literature.** Multiple traumas in childhood, such as neglect, physical, emotional, and sexual abuse, and recurrences of social defeating adversity later in life, have been found to be related to PLE's. A gap was noted in the literature for mechanisms to unveil further pathways involved in the link between adversities and symptoms along the psychosis phenotype spectrum necessary for interventions and treatments. One such risk factor currently presenting as a forerunner responsible for a myriad of psychopathologies is loneliness. Moreover, loneliness has been found to play a role in the emergence of psychotic experiences in both clinical and non-clinical populations. To date loneliness has not been studied as a mediator linking childhood trauma, social defeating experiences and PLE's in a general population sample.

**Aim.** The current chapter purports to explore whether loneliness mediates the pathways between childhood traumas, social defeating experiences in the pathway to three PLE dimensions (negative, positive & disorganised).

**Method.** Secondary analysis of data from the US National Epidemiologic Survey on Alcohol and Related conditions (NESARC) was utilised. Using a multilevel multivariate regression analysis, loneliness was used to mediate the pathway from childhood trauma, social defeating experiences and three PLE dimensions.

**Results.** Loneliness was found to partially mediate the relationship between childhood trauma, social defeat and an array of risk factors. Moreover, loneliness was found to partially mediate the relationship between childhood traumas, and socially defeating experiences, and fully mediate specific pathways; social defeating experiences because of body weight and sexual orientation and the disorganised PLE dimension.

**Contribution to Research.** This research supports the assumption loneliness is a mechanism in the process involved as postulated by several theories, specifically by a combination of the social control hypothesis and the social deafferentation hypothesis. Overall, the current chapter contributes to research building on the existing theoretical explanation models, namely; cognitive models of psychosis, the social defeat hypothesis, and the social deafferentation hypothesis. Also, the present chapter provides further evidence for broader dimensional psychosis phenotypes. This research reiterates the necessity of those who prior to along the continuum to requiring care from experiencing distress from their symptoms are monitored closely by health professionals, and protocols put in place to alleviate loneliness and/or interacting with others or having an animal as a companion and focusing on self creativity to alleviate potential distress associated with being alone.

## **6.1 Introduction to Chapter 6**

The previous chapters in the present thesis explored several different processes linking social explanations to PLE's in a general population sample. Chapter 3 assessed the underlying nature of PLE's using both 'frequency only' and 'frequency and distress' using CFA. Findings revealed three dimensions (positive, negative and

disorganised) of PLE's used in proceeding chapters to measure PLE's in the general population. Chapter 4 assessed the relationship between childhood trauma and social defeating experiences and PLE's, both separately and combined in one model, to explore whether cumulative adversities increased the relationship compared to individual trauma types. The next chapter, chapter 5, as an alternative to focusing on variables, used a person-centered approach to explore whether different groups of individuals with similar histories of childhood traumas and social defeating adversities exist, and whether the classified profiles were related to PLE's.

This chapter will provide theoretical explanations of loneliness, empirical evidence of the relationship between loneliness and psychological adversity, such as psychotic symptoms in both clinical and non-clinical populations. The present chapter will assess if loneliness mediates the pathway from social adversities (childhood trauma and social defeating experiences) to specific PLE dimensions using a multivariate mediation analysis.

### **6.1.1 Social Isolation- subjective versus objective loneliness**

Albeit often unacknowledged, researchers in recent years are emphasising loneliness is a serious psychological painful feeling and not surprisingly one of the most prevalent psychological issues in society, reaching epidemic proportions with approximately 20% of people in the United States suffering in silence (Cacioppo & Patrick, 2008; Meltzer et al., 2013; Snell, 2017; Shankar, McMunn, Demakakos, Hamer & Steptoe, 2017). Loneliness is responsible for an array of health consequences ranging from adverse physical, emotional, and mental health well-being, such as cognitive decline, which is not surprising because as a species, humans have an innate need for engaging socially (Cacioppo & Hawkley, 2009; Panksepp, 2016). Although the terms are often regarded as being equivalent, social isolation and

loneliness are distinct from one another (Hawkley & Cacioppo, 2010; Coyle & Dugan, 2012). The differences between subjective (perceived loneliness) and objective loneliness (social isolation) is the perceived feeling of distress induced by being socially isolated (Cacioppo, Grippo, London, Goossens, Cacioppo, 2015; Hawkley & Cacioppo, 2010; Shevlin et al., 2015). It is not how many confidants that matters, it is the positive impact they have on the individual that is important; quality outweighs quantity (Masi, Chen, Hawkley & Cacioppo, 2011). Thus, an intrinsic experience, it is the negative feeling induced that being socially isolated evokes that differentiates the negative impact of loneliness in an individual. Therefore, a person can be persistently and inescapable lonely around or in the company of other people (Cacioppo & Hawkley, 2009). Therefore, it is seemingly the associated distress of being alone that has an adverse impact on a person. As such, it has been suggested that the distress associated with being isolated determines if the social isolation poses an issue to the individual (Hawkley & Cacioppo, 2009).

Furthermore, companionships are multidimensional (Oh et al., 2014) and accordingly, recent findings suggest that loneliness is multidimensional (Heinrich & Gullone, 2006; Maes, Vanhalst, Spithoven, van den Noortgate & Goossens, 2016; Shevlin et al., 2015), with differing levels of intensity and discrepancies among and across groups, and may be unstable over time (Schinka, van Dulmen, Bossarte, & Swahn, 2012). Therefore, it is difficult to compare groups of individuals on fleeting and chronic loneliness (Jones et al., 2011). Moreover, these variations are dependent on many factors and individual experiences (Cacioppo & Hawkley, 2009). Moreover, it is important to note that some individuals prefer being in solitude (Holt-Lunstad, 2015) comfortable being alone or isolated from society. Thus, it is the distress that warrants clinical attention if associated with social isolation (DSM-IV-TR; American

Psychiatric Association, 2000). Therefore, it is not the social isolation per se, but the distress associated with it that signifies the devastation of loneliness. Moreover, distress supervenes when an individual feels a discrepancy between their level of social interaction and subjective positive gain from their social interactions with others (Coyle & Dugan, 2012).

### **6.1.2 Social Explanations for Loneliness**

It is innately human to fear and avoid loneliness and strive to be part of a social community, thus, social isolation has been found to be associated with chronic feelings of despair particularly if subjectively experienced (Mijuskovic, 1988; Biordi & Nicholson, 2013). Interestingly, Hawkey et al. (2003) found that in comparing people suffering from loneliness and those who do not, there was a discrepancy in their perceptions of interactions in everyday life, with lonely individuals experiencing negative feelings. Thus, researchers are looking at several different avenues on the potential pathways that link loneliness and psychopathology. To date, many research models have attempted to uncover pathways, processes and underlying mechanisms involved in loneliness, the pathways from loneliness to psychopathologies, and the links between adversities, loneliness and psychosis. Whilst some of the theories on loneliness seem simplified, it seems necessary to intertwine multiple theories to get a comprehensive understanding on the links from a social explanatory perspective.

#### **6.1.2.1 Social Control Hypothesis**

The social control hypothesis (Umberson, 1987) emerged in psychological research nearly three decades ago, proposing being part of a close network of friends or having close companions increases wellbeing and healthier habits. The author elucidated the dangers of social isolation, suggesting loneliness in individuals causes

malady ultimately because the individual doesn't have positive companionships to give them a drive to thrive. Therefore, loneliness may be defined as the negative extent to how one perceives their social needs to be orchestrated by others (Bernardon, Babb, Hakim-Larson & Gragg, 2011). However, this hypothesis has been criticised as lacking in depth, as its explanation doesn't expand on the psychological damage of loneliness (Hawkley et al., 2009; Cacioppo, Hawkley, Norman, Berntson, 2011). However, other suggestions on the development of loneliness tie in with the social control hypothesis. For example, nearly two decades ago, Rokach (2002) postulated several stages involved in the process the subjective experience of loneliness, in other words, how an individual perceives loneliness. Firstly, the individual is painfully aware of being alone, however denies the fact, thus preceding this the individual reaches a state of realisation, and explores the reasons negotiating via self-doubt, towards a path of acceptance and mechanisms to cope.

#### **6.1.2.2 Cognitive theories of loneliness**

The detrimental effects of loneliness may be enhanced by faulty cognitions a person has developed to interpret their view of the world, such as appraisals of a threatening environment (Cacioppo & Hawkley, 2009). As such, research has attempted to elucidate the mechanisms involved in the cognitive effects of loneliness in humans (Cacioppo & Hawkley, 2009). Moreover, cognitive theories suggest cognition plays a role via the link between poor social skills and consequent feelings of loneliness (Zavaleta, Samuel, & Mills, 2014). Moreover, increased sensitivity leads to misjudgement via biases in cognition and as such research has repeatedly shown that severe loneliness is associated with poor cognition (Cacioppo and Hawkley, 2009). Thus, real or imagined future social encounters become flawed in a negative

cognitive direction with the individual anticipating the worst (Gable, 2006). Thus, as proposed by Hoffman (2007; 2008) in the social deafferentation hypothesis; the magnifying thoughts emanated during the experience of loneliness permits the brain to build a false picture of reality to make sense of pertaining issues, thus perhaps because of discussing scenarios with oneself rather than conversing with a companion. Consequently, the individual encourages the formation of maladaptive schemas in the form of cognitive biases, such as jumping to conclusion.

### **6.1.2.3 The Social Deafferentation versus the SD Hypothesis**

Briefly noted above and in the introductory chapter of the current thesis, the social deafferentation hypothesis proposed by Hoffman (2007; 2008) surmises that social isolation may be a factor that encourages the development of psychosis in individuals predisposed to psychosis. The hypothesis suggests intrinsic information processing of false spurious information to fill a void due to deprivation of information due to isolation; whereas the social defeat hypothesis suggests that isolation is due to the result of social defeating circumstances or being put in a position of subordination (Selten et al., 2013). The social deafferentation hypothesis emphasises social isolation in the development of psychosis not considering social defeating circumstances, however, it provides an additive mechanism to explain how social exclusion is linked to psychotic disorders (Selten et al., 2013).

However, viewpoints are mixed, and arguments ensue, with some suggesting social isolation to be a result of psychosis elicited by faulty cognitions and consequent apathy (Roth et al., 2004). The social deafferentation hypothesis argues that the reasoning behind this is weak, with the author (Hoffman, 2007) postulating social isolation and withdrawal from society are involved in encouraging the development



of the psychotic symptoms and not the reverse as once depicted. This is apparent via evidence from animal studies that unearthed findings that withdrawal from a supportive environment during critical stages in development has the capability to produce physical changes in the brain. Therefore, in extending this finding to humans is potentially suggestive of changes or deficits in cognitive functioning. Further, Hoffman (2008) reported approximately 70% of patients with psychotic disorder questioned on their memory of first experiencing persistent auditory hallucinations. They acknowledged their first experience of the phenomena was preceded with dramatically reduced social interactions (Hoffman, 2008). Although similar, the social deafferentation hypothesis proposed by Hoffman (2007) and the social defeat hypothesis differ in relation to the mechanisms involved in isolation. Adapting their findings to Hoffman's hypothesis, researchers (Murphy et al., 2013) using the British Psychiatric Morbidity Survey (n= 8580) to assess various pathways from sex abuse to psychotic experiences. The authors found social deafferentation using avoidant personality as a measure to be involved in the underlying process between sex abuse and psychotic experiences. As such social deafferentation mediated the link, however, the authors suggest not because of decreased contact but any personal interactions characterised by anxiety and behavioural and emotional deficits.

#### **6.1.2.4 Socio-Cognitive Models of Loneliness**

Cacioppo and Hawkley (2009) suggest a socio-cognitive model of loneliness involving increased sensitivity to threat and decreased sensitivity to social reward. Several studies have shown that oversensitivity to perceived threat in social situations underpins the development and maintenance of loneliness (Cacioppo, Norris, Decety, Monteleone & Nusbaum, 2009; Hawkley, Burleson, Berntson & Cacioppo, 2003; van Roekel, Ha, Scholte, Engels & Verhagen, 2016). As such, transitioning from social

isolation to loneliness depends on levels of threat perception. In the case of objective social isolation, the individual chooses to be alone, whereas subjective loneliness involves certain levels of distress, however, the individual tends not to do anything about it, due to perceptions of threat, which is also distressing. Thus, building on the cognitive theory of loneliness, Hawkley and Cacioppo (2009) postulate a cyclic response to loneliness in their proposed loneliness model. Social isolation in the form of loneliness is reinforced due to avoiding social situations in fear of expecting the worst outcome. The cycle starts with the development of cognitive biases due to increased sensitivity as a response to loneliness and lack of outside stimulation in the form of positive social interaction. As a result, the lonely individual ends up taking meaning from non-meaningful events. Such biases in social cognition may mediate the risk of psychotic symptoms via the notion of aberrant salience (van Os, Kenis, & Rutten, 2010). However, other theorists (Hawkley & Cacioppo, 2009) postulate that more dynamics are involved, hence postulating an evolutionary approach; suggesting a mixture of biological, environmental and genes all play a role in loneliness or subjective isolation.

### **6.1.3 Loneliness, Psychopathologies and Psychosis like experiences**

Loneliness has been found to be associated with an array of psychopathologies such as anxiety and depression (Meltzer et al., 2013; Cacioppo, Hawkley & Thisted, 2010). An interesting finding in relation to loneliness is the way socially isolated people tend to connect better with other who are social isolated (Cacioppo, Fowler & Christakis, 2009). However, this may be due a shared commonality and the development of a stable friendship may not be the result (Lim & Gleeson, 2014). In recent years psychosis research has been highlighting the area of social isolation in

relation to the development of psychosis (Stan et al., 2012; Sundermann et al., 2014). However, to date research underlying the process between the two has been quite vague (Gleeson, 2014; Lim & Gleeson, 2014).

Astoundingly, more than two-thirds of individuals with clinically defined psychosis have admitted to experiencing loneliness 'sometimes' or 'most of the time' (Badcock, 2015). Psychotic individuals are almost 6 times more likely life time prevalence to be lonely in comparison to healthy controls (Meltzer et al, 2013; Kimhy et al, 2006). Research has shown that onset and consequent development of psychosis may be encouraged if the individual is socially isolated in the period before symptoms develop (Murphy, Shevlin, Adamson, Houston, 2013; Hoffman, 2008). Furthermore, individuals with psychosis experiencing positive symptoms tend to disengage themselves from society (Harley, Bourdman, & Craig, 2012). For example, Alptekin et al. (2009) found in assessing a sample (N=1268) of individuals that poor social support in the form of social isolation had an elevated risk of four and a half times likelihood of experiencing psychotic symptoms (OR 4.5, 95%, CI 2.3-8.6). Furthermore, in accordance with this, Pitkanen et al. (2009) suggest social interactions improve the quality of life for individuals with clinically defined psychosis. For example, an Australian national survey (N=1825) of individuals with psychosis, Stain et al. (2014) found that psychotic episodes were found to be linked with a decrease likelihood of having a close confidant or participating in social activities. Various researchers (Gayer-Anderson & Morgan, 2013) have found a link between social isolation and symptoms of paranoia. Also, lack of close friends and social support are risk factors that have been found to be related to the onset of psychosis. Furthermore, those with clinically defined psychosis have few close friends and when compared to

control groups it has been shown they have decreased social networks/support (Gayer-Anderson & Morgan, 2013).

### **6.1.3.1 Childhood trauma and Loneliness**

In those with clinically defined psychosis isolating oneself is believed to be involved in the onset or intensity of positive symptoms (Selten et al., 2013; El Haj et al., 2016). This has been backed up by a plethora of research findings linking loneliness as a mediating factor between childhood traumatic experiences and the onset and development of psychopathologies such as psychosis in adulthood (Murphy, Shevlin, Adamson, & Houston, 2013; Cacioppo, Hughes, Waite, Hawkley & Thisted, 2006). For example, using data from the adult psychiatric morbidity survey (AMPS), a nationally representative sample of the UK population (N=13,214), Shevlin and colleagues (2015) assessed whether loneliness mediated the link between exposure to trauma in childhood and later psychopathology. The authors found childhood abuse and several psychopathologies were significantly mediated by loneliness. Also, when loneliness was used as a mediator between CT and psychosis the likelihood of psychosis was increased to almost 4 times (OR=3.87 95% CL 1.93-7.76). In line with this, using a nationally representative sample of Dutch adults (N=3980), Merz and Jak (2013) found a relationship between traumas and later loneliness as adults. Although findings are not consistent across different research studies producing mixed findings, new research is continually being established. For example, others (Boyda, McFeeters & Shevlin., 2015) failed to link loneliness as a mediator for childhood sexual abuse and psychosis. As such, researchers (Badcock et al., 2015) have suggested this discrepancy may be due to the association between psychosis and loneliness relative to dimensions of psychosis such as anhedonia in negative symptoms.

Over three decades ago, Hojat (1987) suggested disturbances in relationships during childhood may lead to several fears including but not limited to being rejected, getting close to people, thus providing risk factors to experiencing loneliness in later life. This coincides with a study carried out by Merz and Jak (2013) examining relationships in childhood using a nationally representative study of 3980 Dutch civilians, they uncovered a link between conflict and abuse by parents and later loneliness in adulthood. Research findings are suggesting that perceived social support may decrease the negative impact of childhood abuse, although there have been discrepancies in such findings due to severity of traumas experienced (Salazaret et al., 2011). Evans et al. (2013) found the more severe the trauma, the increased likelihood of experiencing positive impact of social support decreased in a dose/response fashion.

#### **6.1.3.2 Social defeat and Loneliness**

Animal studies have evoked interest in psychological research in recent years acknowledging social avoidance as one of the prime influences that leads to social defeating experiences in humans. Furthermore, such studies have produced findings showing that mice repeatedly exposed to social defeat showed two different types of responses in their social behaviour post defeat; resilience and susceptible (Krishnan et al. 2007). This has also been observed in other psychopathologies, for example in panic, social and post-traumatic stress disorders (Pollack and Marzol 2000; Nestler and Hyman 2010). However, interpreting social avoidance in defeated animals and relating this to humans, particularly when social isolation is used as a marker of susceptibility to social defeat. That said, the untoward effects of loneliness can be extended in humans' due to the high degree of commonality with animal studies, however the studies in humans need longitudinal assessment. For example, in a meta-

analysis, Holt-Lunstad, Smith, Baker, Harris & Stephenson (2015) using 70 prospective studies over a 34-year period comprising of MEDLINE, CINAHL, PsycINFO, social work and Google scholar found astounding numbers of mortality due to loneliness; 29% due to social isolation, 26% loneliness and 32% living alone, respectively. Considering such statistics recaps the importance of evaluating processes involved in the pathways such as social defeat. For example, research has examined social isolation and glucocorticoid receptors in mesolimbic dopaminergic neurons (Barik et al., 2013), highlighting the pivotal role played by mesocorticolimbic pathways and the adverse role that experiencing social defeat has on social interaction. In addition, research is focusing on mesolimbic pathways and the adverse impact because of social defeat and isolation (Espallergues et al., 2012). For example, when comparing subjective isolation with objective loneliness, it has been found perceiving loneliness negatively dysregulates the hypothalamic pituitary adrenocortical axis and immune response (Cole, 2008). In light of this, research is looking at the neurological changes on susceptibility/resilience to social defeat in the form of avoiding social situations (Tsankova et al., 2006; Elliott et al., 2010)

### **6.1.3.3 Loneliness and Demographic Risk Factors**

Research investigating loneliness has assessed variables that may increase the risk of the effect of loneliness. In relation to gender and loneliness there have been mixed results. For example, it has been observed through research findings that males are lonelier than females (Cacioppo et al., 2009; Houghton et al., 2014). In addition, females tend to be less lonely than males (Houghton et al., 2014). This coincides with research suggesting that females have more supportive companions than their male counterparts (Houghton et al., 2014). However, other studies using the UCLA

loneliness scale found no differences between males and females on this measure (Borys & Perlman, 1985; Matthews et al., 2016). Furthermore, in relation to marital status; lower levels of loneliness have been linked to marriage (Savikko, Routasalo, Tilvis, Strandberg & Pitkala, 2005; Stack, 1998). Also, widowhood and bereavement have been found to be synonymous with loneliness (Meltzer et al., 2013; Fried et al., 2015). Others (Lasgaard, Friis & Shevlin, 2016) found living alone was correlated to loneliness from early adulthood to the cusp of old age, with severe loneliness and having no partner linked to psychopathology. Also, associations have been found between loneliness and ethnic minority groups. For example, African-Americans are lonelier than whites. Also, higher educational attainment has been observed to be related to a decrease in loneliness (Cacioppo & Hawkley, 2009). Additionally, research has found that individuals who are unemployed tend to be lonelier (Savikko et al., 2005) and higher levels linked to psychopathology (Lasgaard et al., 2016). Interestingly, lower levels of loneliness have been linked to disability (Perissinolt et al., 2012; Cacioppo & Hawkley, 2009).

#### **6.1.4 Rationale for using Loneliness as a Mediator linking Adversities and PLE's**

The course of action triggering the emergence of psychopathologies in those who have experienced childhood trauma remains a minefield in psychosis research (van Os et al. 2017; Rauschenberg et al. 2017). Researchers are continuously testing hypothesis and more recently incorporating categorical and dimensional perspectives. As noted by Beards et al. (2013) considering their meta-analysis review suggest a gap was noted in the literature assessing life events and the development of psychotic-like experiences. Additionally, Cacioppo et al. (2015) suggest stigmas such as those

imposed on minority groups increases levels of loneliness. Furthermore, loneliness is a pertinent issue in society and has been suggested will reach devastating rates in the next two decades. However, there is no research to date linking loneliness as a potential mediating mechanism underlying the pathways from social defeating experiences to psychotic-like experiences, despite it being a potential key process that links these pathways.

Loneliness activates similar neural pathways in the brain as physical pain (Eisenberger et al, 2003; Eisenberger, 2012). Therefore, this pertinent issue needs to be addressed. Furthermore, loneliness has been found to be linked to individuals presenting with their first psychotic episode (Sündermann, Onwumere, Kane, Morgan & Kuiper, 2014). Noteworthy, loneliness is multidimensional, sharing a degree of similarity with other constructs, such as psychotic-like experiences (Morin et al., 2016; Shevlin et al., 2015). Research has suggested childhood trauma may lead to distrust and thus avoiding social situations, therefore increasing the vulnerability to psychopathologies and social defeat (Hoffman, 2007; 2008; Morrisson, 2001; Selten, van der Ven, Rutten, & Cantor-Graae, 2013). Therefore, it is difficult to establish if loneliness in psychosis is because of withdrawing from society or whether it is distinct (Cohen et al., 2015). For example, it has been estimated that three quarters to almost ninety five percent of individuals with symptoms of psychosis have felt lonely at certain times (Badcock, Barkus, Cohen, Bucks & Badcock., 2016). However, in a recent study, the authors (Badcock et al., 2016) assessed if loneliness and PLE's were distinct and separable constructs or as part of a general p factor. They found loneliness and PLE's to be distinct.

It was established in chapter 4 there was a significant relationship between childhood traumas, social defeat and risk factors, specifically and when combined



increasing in variance explained when all variables were entered simultaneously and found to be associated with the three dimensions of PLE's. When all adversities were considered in one model, there was an increase in the total variance explained. Therefore, the current chapter aims to fill a gap in the literature by delving further into processes that may attribute to the mechanisms linking adversities to psychotic-like experiences; loneliness. For example, the painful experience of loneliness is like an evolutionary trigger signal necessary for humans to reconnect with humans for gene survival, and healthy behaviours (Cacioppo & Patrick, 2008). Others postulate that individuals who are lonely have relationships with others that can be self-defeating (Cacioppo & Hawkins, 2009), thus minority groups are perhaps more likely to suffer from loneliness than those who don't. Moreover, there is tentative evidence to suggest loneliness mediates via childhood trauma and psychosis, however, to date there has been no attempt to look at this relationship using PLE's in a large general population. Moreover, specifically loneliness as a mediator underlying the pathway from social defeat to specific PLE dimensions, and loneliness interceding the relationship between multiple adversities and multidimensional symptoms of PLE's.

The statistical method of multivariate modelling using mediation analysis uncovers mechanisms that lie beneath the core of the relationship between predictor and outcome variables (Fairchild, Mackinnon, Taborga & Taylor, 2009). Thus, rather than postulating a direct linear association mediation models propose a causal link whereby the predictors influence the mediator which in turn influences the outcome variable. As such, methodologies using mediation are increasing in epidemiological research (Richiardi, Beilocco & Zugna, 2013). Previous research investigating the mediating relationship between traumas in childhood and later psychopathology have produced mixed findings. Shevlin and colleagues (2015) using a large population

sample (AMPS, 2007) found the relationship between childhood abuse and an array of psychopathologies; depression, generalised anxiety disorder, comorbid anxiety, phobias, PTSD and psychosis, to be mediated by loneliness.

Based on the literature presented, it is assumed that the relationship between multiple traumas in childhood and social defeat and the relationship with negative, positive and disorganised PLE's would be mediated through loneliness. The present chapter aims to predict that the parameters of this mediation model would be statistically significant while controlling for a range of covariates and potential risk factors associated with psychotic-like experiences. The present chapter hypothesises childhood trauma and social defeating experiences will significantly predict all levels of PLE's (negative, positive and disorganised). It is hypothesised that loneliness will mediate the relationship between CT, SD, demographic risk factors and PLE's. Thus, the risk of PLE's will increase by the addition of loneliness in the pathway from CT and SD and PLE's in a large general population sample.

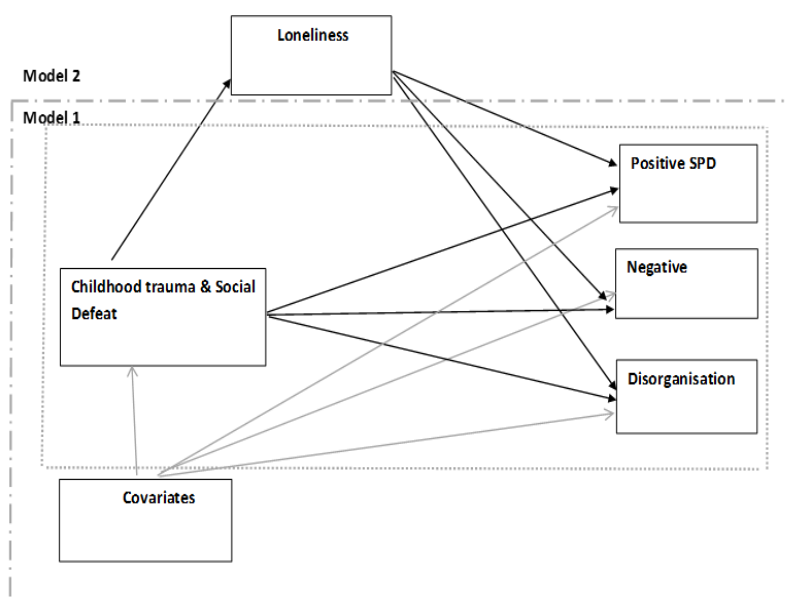
## 6.2 Method

A binary logistic regression model was estimated using robust maximum likelihood. A series of regression models were specified and tested to determine if loneliness was a significant mediator of the relationship between childhood trauma, social defeat and PLE's. Proposed by Preacher and Hayes (2008) the overall model was based on permitting the effects of covariates to be included in the analysis.

The three-stage model is presented in Figure 6.1. The model was estimated in three stages. Firstly, CT and social defeat representing the IV's were dummy coded.

The dependent variables were the three levels of PLE's (taken from the CFA carried out in chapter three (positive, negative, and disorganised PLE's). The covariates were then included in the model. Their paths to the mediator and dependent variables were fixed to zero, allowing a chi-square difference test to be conducted. Model 2:

The direct paths from the covariates were added to the model; ages, sex, whether migration, cannabis use, educational attainment, employment level, and ethnicity (figure 6.1).



*Figure 6.1 Mediation Models 1-3 regression models with loneliness as a mediator of the relationship between childhood trauma, social defeat and PLE's*

The measure for the loneliness variables was taken from section 10, question 1. For the first part of the question measuring social isolation or objective loneliness,

the variable was recoded into 0, 1, and 2 with 0 indicative of having close friends and 1 indicative having not having lots of close friends, and 2 distress associated with not having close friends. The measure for loneliness was taken from all responses coded as 2, distressed due to the absence of friends.

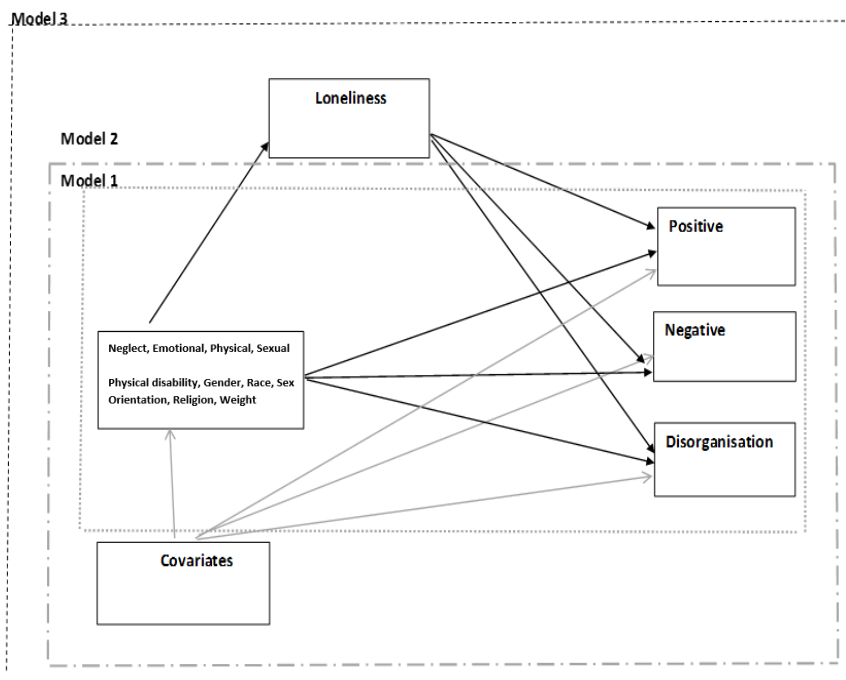


Figure 6.1.1 Mediation Models 1-3 regression models with loneliness as a mediator of the relationship between childhood trauma, social defeat and PLE's

### 6.2.1 Statistical Analysis

Additionally, a series of bivariate multinomial logistic regression path models with the baseline class will be used as a reference category. Path analysis is a statistical method that allows the simultaneous modelling of a system of regression equations among observed variables to examine casual associations between them. Models were specified and estimated using Mplus version 7 (Muthen & Muthen, 1998-2012), using the robust weighted least squares estimator (WLSMV). A series of three regression

models were specified and tested to determine if loneliness was a significant mediator involved in the association between childhood adversities and social defeating experiences and PLE's while controlling for covariates. The reference category represented those who did not experience childhood trauma or social defeat. The dependent variables were the three levels of PLE's. The covariates used in the previous chapters were included. The second model included the direct paths from the background covariates to PLE's. Estimates for all parameters were carried out simultaneously to assess for potential differences in the estimates for adversities between model 1 and model 2 after controlling for covariates. In model 3 loneliness was introduced as a mediator between trauma and PLE's (figure 6.1.1). The effects of the childhood trauma and social defeat variables and demographic risk factors to the loneliness variable were linear regression estimates.

Chi-square difference tests ( $\chi^2$ ) were used to determine the best fitting model. The  $\chi^2$  test measures overall fit, with a good fitting model returning a non-significant result ( $p < 0.05$ ). However, the  $\chi^2$  is sensitive to sample size, with large samples almost always returning an insignificant result. As such, the adequacy of each model was further assessed by examining four fit statistics; the Comparative Fit Index (CFI; (Bentler, 1990)), the Tucker Lewis Index (TLI; (Tucker & Lewis)), the root mean-square error of approximation (RMSEA; (Steiger, 1990)) and the weighted root mean residuals (WRMR; (Brown, 2006)). The CFI and TLI compare the sample covariance matrix with a baseline model in which all latent variables are uncorrelated. The RMSEA is an absolute fit index that tells us how well the model, with unknown but optimally chosen parameter estimates fits the population's covariance matrix. Additionally, RMSEA values below 0.6 are considered to reflect good model fit

however, values less than 0.08 suggest adequate fit (Bentler, 1990; Hu & Bentler, 1999; Joreskog & Sorborn, 1993).

## **6.3 Results**

### **6.3.1 Descriptive Statistics, frequencies, chi-square statistics for PLE's dimensions, childhood trauma, social defeat and risk factor variables by mediator**

Table 6.1 shows the frequencies, percentages, and chi square statistics of respondents who met the criteria for each of the three dimensions of PLE's by loneliness. Table 6.2 shows the frequency of endorsement rates of objective and subjective loneliness experienced by individuals. 27.8% (n=9521) answered 'no' to having lots of friends they are close to, indicative of objective loneliness. Of the 27.8%, 1.3% (N=451) were troubled by this and subsequently admitted to it causing them problems at work/school, with family or other people. This result was indicative of subjective loneliness and was used as a measure of loneliness as a mediator in the present chapter.

**Table 6.1**

*Crosstabulated, expected counts and percentages and chi-square statistics of Negative, Positive & Disorganised PLE's by Loneliness*

		PLE's level		
		Negative	Positive	Disorganised
<b>Loneliness-no</b>	Count (%)	16200(97.8%)	10268(97.7%)	5786(96.6%)
<b>Loneliness</b>	Count (%)	351(2.1%)	234(2.2%)	205(3.4%)
<b><math>\chi^2</math> (df) p</b>		11881.17(4) *	7999.35(4) *	8460.51(4)

*Note:*

\*= $p < 0.05$

**Table 6.2**

*Crosstabulated frequencies, expected counts and percentages and chi-square statistics of loneliness by demographics*

Demographics	Loneliness N (%)	Loneliness-No N (%)	Total N (%)	$\chi^2$ (df) (p)
<b>Males</b>	77(0.5%)	14315 (98.3%)	14564(100%)	3.78(2) *
<b>Ethnicity-other</b>	144 (1%)	14229 (98.4%)	14492(100%)	18.422(2) *
<b>Migration-no</b>	42(0.8%)	5264 (98.2%)	5363(100%)	559.97(4) *
<b>Single status</b>	261(1.7%)	15417(97.7%)	15787(100%)	35.04(2) *
<b>Education- low</b>	14(0.6%)	2285(98.4%)	2323(100%)	18.49(2) *
<b>Employment-no</b>	50(0.9%)	5371(98.2%)	5470(100%)	19.19(2) *
<b>Cannabis-yes</b>	57(2.2%)	2469(97.3%)	2537(100%)	19.92(2) *

*Note:* \*= $p < 0.05$

Table 6.3 displays the frequencies, percentages, and chi-square statistics of respondents who met the criteria for the three dimensions of psychotic-like experiences (negative, positive and disorganised) by childhood trauma type. Also,

individuals exposed to each of the four types of childhood traumas; neglect, physical, emotion and sexual abuse were more likely to report loneliness than those who were not ( $\chi^2(4) = 43.12, p < 0.05$ ).

**Table 6.3**

*Frequencies, percentages, and chi-square statistics of loneliness by childhood trauma type.*

<b>Child Trauma variables</b>	<b>Loneliness N (%)</b>	<b>Loneliness-No N (%)</b>	<b>Total N (%)</b>	<b><math>\chi^2</math> (df) (p)</b>
<b>Neglect-yes</b>	155(2.6%)	5753(97.3%)	5913(100%)	11672.47(4) *
<b>Emotional-yes</b>	118(4.1%)	2776(95.8%)	2897(100%)	15160.05(4) *
<b>Physical-yes</b>	164(2.6%)	6109(97.3%)	6279(100%)	15960.59(4) *
<b>CSA-yes</b>	134(3.5%)	3650(96.4%)	3786(1005)	10385.91(4) *

Note: \*= $p < 0.05$

Table 6.4 displays frequency, percentages and chi square test of independence performed to examine the association between loneliness by social defeat. For example, individuals who experienced social defeat because of physical disability were more likely to report loneliness than those who were not ( $\chi^2(4) = 43.12, p < 0.05$ ). Similarly, this finding was evident for individuals who felt socially defeated due to religion, weight, ethnicity and sex orientation, with all variables showing significant associations ( $p < 0.05$ ). Table 6.2 shows the frequencies, percentages, and chi-square statistics of respondents who met the criteria for loneliness by demographic risk variables. As shown, female respondents, whites, and individuals born in the U.S, those without a partner, with a higher educational attainment, and a history of cannabis use were more likely to report loneliness than their comparison group ( $p < 0.05$ ).



**Table 6.4**

*Crosstabulated, expected counts and percentages and chi-square statistics of Loneliness by Social defeat variables*

<b>Social Defeat</b>	<b>Loneliness N (%)</b>	<b>Loneliness-No N (%)</b>	<b>Total N (%)</b>	<b><math>\chi^2</math> (df) (p)</b>
<b>Disability-yes</b>	25(3.4%)	702(96.4%)	728(100%)	43.12(4) *
<b>Religion-yes</b>	36(3.4%)	1037(96.3%)	1057(100%)	51.98(4) *
<b>Weight-yes</b>	52(4.1%)	1209(95.6%)	1264(100%)	97.38(4) *
<b>Race-yes</b>	98(2.8%)	3425(97%)	3531(100%)	77.51(4) *
<b>Gender-yes</b>	97(3.3%)	2823(96.4%)	2929(100%)	148.41(4) *
<b>Sex-orient-yes</b>	11(6.7%)	154(93.3%)	165(100%)	38.214(4) *

Note: \*=p<0.05

**Table 6.5**

*Fit indices of the mediation model of childhood traumatic experiences and social defeat*

<b>Model</b>	<b><math>\chi^2</math></b>	<b>df</b>	<b>p</b>	<b>RMSEA</b>	<b>CFI</b>	<b>TLI</b>
<b>1</b>	5113.42	393	<0.01	0.019	0.887	0.873
<b>2</b>	3874.42	369	<0.01	0.017	0.916	0.900
<b>3</b>	3162.20	348	<0.01	0.015	0.933	0.914

Note RMSEA=Root-Mean-Square of Approximation; CFI=Comparative Fit Index; TLI=Tucker Lewis Index

### **6.3.2 Direct effects of loneliness on childhood trauma, social defeat and demographic risk factors.**

The introduction of loneliness led to an overall reduction in estimates. The direct effects via loneliness for each of the childhood trauma variables on all three dimensions were statistically significant, with a reduction in standard estimates after the addition of 'loneliness', indicative of partial mediation. Overall the estimates were generally higher for negative PLE's for all trauma variables except for sex abuse which was higher for the positive dimension of PLE's. The estimates were quite similar for neglect, emotional and physical abuse with loneliness as a mediator in the pathway to positive and disorganised PLE's.

Additionally, there was partial mediation for social defeating experiences because of physical disability, race and gender for all three dimensions of PLE's; the variables held significance but decreased in standardised estimates indicative of partial mediation. The introduction of loneliness to the model led to social defeat because of weight and sexual orientation and their relationship to disorganised level of PLE's to become non-significant, indicative of full mediation.

Furthermore, the demographic factors with the exclusion of ethnicity, education and cannabis decreased in estimates after loneliness was controlled for. Therefore, loneliness did not mediate ethnicity or education. However, only the cannabis variable became insignificant via the pathway to the negative dimension of PLE's, indicating full mediation via the pathway between cannabis, loneliness and negative PLE's. The estimates were generally higher for the negative dimension of PLE's except for younger age and male respondents in the disorganised dimension group. Overall, higher scores on the negative PLE dimension was associated with older age, being male, U.S citizen, ethnic minorities, having no partner, lower

educational attainment and unemployment. Higher scores on the negative PLE dimension was associated with having experienced social defeat for all except religion and sex orientation. High scores on the negative dimension were associated with having been subjected to all childhood trauma. Also, across demographics, the estimates were higher for males and being in an ethnic minority group. The estimates were marginally higher for neglect and physical abuse in comparison to emotional and sexual abuse.

High scores on the positive variable were associated with being female, non-white, single, higher educational attainment, being employed and cannabis use. Estimates were highest for respondents in ethnic minority groups. Higher scores were associated with all SD variables and all CT variables, with the highest estimates for sexual abuse. Furthermore, increased scores on the disorganised dimension of PLE's were associated with younger age, being male and being migration, being ethnic minority, and being single and cannabis consumption. Overall, the estimates were highest for males, those migration, and single respondents. Also, high scores were associated with having experienced social defeat because of a physical disability, religion, race, gender. High scores were associated with all CT variables, with sexual abuse being slighter higher in its estimates. The  $R^2$  for the negative dimension of PLE's (15%) did not change after the introduction of loneliness to the model. However, for positive  $R^2$  accounted for 34% in variance increasing by 19% after the addition of loneliness as a mediator, and doubled in percentage after the addition of loneliness in disorganised PLE's ( $R^2=24\%$ ) which indicated a modest and statistically significant proportion of variance explained by multiples adversities and background variable.

### 6.3.3 Indirect effects of loneliness on social defeat and negative, positive and disorganised PLE's.

In the 3<sup>rd</sup> model, loneliness was significantly predicted by age ( $\beta = -0.17$ ,  $p < 0.05$ ), migration ( $\beta = -0.01$ ,  $p < 0.05$ ), being of ethnic majority ( $\beta = -0.11$ ,  $p < 0.05$ ), and having no partner ( $\beta = 0.07$ ,  $p < 0.05$ ). And for the social defeat variables due to weight ( $\beta = 0.07$ ,  $p < 0.05$ ), race ( $\beta = 0.04$ ,  $p < 0.05$ ), gender ( $\beta = 0.04$ ,  $p < 0.05$ ). For the childhood trauma variables, loneliness significantly predicted neglect ( $\beta = 0.07$ ,  $p < 0.05$ ), emotional abuse ( $\beta = 0.06$ ,  $p < 0.05$ ), and sex abuse ( $\beta = 0.10$ ,  $p < 0.05$ ), however, loneliness did not predict physical abuse, revealing no significant relationship ( $\beta = 0.02$ ,  $p > 0.05$ ). Relative to the indirect effects of loneliness on negative, positive & disorganised dimensions of PLE's, loneliness significantly predicted all three dimensions of PLE's with moderately higher estimates for negative PLE's ( $\beta = 0.47$ ,  $p < 0.05$ ) compared to positive ( $\beta = 0.20$ ,  $p < 0.05$ ) and disorganised PLE's ( $\beta = 0.33$ ,  $p < 0.05$ ).  $R^2$  did not change for negative PLE's when loneliness was added to the model. Table 6.6 presents the standardised estimates of the direct paths between childhood trauma and social defeating variables and loneliness, and the loneliness variable and the three dimensions of PLE's. As shown, the direct effects via loneliness for neglect, emotional, physical and sexual abuse childhood traumas on all three dimensions of PLE's were statistically significant, with a reduction in standard estimates after loneliness was added (model 3), indicative of partial mediation.

**Table 6.6**

*Indirect & Direct Standardised regression coefficients (via loneliness) for CT, SD, and demographics on Negative, Positive & Disorganized PLE's symptoms*

	Negative	Positive	Disorganised	Loneliness
<b>Age</b>	0.03*	0.03*	-0.05*	-0.17*
<b>Sex</b>	0.13*	-0.02	0.16*	<b>-0.03</b>
<b>Migration</b>	-0.06*	-0.00	-0.10*	-0.01*
<b>Ethnicity</b>	0.18*	0.14*	0.06*	-0.11*
<b>Marital Stat</b>	0.08*	0.07*	0.10*	0.07*
<b>Education</b>	0.05*	-0.04*	0.02	<b>-0.03</b>
<b>Employment</b>	0.04*	-0.03*	0.01	<b>0.00</b>
<b>Cannabis</b>	<b>0.02</b>	0.05*	0.06*	<b>0.04</b>
<b>Disability</b>	0.03*	0.03*	0.02*	<b>0.03</b>
<b>Religion</b>	0.03	0.03*	0.02*	<b>0.02</b>
<b>Weight</b>	0.02*	0.02*	<b>0.01</b>	0.07*
<b>Race</b>	0.04*	0.05*	0.06*	0.04*
<b>Gender</b>	0.05*	0.06*	0.06*	0.04*
<b>Sex Orientat</b>	<b>0.00</b>	0.02*	<b>0.02</b>	<b>0.02</b>
<b>Neglect</b>	0.08*	0.06*	0.05*	0.07*
<b>Emotional</b>	0.02*	0.04*	0.05*	0.06*
<b>Physical</b>	0.08*	0.07*	0.06*	<b>0.02</b>
<b>SexAbuse</b>	0.06*	0.12*	0.07*	0.10*
<b>Loneliness</b>	0.47*	0.20*	0.33*	
<b>R<sup>2</sup></b>	0.15*	0.34*	0.24*	

*Note: \*=  $p < 0.05$*

## 6.4 Discussion

### 6.4.1 Summary of the Main Findings

Extending on research throughout the present thesis, the present chapter aimed to examine whether loneliness acted as a mediator directly via the pathways from childhood trauma and social defeat and the three dimensions of PLE's uncovered in the confirmatory factor analysis in Chapter 3. Additionally, the present chapter using multivariate mediation regression models assessed whether each specific childhood trauma and social defeat adversity was significantly associated with each specific PLE dimension by introducing loneliness as a mediator to investigate whether this would increase or reduce the effects as found in the current analysis and extending on findings in Chapter 4, assessing direct effects of adversities on the three dimensions of PLE's. Also, the present chapter aimed to address two interconnected hypotheses. Firstly, it was predicted there would be a relationship between each specific childhood trauma, social defeat and loneliness, and association between each level of PLE's and loneliness. Secondly, the relationship between childhood trauma, social defeat and the covariates used throughout would be mediated through a loneliness pathway via the three levels of PLE's. Based on the estimates and the chi-square model results, the addition of loneliness improved the model indicating that loneliness contributes in the process and effects of childhood trauma and socially defeating adversities on PLE's. Secondly, all childhood trauma variables were partially mediated by loneliness, as were the social defeat variables, except for weight and sex orientation which were fully mediated by loneliness via the pathway to the disorganised dimension of PLE's. Therefore, the results are partially in alignment with the hypothesis.

Loneliness significantly mediated the relationship between childhood traumas, social defeat and the three PLE dimensions with the entire model explaining a

moderate amount of variance for dimensional PLE's, a small to moderate amount for positive PLE's, and a small amount for negative PLE's which did not change after loneliness was controlled for in the model. Therefore, inclusion of loneliness to the multivariate regression model on the negative dimension of PLE's did not add to the variability of response to the data around the mean, despite loneliness making a significant contribution to the data. The findings uncovered in the present chapter suggest that childhood trauma and social defeating adversities contend in the development and maintenance of PLE's as a link per se but because of psychotic like experiences. Therefore, in line with postulations by authors (Selten & Cantor-Graae, 2005; Selten et al., 2013).

The four childhood trauma variables significantly predicted all three PLE dimensions and loneliness, supporting the first hypothesis. Additionally, the introduction of loneliness as a mediator led to an overall reduction in the direct effects of all four child trauma variables which held significance on the three PLE dimensions, therefore representative of partial mediation. The present results concur with prior findings by Murphy et al. (2015) who found that loneliness was involved in pathway between childhood adversities and psychosis, with the present results revealing that loneliness played a role as a partial mediator the relationship between childhood trauma, social defeat, and PLE's in a general population sample. These results are also partially in line with previous research (Shevlin et al., 2014; Merz & Jak, 2013; Sperry & Widom., 2013). Also, the present finding provides partial justification for several social explanations of psychosis; cognitive theories of psychosis, the SD hypothesis, the loneliness loop, and the social deafferentation hypothesis.

Full mediation after the addition of loneliness was evident through specific social defeat variables; namely, retreating to a subordinate position because of discrimination, thus being socially defeated because of discrimination due to body weight, and sexual orientation and disorganised PLE dimension. The direct pathway from these variables became non-significant only after introducing loneliness as a mediator, indicating full mediation. These results suggest that the effects of subordination due to weight and sexual orientation increased disorganised PLE's explicable through the mediating effects of loneliness.

The findings concur and interlink with the social defeat hypothesis and the social deafferentation hypothesis (Hoffmann, 2007; 2008), insofar as fallen victim to social defeat leads to submissive behaviours, spiralling from pathways of withdrawal from society, the mind barren of social stimuli attempts to formulate its own interpretation and meaning from such non-meaningful events in the form of delusions, hallucinations and/or thought disorder. Thus, the individual overloaded with thoughts, unable to distinguish reality from cognizance fallacy, becomes distressed and ultimately reaches a threshold warranting clinical attention. Corresponding with research using animal models, and avoiding causality in humans, as per Selten and Colleagues (2005;2007); succeeding social defeat, the threatened animal or rodent becomes submissive and retreats into isolation causing dopamine dysregulation thus leading to psychotic experiences (Isovich, Engelmann, Landgraf & Fuchs, 2001). In parallel with the present findings, following social defeat because of discrimination because of weight and sex orientation were found to be fully mediated by loneliness. This present finding is new to the literature adding to the dearth of literature continually being established on social explanations across dimensional psychosis phenotype research.



#### 6.4.2 Findings in the Context of Previous Research

This is partially in line with findings by few researchers, for example (Mereish & Poteat, 2015; Mereish, Katz-Wise & Woulf., 2017) suggesting an association between loneliness and psychopathology among those in sexual minority group; ultimately the stress induced due to being in a specific minority group precedes loneliness which in turn precedes decreased mental health. Additionally, the present findings relate to assumptions proposed by Meyers (1995; 2003; 2007) per his minority stress theory. Accumulated stress due to stigma of being a minority, exposure to prejudice, expecting rejection, discrimination and subsequent secrecy (which is indicative of accepting rather than doing something about the discrimination) of one's sexual preference potentially leads to isolation. Therefore, amidst an array of possible explanations for this finding, per Schmitt, Branscombe, Postmes and Garcia (2014) social defeating stigmas that can be concealed such as sexual orientation and religion, albeit not always can lead to worse outcomes than stigmas that cannot be hidden, such as physical disability, gender, ethnicity, and body weight. Also, stigmas that can be concealed may lead to deleterious mental health leading to pathways to loneliness via internalising (Goffman, 1963; Chaudoir, Earnshaw & Andel, 2013). Additionally, social defeat due to societal stigmas that can be controlled over one that cannot may result in isolation (Fernández, Branscombe, Gomez, & Morales, 2012). Thus, in keeping with such empirical findings, the present findings infer an element of such an association, surmised through the finding that social defeat submissiveness due to sexual orientation leads to such secrecy and thus feeling loneliness.

Social defeat has been described as the negative experience of being excluded from the majority group. Therefore, this type of adversity is distinct from that of

childhood trauma which predominately takes place at the hands of one's caregiver. For example, a child should not have to feel vulnerable and trust should be instinctive from those who are to provide basic needs and care for them. Also, physical and sexual abuse differentiate from neglect and emotional abuse acts, therefore the impact they will have on the developing brain of the individuals and therefore will have different pathways and route to processes that may lead to PLE's and loneliness. For example, Egerton et al. (2016) using brain imaging techniques found sex and physical abuse to be related to increased dopamine amalgamation in the striatum, however trauma not directly aimed at the individual, such as loss of a caregiver did not yield the same result.

In line with previous research, loneliness has been found to be related to substance use (Cacioppo et al., 2002). A multitude of studies have found a relationship between cannabis use and psychosis. However, the pathway in the present thesis found cannabis fully mediated these results suggesting that the effects of cannabis as a risk factor in increasing the likelihood of being within the negative dimensions of the PLE's group were explicable through the mediating effects of increased loneliness. Furthermore, others (Cohen et al., 2011) found cannabis use to be associated with positive and disorganised PLE's but not negative PLE's which partially falls in line with the results found in the present chapter. When loneliness was introduced into the model, the relationship between cannabis use and negative PLE's was no longer significant, therefore suggestive of full mediation. However, cannabis use was not significant for the indirect effects to loneliness. This is partially in line with reported findings by Salokangas et al. (2013) who unveiled having few close friends mediates cannabis and psychosis. Furthermore, this finding is in line with elements of Hoffman's Social Deafferentation Hypothesis; without loneliness, the link to negative

PLE's and cannabis use is negated. Seemingly, individuals left alone with only their thoughts and cannabis start to entertain disordered thoughts; creating meaning from non-meaningful thoughts or events. Therefore, the present findings follow suit and thus extend on Hoffman's Social Deafferentation hypothesis, and associated adaptations made by Murphy et al (2013) postulating loneliness due to perceived social isolation plays a role in the emergence of psychotic like experiences. Interestingly, loneliness did not mediate the relationship between ethnicity as a demographic risk factor. Therefore, the pathways from being in an ethnic minority group and the disorganised PLE's cannot be explained by an underlying process of loneliness. The standardised estimates were highest for this risk factor for both negative and positive PLE's. Therefore, in line with the SD hypothesis (Selten & Cantor-Graae, 2005) suggesting subordination leads to psychosis like experiences.

#### **6.4.3 Implications and Future Directions for Psychosis Research**

The findings in the present chapter raise some interesting questions. This could be attributed to trust issues following trauma, therefore, an individual preference of being alone. For example, Rotenberg et al. (2010) suggest that lack of trust was a predictor of loneliness. This notion coincides with views by Cacioppo and Hawkey (2009) who suggest that certain individuals choose social isolation via a hypothetical protective shell to avoid being hurt, thus promoting a self-protective barrier as a protection from potential harm or defeat. This falls in line with suggestions by Merz and Jak (2013) who suggest neglect and physical abuse may lead to mistrust and a negative outlook on relationships in adulthood. Therefore, leading to social avoidance by removing oneself from society out of fear of potential failures in friendships or relationships. This is alignment with findings by McLachlan, Zimmer-Gembeck and

McGregor (2010) that dismissal or mistreatment early in life is related to rejection sensitivity later in life, via faulty cognitive processing.

Relative to the findings that social defeat due to weight was fully mediated by loneliness and comparing social defeat research using rats, ensuing caution by equating such research to humans using self-reported measurements; animal studies have shown that post social defeat, the animal withdraws, akin to isolation (Selten, Booij, Buwalda & Meyer-Lindenberg, 2017). For example, the release of the neuropeptide orexin has stimulating effects on dopamine function, controlled by the interplay of the hypothalamus and dopamine system (Moorman & Aston-Jones, 2010). Also, in an animal social defeat study using rats, the researchers found a link between orexin dysfunction in the mesocortical regions of the dopamine system and depression (Nocjar, Zhang, Feng, & Panksepp, 2012). In the study, it was found that body weight of the subject rat increased following social defeat. Other have found evidence of orexin depletion post defeat (Lutter et al., 2008). Such depletion of this neuropeptide induces anhedonia, decreases motivation and increases depression (Moorman & Aston-Jones, 2010). In addition, orexin activates mesolimbic dopamine (Narita et al., 2006). Keeping in line with the present chapter and adapting it to humans might explain such findings involved in the process that links being socially defeated because of body weight and disorganised PLE's via loneliness. Extending such findings to humans and other psychopathologies such as psychotic disorders.

Certain individuals may have developed resilience due to previous traumas experienced. Whilst others' who have experiences such adversities tend to encapsulate themselves from society to ward off potential threat; therefore, social isolation is not distressing for the individual who is content with being in solitude, because it is how

individual perceives social isolation linked to the value of the relationship rather than how often and the number of times one interacts with other people (Hawkley et al. 2008). As suggested, it is when being socially isolated emits feeling of distress that increases the likelihood of a transit to clinically defined psychosis or psychopathology. Furthermore, several research studies on interventions stipulate decreasing the feelings of loneliness through forming friendships via social networking (Pitkala et al., 2011; Winningham & Pike., 2007), others (Stepanikova, Nie, & Hie, 2010) argue about causal association between internet use and loneliness alleviation.

Furthermore, Uchino, Bowen, Carlisle and Birmingham (2012) postulate that positive mental health and changing cognitive biases can only progress when the individual perceives the social support as a positive experience. Therefore, per suggestions made by Masi et al. (2011), using cognitive therapy can ease loneliness to a certain degree. However, if cognitive biases have pronounced the loneliness via faulty reasoning in the first place, then cognitive behavioural therapy could be beneficial. Furthermore, Cacioppo, Grippo, London, Goossens and Cacioppo (2015) suggest using certain pharmacology treatments in conjunction with cognitive behavioural therapy (CBT). The authors suggest administering nasal spray oxytocin to help alleviate loneliness. Interestingly, other researchers have acknowledged that social problems may be rectified to a certain degree using oxytocin treatment (Bartz, Zaki, Bolger & Ochsner, 2011). Oxytocin promotes trust (Theodoridou et al, 2009), thus possibly improving faulty cognitions. However, the effects of oxytocin depend on the person and situation (Heinrichs et al, 2003; Norman, Hawkley, Cole, Bernston & Cacioppo, 2012). Thus, extending this to other areas of research, the administration of oxytocin in individuals with autism has been found to alleviate social problems

(Hollander et al., 2007). Others (Heinrichs, Baumgartner, Kirschbaum & Ehlert, 2003) suggest oxytocin in the form of nasal sprays, decreases the reactions to social stress. Extending on this, this hormone can be naturally elevated in the body through natural treatment such as stroking pets or thinking positively about someone you trust. To fill the emotional gap created by loneliness research has found that technology and other strategies such as reaching out to the paranormal or religion lessen the anxiety associated with loneliness (Epley, Akalis, Waytz & Cacioppo, 2008).

Also, other interventions that might be beneficial and learned from ‘content loners’ is creativity and time spent on their own learning. For example, researchers Bowker and colleagues (2017) suggest social withdrawal in some can have a positive effect. For example, creativity is linked to a want and need for solitude, and therefore can be beneficial. Therefore, interventions in the form of art therapy and music.

#### **6.4.2 Strengths and Weakness of the Current Chapter**

Several potential limitations are noteworthy in the present study. Firstly, the present study is cross sectional, thus continued research is necessary to determine causality, thus measure if the individuals in the sample continued to isolate themselves, or if symptoms increase following longer periods of social isolation. These considerations are particularly important in relation to the potential transition from objective loneliness to subjective loneliness. Thus, cross sectional data fails to capture ongoing underlying processes unique to loneliness. Loneliness waxes and wanes in accordance with specific stressful life events, such as becoming unemployed, retiring or becoming isolated following an accident that lead to disability.

The present thesis did not consider major stressful life events such as serious illness, death of a loved one, or being involved in a life-threatening accident. Therefore, it would substantiate the present research to further assess whether ‘acute’

or 'chronic' loneliness would increase or decrease the effects underlying processes via the pathway to psychosis like symptoms, accordingly. Additionally, intervention models of resilience and coping strategies requires consideration across the life span, in light of suggestions by author (Weiss, 1974), that environmental needs vary according to stages in life and those due to circumstances, therefore certain life time points or events will be more critical than others.

In the present thesis, demographic risk factors, childhood trauma variables, and social defeat variables were coded binary, therefore further exploration such as frequency of exposure were not considered. Additionally, if the long-term effects of social isolation become distressing over time due to aberrant salience; a term used to describe making false connections with neutral stimuli, thus worsening of symptoms or development of positive experiences. Moreover, positive psychotic symptoms can occur as a result from excess dopamine, therefore, possibly leading to applying meaning to meaningless events, therefore, misinterpreting events or stimulus (Cicero, Kerns, & McCarthy, 2010). For example, in relation to animal studies, social isolation after defeating circumstances increases changes in the DA system. However, on reversing the isolation these DA changes were also reversed (Isovich et al., 2001). These finding could provide scope for interventions on loneliness. Furthermore, it can be difficult to measure the experience of loneliness. Loneliness is subjective with individual differences; therefore, measurement models rely on the individual's reports, and therefore underreporting may be an issue (Peplau & Perlman, 1982; Rokach, 2002). Also, loneliness is multi-dimensional with the ability to change over time, depending on circumstances, intensity, and duration (Samini & Bozorgpour, 2012). Furthermore, the difficulty in measuring the link between psychotic-like experiences and loneliness may be due to the overlapping of items pertaining to both,

because of some of the items in both measurements being too alike (Cohen et al., 2015).

### **6.4.3 Implications for Research and Practice**

Despite limitations, the present findings acknowledge important implications for individuals subjected to multiple traumatic experiences mediated by loneliness and possible interventions that could be put in place prior to the onset of psychosis, sub-clinical or psychosis-like experiences. Notwithstanding the immense evidence on the deleterious effects of social isolation this may be reversed or decreased to a certain degree. For example, a few studies have found social networking sites helpful in alleviating or help somewhat to battle the devastating feeling of loneliness (Powers et al., 2011), for example, in students starting university (Lou, Yan, Nickerson & McMorris, 2012). Furthermore, positivity towards ones' preference for solitude, admitting a need for spending time alone decreases feelings of loneliness (Vanhalst, Goossens, Luyckx, Scholte & Engels, 2013). However, certain individuals' want to connect with others, however this may be in conjunction with intrusive thoughts of a threatening society.

There are also implications for theory. For example, findings unique to the present thesis were uncovered highlighting pathways linking social defeat because of weight and sexual orientation and the direct pathway to disorganised PLE's are only transmitted via loneliness. This finding partially supports the social deafferentation hypothesis that suggests isolation is a risk factor by itself. Social defeat hypothesis suggests isolation occurs as an underlying framework of defeat whereas the social deafferentation hypothesis suggests symptoms arise from social isolation. The present



findings seem to relate to both hypotheses albeit entirely depending on the type of adversity.

The following chapter contributes to psychological research due to it being the first attempt to research specifically four types of childhood trauma, five types of social defeating experiences and loneliness using path analysis. Additionally, a valuable strength of the present study was the use of a very large general population sample. Thus, the findings can be generalised to individuals that have experienced PLE's albeit symptoms not warranting clinical support. This has valuable implications for practice. For example, when distress starts to emerge in otherwise experiences that were once fleeting and positively appraised, it is vital to ensure those with experiences of adversities are aware or their caregivers/close ones are aware of the adverse impact retreating into solitude, particularly if being alone is distressing for the individual. Further, the findings point towards the necessity of those who require care experiencing distress of symptoms are monitored closely by health professionals, and protocols put in place to alleviate loneliness and/or interacting with others or bonding with a pet. However, notwithstanding the contribution to research and interesting findings presented, it is difficult to compare the results of the following study with prior research due to this being the first study to look at pathways involved in multiple childhood trauma adversities, social defeating experiences and loneliness and their link PLE dimensions combined in one model. As suggested in the previous chapters, it would be beneficial to assess a similar study using a longitudinal analysis to assess changes over time.

## 6.6 Conclusion

The present study explored pathways involved in multiple adversities, PLE's, and loneliness in a large general population sample. The path analysis considered all four types of childhood traumas, all five types of social defeat and demographic risk factors. The present chapter produced finding explicating a model by which loneliness emerged as a mediator partially for the four specific traumatic childhood traumas, and most of social defeating experiences partially mediated all PLE dimensions and fully for two specific social defeating adversities to a pathway of symptoms for the disorganised dimension of PLE's.

Moreover, evidence is provided for a further link between multiple traumatic events and psychotic-like experiences. Identification of underlying mechanisms in the mediation process from adversities to experiencing psychotic symptoms contributes to research as it is another step forward in the main goal of establishing intervention and preventions for those at risk to transitioning from non-clinical to clinical risk for psychotic disorders. Adding to ongoing research into specificity of adversities and psychotic disorders, the present chapter emerged with findings that loneliness is involved in the process that connects childhood traumas, social defeat and an array of risk factors in those presenting with psychotic-like experiences who have the potential to reach thresholds of clinical significance, or if through awareness and possible intervention there is the potential to direct it in a different pathway.

The results supported the assumption that loneliness is a relevant mechanism in the process involved as postulated by several theories, specifically by a combination of the social control hypothesis and the social deafferentation hypothesis. Overall, the current chapter contributes to research building on the existing theoretical explanation models, namely; cognitive models of psychosis, the social defeat hypothesis, and the

social deafferentation hypothesis. Also, the present chapter provides further evidence for broader dimensional psychosis phenotypes.

## **CHAPTER 7**

### **FINAL THESIS DISCUSSION**

#### **7.1 Overview of the Current Thesis**

The current thesis followed a series of objectives to add to existing research across the dimensional psychosis phenotype. The thesis began with a literature review, followed by chapter 2 providing an overview of the methodology pertaining to the present thesis. The following chapter assessed the underlying structure of psychotic-like experiences (PLE's) in the NESARC wave 2 using confirmatory factor analysis (CFA) to find the best model fit. The confirmatory factor analysis CFA carried out in Chapter 3 substantiated findings of a three-dimensional underlying nature of PLE's at both a 'frequency only' and 'frequency and distress' level best fitted the data in this large general population data sample. The CFA uncovered a 3-factor structure which was used in each subsequent chapter to measure the pathways from childhood traumas and social defeating experiences and dimensions of PLE's experiences.

Furthermore, the subsequent chapters assessed cumulative adversities and PLE's. Also, specific cohorts of individuals with similar patterns of abuse were uncovered, and their specific link to each PLE dimension. The final empirical chapter assessed loneliness as a process involved in the mediating link between adversities and PLE's. The next section will go through each chapter individually and the findings uncovered. This will be followed by limitations of the present thesis, and contributions to research.

### **7.1.1 Chapter 1**

Chapter 1 provided a historical overview of psychosis research, the dimensional nature of the psychosis phenotype, theories into the mechanisms involved in social explanations for the development of psychotic experiences in both clinical and non-clinical populations. Next, an overview of empirical research was provided showing evidence of the relationship between adversities and psychotic experiences in both clinical and non-clinical populations providing a backbone for chapters 3, 4, 5, and 6. With several theoretical perspectives surrounding psychosis research, the literature review provided a summary of the main theoretical views on early trauma, adversity in adulthood and how these may collectively contribute to the development of psychopathologies. Chapter 1 briefly outlined the history of psychosis research, providing an overview of present arguments concerning either moving away from ‘all or nothing’ categorical approach or combining categorical and dimensional perspectives. Thus, throughout the present thesis findings are consistent with prior suggestions advocating the dimensionality of the psychosis phenotype, and as such providing new research combining dimensional and categorical models to break down strict historic barriers created by dichotomous viewpoint of psychopathologies. Also, explanations to date on the impact of trauma and adversities linked to the development of psychotic experiences across the spectrum from healthy individuals displaying symptoms to individuals with severe need for care.

### **7.1.2 Chapter 2**

Chapter 2 explained the methodology of the current thesis, providing a general overview of the data set; Wave 2 the National Epidemiological Survey on Alcohol and Related Conditions (NESARC). A detailed rationale, study design, the sampling

techniques used, and the characteristics of the sample, and the reliability and validity of the relevant measures that were administered to NESARC wave 2 respondents were discussed. A discourse of the measures used to test the various hypotheses throughout the present thesis were provided. The role of using secondary data analysis to achieve the research aims were briefly summarised. Also, chapter 2 explained in detail the variables used throughout the thesis, the section of the NESARC wave two they were taken from, and furthermore, detailing how they were recoded to perform stringent statistical analysis. Furthermore, a description of each statistical technique used to assess the hypothesis in each chapter was described and reasons for using the specific statistical methods.

### **7.1.3 Chapter 3**

Chapter 3 assessed the underlying structure of psychotic-like experiences to find the best fit of the dimensionality of such experiences in a large general population sample. The 16 PLE's underwent confirmatory factor analysis at both a frequency-only item level and 'frequency and associated distress' level, as measured using items on PLE's in the data set. This dimensionality was assessed via a model of 'frequency-only' of experiences at an item level, and subsequently via a model incorporating distress associated with frequency of experiences. It was established that a 3-factor model best fitted the data and the dimensional representation of the two models tested were equivalent. This adds to the literature with previous findings that the underlying nature of experiences are similar in both clinical and general population data samples. Such findings suggest the necessity measurement models include distress as a conjugate based on evidence distress segregates crossing thresholds across the hypothetical continuity spectrum in healthy individuals experiencing symptoms to those that require clinical care. In capturing the associated distress, it was found that

three latent factors of the 16 PLE items taken from the NESARC best fitted the data. One previous study used the present approach in combining distress in the model using CFA (Shevlin et al., 2015), another using network analysis (Murphy et al., 2017). It was established the model remained relatively stable when distress was added to the model. Furthermore, gender held relatively equal across the data for both males and females. Essentially, the findings presented in Chapter 3 suggest that the 3-factor model consistent with Raine and colleagues (1994) model best fitted the data in this general population data set for both ‘frequency-only’ and ‘frequency and distress’ PLE items. The dimensional representation of the two separate models tested remained stable when examined at both a ‘frequency’ item level only and ‘distress with frequency of symptoms’. The findings support the continuum of PLE’s within healthy populations. This finding is synonymous with an array of research findings evident in a meta-analytic review and systematic report (van Os et al. 2009; van Os et al. 2013). For example, findings have revealed that although almost one fifth of individuals with PLE’s endure symptoms that are on-going, most will not transit to a clinical diagnosis (Kaymaz et al., 2012). The purpose of modelling the dimensionality of psychotic experiences with and without associated distress within a large population is valuable in psychosis research. In applying CFA and uncovering the same model fit initially used to assess individuals with psychosis in a general population sample, the findings support a broader dimensional psychosis phenotype. As such, including distress as a conjugate and evidence the model remains stable further increases validity and reliability of measures using broader models of the dimensional psychosis phenotype. Therefore, a requirement for interventions to be put in place prior to the onset of distress of experiences to ensure well-being of those experiencing such adversities. As such, it is important psychotic-like experiences and

associated distress are assessed across the general population on a continuum. Therefore, further advocating broader models of a psychosis phenotype. This provides further support for merging medical models with dimensional models, as suggested by several authors (Bentall et al., 2014). Therefore, future studies should aim to re-evaluate measurement models or the use of alternative models to improved classification of disorder and symptoms and increasing their reliability and validity.

#### **7.1.4 Chapter 4**

Chapter 4 provides additional empirical evidence for a link between childhood traumas and the three dimensions of psychotic-like experiences. Statistical multivariate regressions were applied to the data to assess all childhood traumas, social defeating experiences, and an array of demographics using the 3-factor PLE's dimensions uncovered in Chapter 3. It was found that when all the childhood traumas types, social defeating experiences and demographic risk variables were combined simultaneously into a model with psychotic-like experiences, the model improved significantly. Moreover, social defeating experiences, childhood traumas and several demographic variables were related to PLE's individually and as expected, resulted in increased variance when combined. As such, the findings in chapter 4 agree with prior research (Varese et al, 2012; Morgan et al., 2014a; 2014b), that traumatic experiences in childhood combined with later adversities intensified the link towards trauma and psychosis, and those who suffered multiple traumas had increased levels of all three dimensions of PLE's.

The findings in chapter 4 partially agree with an array of social explanatory models attempting to explain the aetiology of psychotic experiences. Firstly, adapting the findings to the dopamine hypothesis that exposure to trauma may lead to dopamine



dysregulation in certain individuals who have been subjected to traumatic events (Read, et al., 2005; Lardinois et al., 2011; Varese et al., 2012). Also, the present findings agree with the social defeat hypothesis that sensitization to social defeating experiences following prior trauma may increase susceptibility to such experiences in individual (Selten & Cantor-Graae, 2005; van Winkel et al., 2008). Subordination because of being a minority group in society following traumatic abuse in childhood increases PLE's could be because of sensitization. However, relating the findings from cognitive explanations, it could be suggested that those subjected to prior traumatic experiences are more susceptible to experiencing defeat because of heightened threat sensitivity. For example, interpreting situations are being a threat, and focusing thought processes negatively towards a specific thought bias (Peters et al., 2017; Garety et al., 2001; Reininghaus et al., 2016; Freeman et al., 2013).

### **7.1.5 Chapter 5**

Chapter 5 explored individual clusters of traumas experienced in childhood, experiences of social defeat and demographic risk factors in a large representative US sample. Moreover, explore whether experiences of childhood trauma and social defeat within a healthy population are defined by homogenous sub-groups of individuals who have endured similar adversities, or specific types, and whether these traumas occur in multiples or cluster together in patterns of sub-groups. Additionally, further analysis was carried out to find out whether distinct groups of individuals who have suffered similar traumas are linked to psychotic-like experiences, specifically linked to expression of negative, positive and disorganised PLE's. Bernstein et al. (1994) postulate the four main abuse types; physical, neglect, sex and physical abuse all represent different features. Moreover, despite their distinctiveness, they are highly correlated often occurring together. Therefore, it is not surprising that the type of

abuse whether singular or in multiples will have a differential effect on individuals. The present research found that specific sub-groups of individuals suffered specific multiple childhood traumatic events combined with social defeating experiences. The findings tie in with previous research; firstly, that multiple abuse in childhood are common (Read, 2005; 2014) and secondly, individuals abused as children are more prone to further adversities, or revictimization again in adulthood (Morgan et al., 2014a; 2014b). Furthermore, all sub-groups were associated with increasing estimates for each PLE dimension for the high-risk trauma groups, in line with a few authors (Wickham & Bentall, 2014; Houston et al., 2011). Moreover, this applied to another sub-group who did not experience childhood trauma but experienced adversity later in life, again occurring in multiples rather than one social defeating experience. Therefore, in agreement with prior research that has established exposure to one type increases risk to further adversities (Beards et al., 2013; Hodges et al., 2013; Shevlin & Elklit, 2008). The present finding coincides with research that has pin-pointed brain anomalies associated with trauma experienced in childhood which inadvertently leads to the individual to be prone to being more sensitive to stress in daily life events (Read, 2005; Read, 2015). As such, the findings in the current research are in agreement with suggestions by authors, Read et al. (2015), that is, it no longer a question of 'if' there is a link between experiencing adversity and developing psychosis; that the writing is on the wall regarding the outstanding literature connecting the variables with nearly two decades of research findings (Read & Bentall, 2012; Read, 2013; Read, 2014).

The findings in Chapter 5 show a high-risk trauma group characteristic of a profile of individuals with histories consisting of multiple traumas with greater effects on all PLE dimensions, displayed by degrees of magnitude depending on the risk associated. Moreover, this was in line with Morgan et al. (2014a) who found a dose-

response relationship between the intensity of psychotic symptoms and when more than one trauma was experienced. The high-risk trauma class had high probabilities of endorsing all childhood traumas. Furthermore, this is in line with previous research that traumas in childhood quite often occur together; following exposure to one trauma inevitably increases the likelihood of being exposed to consequent traumas (Shevlin et al., 2008).

The social defeat hypothesis offers a parsimonious explanation for the pattern of findings found in Chapter 5; that such defeating circumstances when experienced with other adversities elevates the risk for psychotic experiences (Selten & Cantor-Graae, 2005). Also, additive demographic risk factors, such as ethnic minority, cannabis, and single status further increase the effect of such experiences. Therefore, the findings in the present thesis cannot be explained by genetics, further supporting social explanations of dimensional psychosis phenotype. Furthermore, from a socio-biological standpoint, such negative experiences tend to cluster in individuals, and may lead to PLE's due to sensitization of the mesolimbic dopaminergic system (van Os et al., 2010; Pantazis et al., 2006).

Findings in chapter 5 also suggest that individuals subjected to multiple high-risk trauma were found to be four times more likely to smoke cannabis and twice as likely to be of non-white ethnic origin. Additionally, the latent class analysis in chapter 5 uncovered odds ratios that were highest for cannabis consumption, with all 5 classes found to be significantly related to cannabis use. Therefore, those with high-risk profiles were more likely to consume cannabis. This finding is consistent with empirical research by Morgan et al. (2014) assessed the cumulative odds of elevated psychosis in those who consume cannabis with a history of abuse. They found increased likelihood of over 5 and a half times (OR=5.54) increased psychosis in those

who consumed cannabis with histories of abuse. The likelihood was more than 50% less for those with history of abuse only (OR=2.04) and who consumed cannabis but did not experience abuse (OR=2.04).

#### **7.1.6. Chapter 6:**

Chapter 6 identified loneliness to partially mediate specific variables and fully mediate the relationship between specific adversities and the three PLE dimensions. The findings suggest that certain pathways will either decrease risks such as social support or increase the risk through loneliness. As anticipated, research in Chapter 6 provides up to date evidence suggesting that loneliness mediates the linkage between multiple traumatic experiences and psychotic like experiences, consistent with prior research (Murphy et al, 2015; Shevlin et al, 2014; Boyda et al, 2015). The findings in the chapter 6 suggest that loneliness uniquely does not provide a comprehensive explanation of the link between all traumas and adversities and the three dimensions of PLE's, except for social defeating experiences because of weight and sex orientation, and the disorganised dimension of PLE's. However, the findings do suggest that loneliness fully accounts for the link between subordination because of body weight and ones' sexual orientation and the pathway to symptoms relative to the disorganised dimension of PLE's. Overall, the findings suggest that loneliness acts unique mechanism that mediates the relationship between two specific adversities and PLE dimensions. Therefore, without loneliness mediating the pathway between certain variable, there would be no link between such adversities and PLE's. Thus, the findings are a credible source of additional processes underlying the mechanisms in the relationship between specific adversities and psychotic-like experiences across a large general population cross-sectional sample. However, longitudinal data could

only assess if there would be a change in such processes over time, and whether such discrepancies could arise.

## **7.2 Limitations and Directions for Future Research**

Firstly, a cross sectional data sample was used in the present thesis, therefore further research is necessary to determine causality in the pathway from trauma, social adversities, loneliness and the PLE dimensions. These considerations are particularly important in relation to the potential transition from fleeting PLE's to persistence and associated distress overtime. Going forward, longitudinal studies are necessary to assess if persistence of PLE's overtime inclusive of distress would provide a better representation of distress in general populations. A modification of the continuum perspective, the 'extended psychosis phenotype' includes distress and interplay of persistent psychotic like experiences (van Os & Linscott, 2013). Also, combining components from each perspective to determine the underlying process involved in transition from fleeting psychotic experiences, to sub-clinical reaching levels of clinical need for care due to the experiences. Therefore, future research using longitudinal data will provide a more comprehensive assessment of the underlying structure of PLE's including distress associated with frequency and persistence over time.

Also, relative to loneliness which tends to be unstable in accordance with specific stressful life events; losing a partner, becoming unemployed, retiring or becoming isolated following an accident that lead to disability. Therefore, it would substantiate the present research to further assess whether 'acute' or 'chronic' loneliness would increase or decrease the effects underlying processes via the pathway

to psychosis like symptoms, accordingly. Therefore, this would need assessment using longitudinal studies.

The present thesis did not consider major stressful life events such as serious illness, death of a loved one, or being involved in a life-threatening accident. Therefore, cross sectional data fails to capture ongoing underlying processes unique to further adversities. Also, the social defeating experience measures in the NESARC Wave 2 did not address the associated level of distress, frequency, or intensity due to experiencing adversities addressed in the present study. Therefore, more rigorous assessment over time would provide more information on whether the effects would increase overtime. Overall, on-going and future research into the intricate web of connection linking adversities to psychopathologies could attempt to look at these variables using more stringent measurements, and longitudinal studies

Furthermore, another limitation which could not be avoided is underreporting of childhood abuse in self-reported questionnaires, usually because of fear of disclosing personal information, mistrust, stigma, and feeling ashamed (Sedlak et al., 2010). Also, reporting abuse leads to family fallouts, therefore fear of being outcast or discriminated because exposing abuse. Furthermore, extending this to clinical assessments, research suggests that clinicians still do not ask patients about histories and present abuse enough. For example, in a recent study (Read & Sampson, 2017) to explore the extent of improvements in the identification and recording of abuse in both children and adults in the last two decades. The study using randomly selected records (N=250) from a mental health services to compare results to an audit complete over 20 years. Overall, the authors found there has been a significant increase in the prevalence of sex and abuse in childhood, and sex abuse in adulthood. It was revealed mental health staff did not ask about physical and emotional neglect as much as they

should. Also, there were discrepancies across gender. For example, females were asked about abuse more than males, and males were less likely to ask about abuse and neglect than their females counterparts. Interestingly, patients with a diagnosis of psychosis were not asked about abuse and neglect, reflective of low rates of abuse identified. Therefore, although there has been an improvement since policy and training guidelines were published a decade ago (National Health Service, 2008) on asking questions about trauma and abuse was introduced, there are still gaps that need to be addressed and more stringent training for staff. Therefore, it is imperative a full psychological evaluation including detailed histories and ongoing abuse is vital. Moreover, if the topic of abuse is and opening up about previous traumas is advertised more publically, this will extend to general populations.

### **7.3 Contributions of the present Research**

#### **7.3.1 Combining Categorical & Dimensional Approaches**

The present research adds to the ongoing dearth of literature through providing knowledge that trauma and social adversities are ostensibly explanations for psychosis like disorders. Such explanations and their pathways to PLE's follow a curve like distribution in a large general population samples, thus providing additional support for a dimensional psychosis phenotype. A primary aim in the present thesis sought to establish if incorporating distress into a general population model of frequency of symptoms underlying the latent structure would encapsulate experiences that potentially warrant clinical care. The findings suggest that previous models of 'frequency only' of symptoms which is primarily the measurement models used in testing psychotic-like experiences in the general population was found to have an

equivalent structure for PLE's in the NESARC-wave 2 (3-factor model) when distress was incorporated into the model; thereby simulating that expressed in clinical measurements.

The current findings open avenues for specific interventions at stages across the dimensional psychosis phenotype might these experiences become frequent, persistent, or distressing. Therefore, including distress in psychological measurements is important. Also, publicly addressing such issues in social media or through school programmes might encourage adults and adolescents to become aware of the potential distressing nature of certain experiences. Moreover, incorporating measures to pinpoint experiences that are more significant in terms of risk and incorporating them with distress should essentially further increase validity and reliability. Moreover, psychotic-like experiences are multidimensional construct and are capable of increased severity across the spectrum, depending on how the experiences are appraised (Hanssen et al., 2005; Shevlin et al., 2015). Also, it is important to distinguish that for some individual's psychotic-like experiences may be helpful for some, depending on how the experience is cognitively appraised (Brett et al., 2014; Unterrassner et al., 2017; Peters et al., 2017). For example, belief in paranormal activities, and horoscopes might be important for healthy psychological functioning for some. Also, extending on views by authors (Unterrassner et al. 2017; Yung et al., 2006) delusional beliefs or aberrant salience during grieving or following life changing events. For example, belief that certain non-meaningful events or stimuli have significance. Therefore, such delusions could be a coping mechanism or comfort for those dealing with grief of a loved one and if it does not cause distress, then it does not warrant attention. Therefore, to assess if positively appraised delusions become



frequent, persistent and distressing overtime requires assessment using longitudinal studies.

Thus, adding to proposals suggesting a positive move towards categorical and dimensional perspectives joining together, to increase the reliability and validity of measurement models. Also, to delineate what differentiates those at heightened risk for psychosis in the general population. As such, the present thesis has contributed to empirical research by successfully uncovering the underlying nature of PLE's using a modified version of CFA including distress with frequency of experiences. in a large general population data sample. Therefore, testing theoretical assumptions directed in prior literature suggesting a positive move forward. Therefore, providing justification for combining categorical and dimensional elements.

The findings contribute to research suggesting that cumulative adversities in comparison to singular traumas increase psychotic-like experiences in healthy populations. Moreover, prior to the current thesis, social defeating experiences have never been assessed in one model with childhood trauma to assess their cumulative effect on PLE's. Also, the findings agree with the hypothesis that sensitization to social defeat experiences following trauma in childhood may increase susceptibility to such phenomena (Selten & Cantor-Graae, 2005). Also, subordination because of being a minority group in society following traumatic abuse in childhood increases PLE's. Also, the present thesis established that social exclusion, in the form of social defeating experiences leads to subordination and additively increase the likelihood of psychosis-like experiences. And, as stressed by Selten and colleagues (2013), caution is vital in comparing such measurements as utilised in this study with that of animal models, thus more rigorous future research is necessary.

Furthermore, in capturing the co-occurrence of exposure to childhood trauma and subsequent adult adversities, distinct subgroups were identified. There is a dearth of research elucidating the factors that play a role in the emergence of psychotic like experiences. Additionally, the present findings are in line with Varese et al. (2014) relative to their meta-analysis suggesting approximately one third of new diagnosis of psychotic disorders would cease to exist if the several types of traumatic experiences endured by victims ceased to exist in society. Therefore, the present thesis adds to vast research on the relationship between trauma and psychosis, and while this research cannot assume causality, its addition increases its legitimacy. Thus, another step closer to increasing awareness and suggesting putting interventions into place before such experiences become an issue. Also, the findings raise the issue on the prevalence of childhood trauma and social defeat, therefore making this information public and as part of programs in schools would be beneficial. As such, in accordance with prior research these adversities were found to be associated with an array of demographic variables, namely, cannabis use, and being of ethnic origin. In addition, all sub-groups were associated with all three dimensions of PLE's. Moreover, the present findings suggest that traumatic events tend to occur in multiples rather than solely, as identified in prior research (Curran et al., 2016) who utilised the same data set (NESARC-Wave 2) assessing different forms of adversities.

The current findings tie in with the theoretical underpinnings of the dopamine hypothesis, and the TN model. For example, partially in line with the current findings, others have found childhood trauma, particularly sexual abuse results in elevated risk for psychosis in those who abuse cannabis as early as adolescence (Houston et al., 2011). These findings coincide with suggestions that stressful events in childhood may lead to a disruptive response in activity of dopamine receptors in adulthood (Read,

2001; 2014). Additionally, combining stressful life events and THC-delta-9 tetrahydrocannabinol increases firing of dopamine in the mesolimbic system and as a result increases the risk for psychosis (Soliman et al., 2008; Bossong et al., 2009). Moreover, exposure to further adversities may cause dopamine dysregulation in certain individuals who have been exposed to traumatic events (Read, et al., 2005; Lardinois et al., 2011; Varese et al, 2012).

Considering such findings future studies exploring experiences of other drug use and links to psychotic experiences would be beneficial. Exploring other links outside of the dopamine hypothesis, (Stahl, 2018) hypothesized the neural network hypothesis. For example, cocaine and other psychostimulants use releases dopamine stimulating D2 receptors linked to auditory hallucinations and paranoid delusions. Ketamine and other anesthetics has been found is an NMDA antagonist and has been found to be associated with visual and paranoid hallucinations. The third route is the use of psychedelics, 5HT2A agonists which is linked to visual mystical hallucinations (Stahl, 2018). Therefore, future research would benefit by looking at the effects of experiencing other drugs and symptoms of psychotic experiences.

Contributing to the literature and awareness that loneliness will reach epidemic proportions in the next 13/14 years (Holt-Lunstad et al., 2015), the current thesis revealed loneliness to be involved in the process underlying the pathways from childhood trauma and social defeating experiences and PLE's in a general population sample. These specific adversities had not been previously assessed using these exact variables. For example, hypothesising loneliness mediated the pathway rather than motivated by psychotic-like experiences was assessed. As such, findings established that loneliness acted as a partial mediator between childhood trauma variables, social defeat variable and psychotic-like experiences, and fully mediated the link between

social defeating experiences because of body weight and disorganised PLE's, which is a new finding in psychosis literature. Such findings are important in contributing to the search for interventions with evidence of an underlying link accelerating such processes. For example, there have been advancements made in psychosis research on the use of oxytocin therapy, to alleviate symptoms such as loneliness because of social isolation (Feifel, 2012). For example, authors, Norman and colleagues (2012) suggest decreased levels of the release of oxytocin contribute to loneliness and lack of trust fuels loneliness, and as discussed in Chapter 6, several researchers have acknowledged that social problems could be rectified to a degree using oxytocin treatment (Bartz et al., 2011) as oxytocin promotes trust (Theodoridou et al., 2009), thus potentially improving faulty cognitions. Moreover, this hormone can be naturally elevated in the body through natural treatment such as stroking pets or thinking positively about someone you trust (Handlin et al., 2011). Therefore, interventions through getting a pet, or pet focused therapy could possibly benefit some individuals. Moreover, to fill the emotional gap created by loneliness research has found that technology and other strategies such as reaching out to the paranormal or religion lessen the anxiety associated with loneliness (Epley et al., 2008). Therefore, this is in line with suggestions in both chapters 3 and 6 that experiences that cause distress in some individuals can be a positive experience for others depending on the appraisal, such as abbrent salience in those grieving or after life-threatening accident Therefore, emphasising the benefits of merging categorical and dimensional perspectives through assessing the phenomena in general population samples using appropriate measurement tools with clinical criteria such as fear and distress.

Overall, it is imperative that interventions are put in place to deter harmful effects of loneliness and prior to transitioning to more severe psychotic-like

symptoms, therefore assessing psychotic-like experiences in the general population levels such as the current thesis is necessary.

### **7.3.2 Combining Psychological, Biological and Biomedical Disciplines to Advance Dimensional Psychosis Phenotype Research**

It is becoming paramount in psychosis research that experiencing trauma may lead to deficits in brain structures and neurological systems ultimately playing havoc with the hypothalamic- pituitary-adrenal axis, a protagonist for normal stress response (Read, 2001; Read, 2014; Read et al., 2014). For example, according to Kuhlman et al. (2015) the function of the HPA differs in response to specific traumas. For example, physical abuse has been found increase sensitivity of HPA activation through increasing cortisol reactivity and decrease retrieval of cortisol levels post the adversity experienced, and emotional abuse specifically impedes the recovery of acute stress response, increasing response activation to stress. Furthermore, combined traumas play havoc with circadian regulatory systems, interfering with sleep patterns. Also, according to Prussner et al. (2010) this dopamine hyperactivity can induce a type of stress in adulthood following childhood trauma. This chronic repeated stress may subsequently lead to symptoms of psychosis, therefore, it important to put interventions into place when these experiences are below thresholds of clinical significance.

Thus, as suggested by Selten & Cantor-Graae (2016) exposing subjects to experimental studies to assess associations between defeating scenarios and measures of psychosis like experience via reaction tasks could possibly measure defeat. For example, applying neuroimaging studies of the cortex (Premkumar, 2012). However, such experimental studies of the neural activity in the brain in relation to social defeating tasks in humans requires further research.

Therefore, in agreement with Read and colleagues (2014) merging biological and psychosocial disciplines could potentially advance psychosis research through rigorous research of specific traumas and their relationship to brain dysfunction because of trauma and sensitization of current social interactions that could be responsible for the emergence of PLE's. Therefore, mimicking social interactions through online virtual video games, and assessing triggers that lead to changes in brain systems using neuroimaging FMRI equipment. For example, Schmäzle et al. (2017) used such techniques successfully in assessing brain connectivity during social exclusion. Moreover, how social exclusion negatively impacts on cognitive processes such as mentalising and the consequent effects on specific brain regions. Thus, merging an array of disciplines with psychological research and classifying new measurement models to assess PLE's in general population samples could provide potential breakthroughs in psychosis research.

### **7.3.3 Specific Interventions for Specific Psychotic-like Symptoms**

The present thesis adds to existing literature and coincides with an array of theoretical assumptions through exploring the value of social explanations linking psychosis-like experiences in a general population. The findings suggest if social exclusion can increase psychological issues, specific interventions and treatments in the form of promoting social inclusion could benefit as form of therapy, such as a team sport. For example, Mittal et al. (2017) recently carried out a comprehensive review on exercise treatments in those with psychotic disorder. Moreover, the article provides concise review of evidence on the benefits of exercise, team sports, yoga and cycling to be used in conjunction with treatments or interventions in those experiencing symptoms prior to reaching need for care on the psychosis phenotype spectrum.

Based on the findings established across the four empirical chapters, future research should navigate towards developing questions towards specific interventions using cognitive behavioural techniques in those experiencing psychotic-like symptoms prior to clinical manifestation and along thresholds where distress begins to emerge. Thus, promoting change in faulty thought processes by raising awareness of cognitive biases and the possibility of forming of false beliefs and irregular thought processes (van der Gaag et al., 2012 Cicchetti, 2013). Therefore, such interventions are imperative, as early detection of these phenomenon and awareness of transitioning across clinical manifestation of psychosis (Oh et al., 2014). Moreover, sub-types of groups as found by latent class analysis in chapter 5 detected cohorts of individuals with specific characteristics, which could be used to zoom in on (target populations) using interventions or preventative programs.

For example, Morrison et al., (2014) found that non-medicated individuals with psychosis found usefulness in psychotherapy in the form of CBT. Others (Braehler, Harper & Gilbert, 2013) advocate a type of CBT know as ‘compassion’ focused approach. In light of this and research suggesting brain anomalies as a result of trauma in childhood are capable of being reversed (Longden & Read, 2016), this type of psychotherapy could prove beneficial in regulating the HPA axis as previously suggested by authors (Schuengel, Oosterman & Sterkenburg, 2009).

The findings add to the dearth of evidence that traumatic childhood events and other adversities should be a compulsory part of assessment in patients and outpatients experiencing psychotic disorders (Read, 2014; Bentall et al., 2014). Moreover, extensive evaluation of trauma histories will aid towards better classifying disorders, symptoms and effectively the treatment. For example, individuals with histories of abuse could potentially respond to trauma-focused therapies, this should decrease

prescribing psychotropic medication that have potential side effects. Some individuals are more sensitive to medications, and thus could be potentially more harmful than beneficial.

In line with this, trauma-based therapies have been predominantly used in the treatment of PTSD. Authors (Brand, McEnery, Rossell, Bendall & Thomas, 2017) suggest trauma-focused interventions could possibly benefit treating psychotic disorders due to the overlap of symptoms. The authors (Brand et al., 2017) carried out a systematic literature review and meta-analysis based on such treatments in those on the psychosis spectrum. Using PsychInfo, Pubmed, EMBASE, CINAHL and the Cochrane Library, 25 articles were kept in the review, comprising of 12 remaining in the meta-analytic analysis. Overall, the findings revealed trauma focused therapies significantly improved positive symptoms only, however, the effect was quite small. Brand and colleagues (2017) suggest trauma-focused therapies have the potential benefit going forward in treating specific psychotic symptoms. Therefore, merging categorical and dimensional classifications seems like a positive move forward. Moreover, the main priority should be focused towards individuals suffering from debilitating symptoms, and those in the general population that experience psychotic symptoms that are distressing, but fear treatment, and those experiencing healthy psychotic symptoms that need to be aware and interventions put in place prior to possible transitioning across thresholds along the spectrum of severity.

#### **7.3.4 Concluding remarks**

Overall, the present thesis explored various avenues along the pathway from trauma in early life to later social adversities to specific dimensions of psychotic-like experiences in a large general population. Despite the contributions to research, there is clearly a call for more rigorous assessment of mediating factors that are potential



triggers that awaken latent histories of traumas in those with symptoms due to the lengthy times from childhood trauma leading to the emergence of psychotic experiences after remaining latent for long periods (Read et al., 2001; Bentall et al., 2014). This suggests that for some individuals there is a potential trigger along the way. Therefore, using specific symptoms methods regarding the severity and types of adversities to delineate the emotional and cognitive triggers and in turn providing valuable knowledge into treatments. The US national Institute of Mental Health Research domain has proposed a strategic plan to encourage researchers to focus on transdiagnostic psychopathology symptom dimensions. As such, this will differentiate specific processes involved in the pathways from traumas to symptoms. Therefore, improving measurement to assess psychotic-like experiences across the spectrum, and in turn treatment protocols.

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